Proceedings for the 27th International Seating Symposium

27th ISS

Revolution • Evolution

March 3-5, 2011

Gaylord Opryland Hotel & Convention Center • Nashville, TN

Department of Rehabilitation Science and Technology
Continuing Education
School of Health and Rehabilitation Sciences
University of Pittsburgh

Course Director: **Mark R. Schmeler, PhD, OTR/L, ATP**
Department of Rehabilitation Science and Technology, School of Health and Rehabilitation Sciences, University of Pittsburgh

In Collaboration with:

- **Sunny Hill Health Centre for Children,** University of British Columbia
- **Department of Rehabilitation Science and Technology,** School of Health and Rehabilitation Sciences, University of Pittsburgh
- **Pittsburgh VA Rehabilitation Research and Development Center of Excellence - Human Engineering Research Laboratories**
- **RERC on Wheelchair Transportation Safety, Telerehabilitation, Spinal Cord Injury**
- **European Seating Symposium**

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Faculty

A

David Algood
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ISS Practice Forum Chair – Thursday – 3:30PM
Love What You Do – Need a New Place to Do It?

Ana Allegretti
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Paper Session 3 – Friday – 1:00PM
A Telerehabilitation Approach to Guide Therapists to Prescribe Mobility Assistive Equipment

Dan Allison
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IC 25 – Friday – 1:00PM
The Relationship between Driving, Vehicle Modifications and Seating and Mobility

Claudia Amortegui
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IC 47 – Friday – 10:45AM
I Know the Best Product for My Client, But Will it Be Funded?

Josh Anderson
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IC 37 – Friday – 9:15AM
Why Wheelchair Prescription for Independent Propulsion Matters and How to Do It

Michele Audet
Children's Healthcare of Atlanta
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michele.audet@choa.org

Paper Session 5 – Friday – 1:00PM
Neuromuscular Spinal Deformities In Children: Challenges of Custom Molding.

Martino Avellis
Fumagalli Srl
Ponte Lambro, Italy
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Paper Session 3 – Friday – 1:00PM
Comparison Between 2 Points and 4 Points Seat Belt in Patients with CP

B

Mary Bacci
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Paper Session 2 – Friday – 1:00PM
Collaboration in the Wheelchair Evaluation Process for the Pediatric User

Cara Bachenheimer
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Pre-Conference Workshop- Wednesday – 8:00AM – 5:30PM
Policy & Funding for Mobility Assistive Equipment in the USA

Deanna Baldassari
McGuire VA Medical Center
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Paper Session 5 – Friday – 1:00PM
Design, Re-design, Repeat: A Holistic Approach to Seating a Veteran Client

ISS Practice Forum Chair – Thursday – 3:30PM
Love What You Do – Need a New Place to Do It?

E. Reagan Bergstresser-Simpson
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Nashville, TN USA
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Poster Session 1 – Thursday – 12Noon
Perceived quality of life of children who participate in wheelchair sports

Theresa Berner
The Ohio State University Medical Center
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Theresa.berner@osumc.edu

Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
Service Delivery Innovations and Strategies in Implementing a Wheeled Mobility and Seating Program.

Jennith Bernstein
Shepherd Center
Atlanta, GA USA
Jennith-bernstein@shepherd.org

Paper Session 1 – Friday – 1:00PM
A Retrospective Look at Seating & Mobility Options for Lower Extremity Amputees

Paper Session 2 – Friday – 1:00PM
Improving Service Delivery Throughout the Rehab Continuum.

Kendra Betz
VA Prosthetics & Sensory Aids Service
Washington, DC USA
kendra.betz@va.gov

Pre-Conference Workshop – Tuesday – 8:00AM – 5:30PM
Fundamentals of Wheelchair Seating and Mobility

General Session 1 – Thursday – 10:00AM
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IC 9 – Thursday – 3:30PM
Winter Sports & Recreation: Adaptive Options & Assistive Technologies

Amy Bjornson
Sunrise Medical
Neutral Bay, NSW Australia
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Paper Session 6 – Friday – 1:00PM
I Deserve Filet Mignon: Best Practice vs. Compromise in Equipment Prescriptions

Jim Black
Invacare/Top End
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jblack@invacare.com

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Paper Session 6 – Friday – 1:00PM
Let's Roll! A Team Approach to Achieving Optimal Rolling Dynamics

Sheila Blochlinger
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Mountainside, NJ USA
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Paper Session 1 – Friday – 1:00PM
Do Standing Programs Make a Difference?

Paper Session 2 – Friday – 1:00PM
Changing Lives Through Recovery: A Comprehensive Team Approach

Lois Brown
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IC 13 – Thursday – 3:30PM
Incorporate Programming & Consumer Education for Power Positioning Use.

Sheila Buck
Therapy NOW! Inc.
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IC 53 – Friday – 1:00PM
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Mary Ellen Buning
University of Louisville & Frazier Rehabilitation Institute
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Me_buning@mac.com

IC 10 – Thursday – 3:30PM
RESNA Standards Volume 4: Wheelchairs and Transportation

Paper Session 2 – Friday – 1:00PM
Introducing Fieldwork Students to Wheelchair Seating & Mobility

C

Evan Call
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Centerville, UT USA
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Paper Session 3 – Friday – 1:00PM
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Brenda Canning
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Empower with Power: How Attitudes About Power Mobility Can Affect Outcomes

Nettie Capasso
Rusk Institute NYU
Langone Medical Center
New York, NY USA
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Poster Session 2 – Thursday – 12Noon
Bariatric Seating and Positioning: Lessons Learned in an Urban Medical Center

Theresa Clancy
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IC 17 – Thursday – 4:45PM
Providing Powered Mobility for the Severely Involved Child

Donald Clayback
National Coalition for Assistive and Rehab Technology (NCART)
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IC 2 – Thursday – 1:00PM
Complex Rehab Technology Separate Benefit Update

Laura Cohen
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Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
Policy & Funding for Mobility Assistive Equipment in the USA

IC 2 – Thursday – 1:00PM
Complex Rehab Technology Separate Benefit Update

IC 14 – Thursday – 3:30PM
Ethics and Certification: Raising the Bar of Professionalism

Elizabeth Cole
U.S. Rehab
Waterloo, IA USA
elizabeth.cole@usrehab.com

IC 2 – Thursday 1:00PM
Complex Rehab Technology Separate Benefit Update

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Medicare 101 for the Clinician Prescribing
Seating and Mobility Products

Al Condeluci
CEO – United Cerebral Palsy of Pittsburgh
Pittsburgh, PA
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Keynote Presenter – Thursday – 9:00AM
Cultural Shifting: Building Social Capital

Rory Cooper
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Paper Session #3 – Friday – 1:00PM
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Scans to Advance Seating Design

Paper Session #4 – Friday – 1:00PM
Vibration Dampening Characteristics of Wheelchair Cushions

Paper Session #4 – Friday – 1:00PM
Mobility Device Use and Satisfaction among
People with Multiple Sclerosis (MS)

Rosemarie Cooper
University of Pittsburgh
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Paper Session 4 – Friday – 1:00PM
Mobility Device Use and Satisfaction among
People with Multiple Sclerosis (MS)

Barbara Crane
University of Hartford
Wethersfield, CT USA
barb.crane@cox.net

IC 26 – Friday – 1:00PM
Quantifying Posture According to an International Standard

Ryan Crosby
VA Eastern Colorado Healthcare Systems
Denver, CO USA
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IC 54 – Saturday – 8:30AM
Out and About: Reducing Injury via Vehicle
Wheelchair Lifts and Van Conversions

D

Kimberly Davis
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IC 1 – Thursday – 1:00PM
ISO Pressure Mapping Clinical Guidelines –
Combining Expertise and Evidence

Brad Dicianno
University of OPittsburgh
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Paper Session 3 – Friday – 1:00PM
Comfort and Stability of Wheelchair Backrests

Paper Session 3 – Friday – 1:00PM
Identifying Generic Back Shapes from Anatomical
Scans to Advance Seating Design

Carmen DiGiovine
The Ohio State University
Columbus, OH USA
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Pre-Conference Workshop – Wednesday – 8:00Am – 5:30PM
Service Delivery Innovations and Strategies in Implementing
a Wheeled Mobility and Seating Program

Jay Doherty
Quantum Rehab/Pride Mobility Products
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Paper Session 6 – Friday – 1:00PM
Single Switch Access: The Story of One Boys Independence

Fran Dorman
New Mexico Department of Health
Albuquerque, NM USA

IC 56 – Saturday – 8:30AM
Focusing on Breathing in Adults with Cerebral Palsy

E

Susan Eason
St. Mary's Home for Disabled Children
Norfolk, VA USA
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IC 60 – Saturday – 9:45AM
Dynamic Seating: Why, Who and How?

Casey Emery
Banner Good Samaritan/Touchstone Rehab
Phoenix, AZ USA
cemeryot@gmail.com

IC 61 – Saturday – 9:45AM
Powered Mobility and the Effects on Visual/Perceptual Deficits

Bengt Engström
Engström Concept AB
Stallarholmen,   Sweden
beseat@telia.com

Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
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Ann Eubank
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Cane Ridge, TN USA
anneubank@usersfirst.org

Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
Go Baby Go! The Science, Training and
Technology of Early Wheeled Mobility

General Session #1- Thursday – 10:00AM
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F

Kathryn Fisher
Shoppers Home Health Care
Toronto, ON   Canada
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Solving for Complex Access

IC 62 – Saturday – 9:45AM
Head Positioning: Problems or Possibilities?

Delia Freney
Kaiser Permanente
Castro Valley, CA USA
DDFreney@aol.com

IC 42 – Friday – 10:45AM
Special Considerations for Transporting Clients with Special Needs

Tetsuro Fukuhara
Tokyo Space Dance
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Poster Session #1 – Thursday – 12:00 Noon
Space Tube, for Welfare and Rehabilitation Technology

G

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Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
Go Baby Go! The Science, Training and
Technology of Early Wheeled Mobility

Yasmin Garcia Mendez
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Paper Session #4 – Friday – 1:00PM
Vibration Dampening Characteristics of Wheelchair Cushions

Nava Gelkop
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IC 22 – Thursday – 4:45PM
24 Hours Postural Management Program

Kevin Gouy
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IC 11 – Thursday – 3:30PM
Engagement: How to Foster a Healthy Rehab Industry

Eric Grieb
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IC 11 – Thursday – 3:30PM
Engagement: How to Foster a Healthy Rehab Industry

Jonathan Greenwood
Northeast Rehabilitation Hospital Network
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IC 55 – Saturday – 8:30AM
Beyond Seating: Enhancing Function & Fun with
Children through Adaptive Equipment

Mark Greig
Sunrise Medical
Longmont, CO USA
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IC 43 – Friday – 10:45AM
Investigating Clinically Relevant Cushion
Characteristics Via Laboratory Testing

Keith Grewe
Cardinal Hill Rehab
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kygrewe@hotmail.com

Poster Session 1 – Thursday – 12:00 Noon
Wheelchair Cushions and Temperature
When Exposed to Direct Sunlight

Paper Session 2 – Friday – 1:00PM
Pressure Relief and Common ADL Activities

Gary Gilberti
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IC 2 – Thursday – 1:00PM
Complex Rehab Technology Separate Benefit Update

Michelle Gunn
Browning's Health Care
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IC 27 – Friday – 8:00AM
Self Advocacy, It's Just Not for Consumers!

H

Simon Hall
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shall@crc.ie

Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
Service Delivery Innovations and Strategies in Implementing
a Wheeled Mobility and Seating Program

IC 45 – Friday – 10:45AM
Clinical Standards in Specialized Services

W. Darren Hammond
The ROHO Group, Inc.
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IC 3 – Thursday – 1:00PM
Choosing the Best Cushion: How Do We Really Get There?

Dave Harding
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General Session 1 – Thursday – 10:00AM
Reality: The Case of the Stolen Scooter –
And Other Possible Dilemmas

Denise Harmon
National Seating and Mobility
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Tricia Henley
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IC 3 – Thursday – 1:00PM
Choosing the Best Cushion: How Do We Really Get There?

Thomas Hetzel
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IC 6 – Thursday – 1:00PM
Custom Sooner = More Meaningful and Lasting Outcomes

Andy Hicks
Altimate Medical Inc.
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IC 16 – Thursday – 3:30PM
Get Your Hands On a Stander – How to Properly
Set Up and Fist Standing Devices

Marlene Holder
Holland Bloorview Kids Rehabilitation Hospital
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IC 31 – Friday – 8:00AM
First Time Pediatric Power Users, Problem
Solving for Complex Access

Eun-Kyoung Hong
University of Pittsburgh
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euh3@pitt.edu

Paper Session #3 – Friday – 1:00PM
Comfort and Stability of Wheelchair Backrests

Paper Session #3 – Friday – 1:00PM
Identifying Generic Back Shapes from Anatomical
Scans to Advance Seating Design

Rita Hostak
Sunrise Medical
Longmont, CO USA
Rita.hostak@sunmed.com

Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
Policy & Funding for Mobility Assistive Equipment in the USA

IC 2 – Thursday – 1:00PM
Complex Rehab Technology Separate Benefit Update

J

Susan Johnson
Columbia Medical
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IC 42 – Friday - 9:15AM
Special Considerations for Transporting Clients with Special Needs

Susan Johnson Taylor
Rehab Institute of Chicago
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staylor@ric.org

IC 17 – Thursday – 4:45PM
Providing Powered Mobility for the Severely Involved Child

IC 28 – Friday – 8:00AM
Make It and Take It – A Beginner's Guide to Wheelchair Evaluations

K

Karen Kangas
Private Practice
Shamokin, PA USA
kmkangas@ptd.net

IC 33 – Friday – 9:15AM
The Challenges of Seating and Mobility for Children with Dystonia
Paper Session #5 – Friday - 1:00PM

Creating Molded Seating for An Adult with
Tone which Supports Movement

Patricia Karg
University of Pittsburgh
Pittsburgh, PA USA
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IC 10 – Thursday – 3:30PM
RESNA Standards Volume 4: Wheelchairs and Transportation

Chad Kincaid
Grand Junction VA Medical Center
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IC 46 – Friday – 10:45AM
Aquatic Sports: Supporting Recreation in an Unstable Environment

Lori Knott
Health Sciences Centre Winnipeg
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IC 20 – Thursday – 4:45PM
Integrating Outcome Measures into Daily Practice,
Ride Outcome Survey and Cases

Penelope Knudson
Otto Bock Health Care GmbH
Balukham Hills, NSW Australia
Penny.knudson@ottobock.com

IC 57 – Saturday – 8:30AM
Designing a Pediatric Power Wheelchair
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Kay Koch
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IC 28 - Friday – 8:00AM
Make It and Take It – A Beginner's Guide to Wheelchair Evaluations

Liz Koczur
Alfred I. DuPont Hospital for Children
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IC 19 – Thursday – 4:45PM
Positioning for Children with Cerebral Palsy
Pre and Post Orthopaedic Surgeries

Alicia Koontz
University of Pittsburgh
Pittsburgh, PA USA
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Paper Session #1 – Friday – 1:00PM
The Transfer Assessment Instrument for
Measuring Transfer Performance

Christin Krey
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ISS Practice Forum Chair – Thursday – 3:30PM
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Andrew Kwarciak
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IC 21 – Thursday – 4:45PM
Propulsion Training for Everyone

L

Michelle Lange
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Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
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James Lenker
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Alison Lichy
National Rehabilitation Hospital
Washington DC USA
alison.m.lichy@medstar.net

IC 12 – Thursday – 3:30PM
Comparing Wheelchair, Wheelchair Skill Level,
Community Participation and Payer

Jenny Lieberman
Mount Sinai Hospital
New York, NY USA
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IC 63 – Saturday – 9:45AM
To Power or Not: Powered Mobility and the Obese Client with Venous Stasis Ulcers

Roslyn Livingstone
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IC 7 – Thursday – 1:00PM
Best Practice: Power Mobility Workshop

IC 52 – Friday – 1:00PM
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M

Jacqueline Macauley
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IC 15 – Thursday – 3:30PM
Do You Have Your Client's Back?

Simon Margolis
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IC 2 – Thursday – 1:00PM
Complex Rehab Technology Separate Benefit Update

IC 27 – Friday – 8:00AM
Self Advocacy, It's Just Not for Consumers!

William (Rusty) Mattingly
Frazier Rehab
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Paper Session #2- Friday – 1:00PM
Introducing Fieldwork Students to Wheelchair Seating & Mobility

J. David McCausland
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Belleville, IL USA
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IC 43 – Friday - 10:45AM
Investigating Clinically Relevant Cushion Characteristics Via Laboratory Testing

Laura McClure
University of Pittsburgh
Pittsburgh, PA USA
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Paper Session #1 – Friday – 1:00PM
The Transfer Assessment Instrument for Measuring Transfer Performance

Patrick Meeker
The ROHO Group
Belleville, IL USA
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IC 1 – Thursday – 1:00PM
ISO Pressure Mapping Clinical Guidelines – Combining Expertise and Evidence

Amy Meyer Morgan
Permobil, Inc.
Lebanon, TN USA
amy.morgan@permobilus.com

IC 16 – Thursday – 4:45PM
Get Your Hands On a Stander – How to Properly Set Up and Fit Standing Devices

IC 35- Friday - 9:15AM
Powered Standing Mobility in Boys with Duchenne Muscular Dystrophy

Jean Minkel
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New Windsor, NY USA
jminkel@aol.com

Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
Policy & Funding for Mobility Assistive Equipment in the USA

Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
Service Delivery Innovations and Strategies in Implementing a Wheeled Mobility and Seating Program

IC 4 – Thursday – 1:00PM
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ISS Practice Forum Chair – Thursday – 3:30PM
Love What You Do – Need a New Place to Do It?

Jennifer Miros
St. Louis Children's Hospital
St. Louis, MO USA
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IC 32 – Friday – 8:00AM
Adaptive Cycling for People with Special Needs

Steven Mitchell
Cleveland VA Medical Center
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Steven.Mitchell@va.gov

IC 64 – Saturday – 9:45AM
Emphasizing Usability During Wheelchair Specification and Configuration

Shiro Mitsumori
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Poster Session #1 – Thursday – 12:00 Noon
Space Tube, for Welfare and Rehabilitation Technology

Brenlee Mogul – Rotman
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IC 28 – Friday – 8:00AM
Make It and Take It – A Beginner's Guide to Wheelchair Evaluations

IC 44 – Friday – 10:00AM
Diagnosis…..More Than Just Words

Darrell Musick
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IC 40 – Friday - 9:15AM
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IC 48 – Friday – 10:45AM
Understanding and Teaching Advanced Wheelchair Skills (Session 2)

N

Leif Nelson
VA New York Harbor Health Care System
New York, NY USA
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IC 46 – Friday - 10:45AM
Aquatic Sports: Supporting Recreation in an Unstable Environment

Linda Norton
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Paper Session #6 – Friday – 1:00PM
Twenty-Four Hour Postural Management for Adults

O

Hisaichi Ohnabe
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Poster Session #1 – Thursday – 12:00 Noon
Space Tube, for Welfare and Rehabilitation Technology

Melissa Oliver
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Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
Service Delivery Innovations and Strategies in Implementing
a Wheeled Mobility and Seating Program

Paper Session #5 – Friday – 1:00PM
Design, Re-design, Repeat: A Holistic
Approach to Seating a Veteran Client

P

Joan Padgitt
Eastern Colorado Healthcare Systems - Denver VAMC
Denver, CO USA
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IC 54 – Saturday – 8:30AM
Out and About: Reducing Injury via Vehicle
Wheelchair Lifts and Van Conversions

Ginny Paleg
Montgomery County Schools
Silver Spring, MD USA
ginny@paleg.com

IC 7 – Thursday – 1:00PM
Best Practice: Power Mobility Workshop

IC 49 – Friday – 1:00PM
Seating and Positioning Fairy Godmothers: Real Live
Cases in an Interactive Game-Show Format

Jonathan Pearlman
University of Pittsburgh
Pittsburgh, PA USA
jlp46@pitt.edu

Paper Session #3 – Friday – 1:00PM
Identifying Generic Back Shapes from Anatomical
Scans to Advance Seating Design

Paper Session #3 – Friday – 1:00PM
Comfort and Stability of Wheelchair Backrests

Paper Session #4 – Friday – 1:00PM
Vibration Dampening Characteristics of Wheelchair Cushions

Rhonda Perling
Georgia Assistive Technology Act Program
Atlanta, GA USA

Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
Policy & Funding for Mobility Assistive Equipment in the USA

Jessica Pedersen
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IC 12 – Thursday – 3:30PM
Comparing Wheelchair, Wheelchair Skill Level,
Community Participation and Payer

IC 39 – Friday - 9:15AM
Postural Support for SCI: Theory, Products, and Opinions

IC 56 – Saturday – 8:30AM
Focusing on Breathing in Adults with Cerebral Palsy

Tim Pederson
West Med Rehab, Inc.
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IC 2 – Thursday – 1:00PM
Complex Rehab Technology Separate Benefit Update

Denise Peischl
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IC 19 – Thursday – 4:45PM
Positioning for Children with Cerebral Palsy
Pre and Post Orthopaedic Surgeries

Wes Perry
T.K. Martin Center, Mississippi State University
Mississippi State, MS USA
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IC 25 – Friday – 8:00AM
The Relationship Between Driving, Vehicle
Modifications and Seating and Mobility

Julie Piriano
Pride Mobility Products Corp.
Exeter, PA USA
jpiriano@pridemobility.com

Pre-Conference Workshop – Tuesday – 8:00AM – 5:30PM
Fundamentals of Wheelchair Seating and Mobility

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Policy & Funding for Mobility Assistive Equipment in the USA

IC 14 – Thursday– 3:30PM
Ethics and Certification: Raising the Bar of Professionalism

Teresa Plummer
Belmont University, Vanderbilt Children's Hospital
Nashville, TN USA
teresa.plummer@belmont.edu

IC 34 – Friday – 9:15AM
A Practice Guide for Wheelchair Assessments

Paper Session #4 – Friday – 1:00PM
The Wheelchair Assessment: Results of a Qualitative Study

IC 61 – Saturday – 9:45AM
Powered Mobility and the Effects on Visual/Perceptual Deficits

Sharon Pratt
Sunrise Medical
Longmont, CO USA
sharon.pratt@sunmed.com

IC 3 – Thursday – 1:00PM
Choosing the Best Cushion: How Do We Really Get There?

Randy Potter
Denver VAMC Eastern Colorado Healthcare System
Denver, CO USA
Randy.potter@va.gov

Paper Session #6 – Friday – 1:00PM
Let's Roll! A Team Approach to Achieving Optimal Rolling Dynamics

Deborah Pucci
Rehabilitation Institute of Chicago
Chicago, IL USA
dpucci@ric.org

IC 36 – Friday – 9:15AM
Empower with Power: How Attitudes About
Power Mobility Can Affect Outcomes

Paper Session #5 – Friday – 1:00PM
Around We Go: Custom Anterior Supports in
Conjunction with Molded Seating

R

Mark Richter
MAX mobility
Antioch, TN USA
mark@max-mobility.com

IC 21 – Thursday - 4:45PM
Propulsion Training for Everyone

Russell Rodriguez
MAX mobility
Antioch, TN USA
russell@max-mobility.com

IC 21 – Thursday - 4:45PM
Propulsion Training for Everyone

Lauren Rosen
St. Joseph's Children's Hospital of Tampa
Tampa, FL USA
PTLauren@aol.com

Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
Go Baby Go! The Science, Training and
Technology of Early Wheeled Mobility

IC 37 – Friday - 9:15AM
Why Wheelchair Prescription for Independent
Propulsion Matters and How to Do It

Lisa Rotelli
Adaptive Switch Laboratories, Inc.
Spicewood, TX USA
lrotelli@asl-inc.com

Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
Go Baby Go! The Science, Training and
Technology of Early Wheeled Mobility

Wayne Ryerson
Gillette Children's Specialty Healthcare
St. Paul, MN USA
wrydberg@gillettechildrens.com

S

Andrina Sabet
Cleveland Clinic Children's Hospital for Rehabilitation
Cleveland, OH USA
asabet@adelphia.net

IC 65 – Saturday – 9:45AM
Oh the Places You'll Roll…..Encouraging Adolescent Independence

Andi Saptono
University of Pittsburgh
Pittsburgh, PA USA
Ans38@pitt.edu

Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
Service Delivery Innovations and Strategies in Implementing
a Wheeled Mobility and Seating Program

IC 30 – Friday – 8:00AM
Use of Telerehabilitation in Wheeled Mobility and Seating Clinics

Paper Session #1 – Friday – 1PM
Development and Usability of an On-line AT
Outcome Measurement Database

Faith Savage
The Boston Home
Natick, MA USA
fsaftlersavage@rcn.com

IC 50 – Friday - 1:00PM
Assessment Issues for Individuals with Spinal Cord Injuries

Richard Schein
University of Pittsburgh
Pittsburgh, PA USA
Rms35@pitt.edu

Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
Service Delivery Innovations and Strategies in Implementing
a Wheeled Mobility and Seating Program

IC 30 – Friday – 8:00AM
Use of Telerehabilitation in Wheeled Mobility and Seating Clinics

Paper Session #1 – Friday – 1PM
Development and Usability of an On-line AT
Outcome Measurement Database

Paper Session #3 – Friday – 1:00PM
A Telerehabilitation Approach to Guide Therapists
to Prescribe Mobility Assistive Equipment

Mark Schmeler
University of Pittsburgh
Pittsburgh, PA USA
Schmeler@pitt.edu

International Seating Symposium Director

Pre-Conference Workshop – Tuesday – 8:00AM – 5:30PM
Fundamentals of Wheelchair Seating and Mobility

Opening Session – Thursday – 8:30AM

IC 30 – Friday – 8:00AM
Use of Telerehabilitation in Wheeled Mobility and Seating Clinics

Paper Session #3 – Friday – 1:00PM
A Telerehabilitation Approach to Guide Therapists
to Prescribe Mobility Assistive Equipment

Paper Session #1 – Friday – 1PM
Development and Usability of an On-line AT
Outcome Measurement Database

Mary Shea
Kessler Institute for Rehabilitation
Hoboken, NJ USA
mshea@kessler-rehab.com

IC 34 – Friday – 9:15AM
A Practice Guide for Wheelchair Assessments

Efrat Shenhod--malihi
Sheba Hospital -Tel Hashomer
Modiin,   Israel
nir99@bezeqint.net

IC 22 – Thursday – 4:45PM
24 Hours Postural Management Program

Paul Schulte
Invacare/Top End
Pinellas Park, FL USA
pschulte@invacare.com

IC 24 - Thursday - 4:45 PM
The Winning Combination for Court Sports

Cynthia Smith
Craig Hospital
Englewood, CO USA
csmith@craighospital.org

IC 39 – Friday – 9:15AM
Postural Support for SCI: Theory, Products, and Opinions

Ana Souza
University of Pittsburgh
Pittsburgh, PA USA
Aes33@pitt.edu

Paper Session #4 – Friday – 1:00PM
Mobility Device Use and Satisfaction among
People with Multiple Sclerosis (MS)

Jill Sparacio
Sparacio Consulting Services
Downers Grove, IL USA
otspar@aol.com

IC 56 – Saturday – 8:30AM
Focusing on Breathing in Adults with Cerebral Palsy

Paper Session #4 – Friday – 1:00PM
Custom Molded Seating: Is Softer Better?

Stephen Sprigle
Georgia Institute of Technology
Atlanta, GA USA
sprigle@gatech.edu

IC 38 – Friday – 9:15AM
Activities of Suppliers During Provision of
Wheeled Mobility and Seating Devices

Brenda Sposato
University of Illinois at Chicago
Chicago, IL USA
bsposato@uic.edu

Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
Service Delivery Innovations and Strategies in Implementing
a Wheeled Mobility and Seating Program

Michael Stacey
University of Western Australia
North Fremantle, WA Australia
michael.stacey@uwa.edu.au

IC 18 – Thursday - 4:45PM
AusCAN Risk Assessment for Sitting Acquired Pressure Ulcers

Paper Session #1 – Friday – 1:00PM
Interface Pressure Mapping: New Evidence
for the International Protocol

"Jodie" Kitty Stogner
Southeastern Assistive Technology Solutions, LLC
Brandon, MS USA
seat_solutions@bellsouth.net

Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
Service Delivery Innovations and Strategies in Implementing
a Wheeled Mobility and Seating Program

IC 51 – Friday – 1:00PM
Wheelchair Basics and Reimbursement for
Wheelchair Therapy Services

Maureen Story
Sunny Hill Health Centre for Children
Vancouver, BC Canada
mstory@cw.bc.ca

IC 23 – Thursday – 4:45PM
Controlling the Pelvis – A Practical Guide!

Carrie Strine
Alfred I. DuPont Hospital for Children
Wilmington, DE USA
leoandcarrie@verizon.net

IC 19 – Thursday – 4:45PM
Positioning for Children with Cerebral Palsy
Pre and Post Orthopaedic Surgeries

Bryce Sutton
James A. Haley VA Medical Center)
Tampa, FL USA
Bryce.Sutton@va.gov

IC 5 – Thursday – 1:00PM
An Introduction to Economic Evaluation of Health Care Interventions

Jillian Swaine
University of Western Australia
North Fremantle, WA Australia
jswaine@meddent.uwa.edu.au

IC 18 – Thursday - 4:45PM
AusCAN Risk Assessment for Sitting Acquired Pressure Ulcers

Paper Session #1 – Friday – 1:00PM
Interface Pressure Mapping: New Evidence
for the International Protocol

T

Stephanie Tanguay
Motion Concepts
Troy, MI USA
stanguay@motionconcepts.com

IC 13 – Thursday – 3:30PM
Incorporate Programming & Consumer
Education for Power Positioning Use

Erika Teixeira
Sao Paulo, Brazil

Poster Session – Thursday – 12:00 Noon
The Effects of Power Tilt and Recline During a Rehabilitation
Process of a Patient with Traumatic Brain
Injury – A Case Study

Elise Townsend
Massachusetts General Hospital
Boston, MA USA
etownsend@mghihp.edu

IC 35 – Friday – 9:15AM
Powered Standing Mobility in Boys with
Duchenne Muscular Dystrophy

Diane Thomson
Rehabilitation Institute of Michigan
Saline, MI USA
dthomson2@dmc.org

IC 39 – Friday - 9:15AM
Postural Support for SCI: Theory, Products, and Opinions

V

Bart Van Der Heyden
The ROHO Group Europe
Destelbergen, Belgium
bvanderheyden@attglobal.net

IC 41 – Friday – 10:45AM
The Changing Perception Towards Disability and Wheelchair
Users and its Impact on Seating Interventions and AT Provision

Menno van Etten
Etac AS, Norway
Moss, Norway
menno.vanetten@etac.no

IC 29 – Friday – 8:00AM
Influences on the Seated Position

W

Ann "Weesie" Walker
National Seating and Mobility
Atlanta, GA USA
wwalker@nsm-seating.com

Pre-Conference Workshop – Wednesday – 8:00AM – 5:30PM
Policy & Funding for Mobility Assistive Equipment in the USA

Kelly Waugh
Assistive Technology Partners
Denver, CO USA
kelly.waugh@ucdenver.edu

IC 58 – Saturday – 8:30AM
A Problem Solving Model for Wheelchair Seating Assessment

Anjali Weber
RESNA
Alexandria, VA USA
aweber@resna.org

IC 14 – Thursday – 3:30PM
Ethics and Certification: Raising the Bar of Professionalism

Madalynn Wendland
Cleveland Clinic Children's Hospital
Cleveland, OH USA
wendlam@ccf.org

IC 65 – Saturday – 9:45AM
Oh the Places You'll Roll……Encouraging Adolescent Independence

Douglas Whitman
UCP of NYC
Bronx, NY
dwhitman@ucpnyc.org

Paper Session #6 – Friday – 1:00PM
I Deserve Filet Mignon: Best Practice vs.
Compromise in Equipment Prescriptions

Nicole Wilkins
Sunny Hill Health Centre for Children
Vancouver, BC, Canada
nwilkins@cw.bc.ca

IC 52 – Friday – 1:00PM
The Power of Choice – Talking, Computing,
ECU's Through the Power Wheelchair

Jacqueline Wolz
Eastern Colorado Healthcare System
VAMC – Denver
Denver, CO USA
Jacqueline.wolz@va.gov

IC 8 – Thursday – 1:00PM
Bike On! A Guide to Matching Your Client with the Right Handcycle

Paper Session #6 – Friday – 1:00PM
Let's Roll! A Team Approach to Achieving Optimal Rolling Dynamics

Lee Woodruff
Author, Freelance Writer & Contributing Editor
ABC's Good Morning America
http://www.leewoodruff.com

Closing Session – Saturday – 11:00AM
In an Instant

Z

Jean Zollars
Jean Anne Zollars Physical Therapy, Inc.
Albuquerque, NM
jzollars@q.com

Paper Session #5 – Friday – 1:00PM
Supporting, Not Stressing the Autonomic
Nervous System: Two Case Studies

John Zona
Lakeview Medical /Fallon Clinic
Auburn, MA USA
john.zona@fallonclinic.org

IC 27 – Friday – 8:00AM
Self Advocacy, It's Just Not for Consumers!

General Information

Audience

- Assistive Technology Professionals (ATP)
- Seating and Mobility Specialist (SMS)
- Rehabilitation Engineering Technologist (RET)
- Occupational Therapists
- Physical Therapists
- Educators
- Manufacturers
- Product Developers
- People with Disabilities
- Physicians
- Nurses
- Rehabilitation Engineers & Technicians
- Vocational Rehabilitation Counselors
- Researchers

Introduction

The symposium will include scientific and clinical papers, research forums, in-depth workshops, panel sessions, and an extensive exhibit hall. Presentations will address the wheeled mobility and seating challenges and solutions for people with disabilities across the lifespan and conditions such as neuromuscular disorders, spinal cord injury and diseases of the spinal cord, orthopedic conditions, systemic conditions, obesity, or polytrauma.

Program Objectives

- Identify wheeled mobility and seating interventions for people with physical disabilities
- Discuss service delivery practices
- Identify and apply relevant current research
- Understand features and the clinical impact of wheeled mobility and seating technologies

Continuing Education Credit

The University of Pittsburgh, School of Health and Rehabilitation Sciences awards Continuing Education Units to individuals who enroll in certain educational activities. The CEU is designated to give recognition to individuals who continue their education in order to stay current in their profession. (One CEU is equivalent to 10 hours of participation in an organized continuing education activity). Each person should claim only those hours of credit that they actually spent in the educational activity. The University of Pittsburgh is certifying the educational contact hours of this program and by doing so is in no way endorsing any specific content, company, or product. The information presented in this program may represent only a sample of appropriate interventions. 1.6 Continuing Education Units (CEUs) will be awarded to individuals for attending 16 hours of instruction. CEUs will be pro-rated for those not attending the full program.

Exhibits

The exhibit hall will be filled with commercial products and innovations from North America and abroad. There will be ample opportunity to explore wheeled mobility and seating options.

Schedule

Wednesday - March 2, 2011

7:00 AM - 6:00 PM
Registration
(Governor's Registration Desk)

Thursday - March 3, 2011

7:30 AM
Registration
(Governor's Registration Desk)
Continental Breakfast
(Ryman Exhibit Hall B 4-5)

8:30 AM
Opening
(Governor's Ballroom)

Welcome:
Mark R. Schmeler, PhD, OTR/L, ATP
Symposium Course Director
Director, Continuing Education Program
Assistant Professor, Department of Rehabilitation Science and Technology
School of Health and Rehabilitation Sciences
University of Pittsburgh

9:00 AM
Keynote Address Supported by The Comfort Company
(Governor's Ballroom)

Al Condeluci, PhD – CEO of United Cerebral Palsy of Pittsburgh, Pittsburgh, PA, United States

Cultural Shifting: Building Social Capital
All of us are interested in a better community where all people have an opportunity for accessible and affordable homes, jobs or meaningful daytime opportunities and lifestyles of their choice. In spite of our many years of work on this goal, the outcomes in this area are still not satisfactory for people who are vulnerable due to age, disability or other compromises. Many of these vulnerable people find themselves in isolated situations with limited options for friendships and important social relationships. This presentation takes a close look at the reasons why our systems have not been more successful in these goals, defines and delineates the concept of social capital, and offers a community building perspective designed to shift the culture to be more inclusive and supportive to all people.

10:00 AM

GS 1 General Session – Papers
(Governor's Ballroom)

GS1:1 Participation: The Ultimate Outcome
Kendra L. Betz, MSPT, ATP, Prosthetics & Sensory Aids Service, VA Central Office, Washington, DC, United States

GS1:2 Being an Advocate in Today's Service Delivery Process –Do We Have a Choice
Ann Eubank, MSSW, OTR/L, ATP, Users First Alliance, Cane Ridge, TN, United States

GS1:3 Reality: The Case of the Stolen Scooter- And Other Possible Dilemmas
Dave Harding, MPA, School of Health and Rehabilitation Sciences, University of Pittsburgh

11:00 AM – 1:00 PM

Walk-About Lunch
(lunch included in tuition)
Ryman Exhibit Hall B 4-5

12:00 Noon

Poster Session 1
(Ryman Exhibit Hall B 4-5)

P 1: Perceived Quality of Life of Children Who Participate in Wheelchair Sports
E. Reagan Bergstresser-Simpson,
Belmont University, Nashville, TN, United States

P 2: Bariatric Seating and Positioning: Lessons Learned in an Urban Medical Center
Nettie Capasso, Rusk Institute, NYU Langone Medical Center, New York, NY, United States

P 3: Wheelchair Cushions and Temperature When Exposed to
Direct Sunlight
Keith Grewe, Cardinal Hill Rehab, Lexington, KY, United States

P 4: Space Tube, for Welfare and Rehabilitation Technology
Hisaichi Ohnabe, PhD, Niigata University of Health and Welfare, Japan
Tetsuro Fukuhara, Tokyo Space Dance, Japan
Shiro Mitsumori, The Institute for Future Technology, Japan

P 5: The effects of power tilt and recline during a rehabilitation process of a patient with Traumatic Brain Injury- A case study
Erika Teixeira, MOT, São Paulo, Brazil

1:00 PM – 3:00 PM Two-Hour Sessions

IC 1: ISO Pressure Mapping Clinical Guidelines - Combining Expertise and Evidence
Kimberly Davis, MSPT, ATP, ATECH Services, Concord, NH, United States
Patrick Meeker, MS, PT, CWS, The ROHO Group, Belleville, IL, United States
**Advanced*
Governors Ballroom B

IC 2: Complex Rehab Technology Separate Benefit Update
Laura Cohen, PT, PhD, ATP, Rehab & Tech Consultants, LLC, Decatur, GA, United States
Don Clayback, Executive Director, NCART, Buffalo, NY, United States
Tim Pederson, CEO, WestMed Rehab, Inc, Rapid City, SD, United States
Rita Hostak, Vice President, Government Relations, Sunrise Medical, Longmont, CO, United States (M)
Elizabeth Cole, MSPT, U. S. Rehab, Waterloo, IA, United States
Simon Margolis, ATP, National Registry of Rehabilitation Technology Suppliers, Trinidad, CO, United States
Gary Gilberti, Chesapeake Rehab Equipment, Inc., Baltimore, MD, United States
**Beginner*
Ryman Studio – MNO

IC 3: Choosing The Best Cushion: How Do We Really Get There
Darren Hammond, MPT, CWS, The ROHO Group, Inc., Belleville, IL, United States (M)
Sharon Pratt, PT, Sunrise Medical, Longmont, CO, United States (M)
Tricia Henley, PT, ATP, The ROHO Group, Belleville, IL, United States (M)
**Intermediate*
Governors Ballroom CD

IC 4: Physical Assessment – Where Do I Put My Hands
Jean Minkel, MA, PT, ATP, Minkel Consulting, New Windsor, NY, United States
**Beginner*
Ryman Studio PQR

IC 5: An Introduction to Economic Evaluation of Health Care Interventions
Bryce Sutton, PhD, James A. Haley VA Medical Center, Tampa, FL, United States
**Beginner*
Ryman Ballroom C

IC 6: Custom Sooner = More Meaningful and Lasting Outcomes
Thomas Hetzel, PT, ATP, Ride Designs, Sheridan, CO, United States (M)
**Intermediate*
Ryman Ballroom AD

IC 7: Best Practice: Power Mobility Workshop
Roslyn Livingstone, Dip COT, MSc (RS), Sunny Hill Health Centre, Vancouver. BC, Canada
Ginny Paleg, DScPT, Montgomery County Schools, Silver Spring, MD, United States
**Intermediate*
Governors Ballroom AE

IC 8: Bike on! A Guide to Matching Your Client with the Right Handcycle
Jacqueline Wolz, MSPT, Eastern Colorado Healthcare Systems - Denver VAMC, Denver, CO, United States
**Intermediate*
Exhibit Hall - Ryman 4 - 5 - 6

3:00 PM

Break
Ryman Exhibit Hall B 4-5

3:30 PM – 4:30 PM One-Hour Sessions

IC 9: Winter Sports & Recreation: Adaptive Options & Assistive Technologies
Kendra L. Betz, MSPT, ATP, Prosthetics & Sensory Aids Service, VA Central Office, Washington, DC, United States
**Beginner*
Ryman Ballroom CF

IC 10: RESNA Standards Volume 4: Wheelchairs and Transportation
Mary Ellen Buning, PhD, OTR/L, ATP, University of Louisville & Frazier Rehabilitation Institute, Louisville, KY, United States
Patricia Karg, MSE, University of Pittsburgh, Pittsburgh, PA, United States
**Intermediate*
Gov Ballroom CD

IC 11: Engagement: How to Foster a Healthy Rehab Industry
Kevin Gouy, ATP, United Seating & Mobility, Portland, OR, United States
Eric Grieb, OTR, ATP, United Seating & Mobility, Colorado Springs, CO, United States
**Intermediate*
Ryman Studio - MNO

IC 12: Comparing Wheelchair, Wheelchair Skill Level, Community Participation and Payer
Alison Lichy, PT, DPT, NCS, National Rehabilitation Hospital, Washington, DC, United States
Jessica Pedersen, OTR/L, ATP, Rehabilitation Institute of Chicago, Chicago, IL, United States
**Intermediate*
Ryman Studio PQR

IC 13: Incorporate Programming & Consumer Education for Power Positioning Use
Stephanie Tanguay, OTR, ATP, Motion Concepts, Troy, MI, United States (M)
Lois Brown, MPT, ATP, Invacare Corp., Elyria, OH, United States (M)
**Intermediate*
Gov Ballroom AE

IC 14: Ethics and Certification: Raising the Bar of Professionalism
Anjali Weber, MS, ATP, RESNA , Arlington, VA, United States
Laura Cohen, PT, PhD, ATP, Rehab & Tech Consultants, LLC, Decatur, GA, United States
Julie Piriano, PT, ATP, SMS, Pride Mobility Products Corp., Exeter, PA, United States (M)
**Intermediate*
Ryman Ballroom AD

IC 15: Do You Have Your Client's Back
Jacqueline Macauley, PT, ATP, Sunrise Medical EU, Belfast Northern Ireland, United Kingdom
**Beginner (M)*
Gov Ballroom B

IC 16: Get Your Hands On a Stander - How to Properly Set Up and Fit Standing Devices
Amy Meyer, PT, ATP, Permobil, Inc., Lebanon, TN, United States (M)
Andy Hicks, ATP, Altimate Medical Inc., Morton, MN, United States (M)
**Intermediate*
Exhibit Hall - Ryman 4 - 5 - 6

4:45 PM – 5:45 PM One-Hour Sessions

IC 17: Providing Powered Mobility for the Severely Involved Child
Susan Johnson Taylor, OTR/L, Rehab Institute of Chicago, Chicago, IL, United States
Theresa Clancy, PT, Rehab Institute of Chicago, Chicago, IL, United States
**Intermediate*
Gov Ballroom AE

IC 18: AusCAN Risk Assessment for Sitting Acquired Pressure Ulcers
Jillian Swaine, OT, University of Western Australia, North Fremantle, Wa, Australia
Michael C. Stacey, MD, University of Western Australia, North Fremantle, Wa, Australia
**Intermediate*
Ryman Studio PQR

IC 19: Positioning for Children with Cerebral Palsy Pre and Post Orthopaedic Surgeries
Denise Peischl, BSE, Alfred I. duPont Hospital for Children, Wilmington, DE, United States
Liz Koczur, MPT, PCS, Alfred I. duPont Hospital for Children, Wilmington, DE, United States
Carrie Strine, OTR/L, Alfred I. duPont Hospital for Children, Wilmington, DE, United States
**Beginner*
Gov Ballroom B

IC 20: Integrating Outcome Measures into Daily Practice, Custom Seating Outcome Survey and Cases
Lori Knott, OT
Health Sciences Centre, Winnipeg, Manitoba Canada
**Intermediate*
Ryman Ballroom CF

IC 21 : Propulsion Training for Everyone
Mark Richter, PhD, MAX Mobility, Antioch, TN, United States (M)
Andrew Kwarciak, MAX Mobility, Antioch, TN, United States (M)
Russell Rodriguez, MAX Mobility, Antioch, TN, United States (M)
**Intermediate*
Ryman Ballroom AD

IC 22: 24 Hours Postural Management Program
Gelkop Nava PT, MSc, Sheba Hospital -Tel Hashomer, Modiin, Israel
Efrat Shenhod BOT, Sheba Hospital -Tel Hashomer, Modiin, Israel
**Intermediate - Advanced*
Ryman Studio MNO

IC 23: Controlling the Pelvis - A Practical Guide!
Maureen Story, BSR(PT/OT), Sunny Hill Health Centre for Children, Vancouver, BC, Canada
Bob Stickney, Sunny Hill Health Centre for Children, Vancouver, BC, Canada
**Beginner*
Gov Ballroom CD

IC 24: The Winning Combination for Court Sports
Jim Black, Top End, Pinellas Park, FL, United States (M)
Paul Schulte, Top End, Pinellas Park, FL, United States (M)
**Intermediate*
Exhibit Hall - Ryman 4 - 5 - 6

5:45 PM
Adjournment

5:45 PM 7:30 PM
Welcome Reception (Ryman Exhibit Hall)

Friday - March 4, 2011

7:00 AM
Continental Breakfast
Ryman Exhibit Hall B 4-5

8:00 AM – 9:00 AM One-Hour Sessions

IC 25: The Relationship Between Driving, Vehicle Modifications and Seating and Mobility
Wes Perry, ATP, CDRS, MSBME, Mississippi State University, T.K. Martin Center, Mississippi State, MS, United States
Dan Allison, Mississippi State University, T.K. Martin Center, Mississippi State, MS, United States
**Intermediate*
Ryman Ballroom CF

IC 26: Quantifying Posture According to an International Standard.
Barbara Crane, PhD, PT, ATP, University of Hartford, West Hartford, CT, United States
**Intermediate*
Gov Ballroom B

IC 27: Self Advocacy, It's Just Not for Consumers!
Michelle Gunn, ATP, CRTS, Browning's Health Care, Orlando, FL, United States
Simon Margolis, ATP, National Registry of Rehabilitation Technology Suppliers. Trinidad, CO, United States
John Zona, ATP, CRTS, Lakeview Medical / Fallon Clinic, Auburn, MA, United States
**Intermediate*
Ryman Studio PQR

IC 28: Make It and Take It- A Beginner's Guide to Wheelchair Evaluations
Kay Koch, OTR/L, ATP, Mobility Designs/ CHOA, Atlanta, GA, United States
Susan Johnson Taylor, OTR/L, Rehab Institute of Chicago, Chicago, IL, United States
Brenlee Mogul-Rotman, BSc (OT), OTR, ATP, OT (Reg. Ont.), Toward Independence, Richmond Hill, ON, Canada
**Beginner*
Gov Ballroom CD

IC 29: Influences on the Seated Position
Menno van Etten, Etac AS, Moss, Norway (M)
**Beginner*
Ryman Studio MNO

IC 30: Use of Telerehabilitation in Wheeled Mobility and Seating Clinics
Richard Schein, PhD, University of Pittsburgh, Pittsburgh, PA, United States
Andi Saptono, PhD, University of Pittsburgh, Pittsburgh, PA, United States
Mark R. Schmeler, PhD, OTR/L, ATP, University of Pittsburgh, Pittsburgh, PA United States
**Beginner*
Ryman Ballroom AD

IC 31: First Time Pediatric Power Users, Problem Solving for Complex Access
Marlene Holder, PT, Bloorview Kids Rehab, Toronto, ON, Canada
Kathryn Fisher, B.Sc. OT, ATP, OT Reg.(Ont), Shoppers Home Health Care, Toronto, ON, Canada
**Intermediate*
Gov Ballroom AE

IC 32: Adaptive Cycling for People with Special Needs
Jennifer Miros, MPT, St. Louis Children's Hospital, St. Louis, MO, United States
**Beginner*
Exhibit Hall Ryman 4 - 5 - 6

9:15 AM – 10:15 AM One-Hour Sessions

IC 33: The Challenges of Seating and Mobility for Children With Dystonia
Karen Kangas, OTR/L, ATP, Private Practice, Shamokin, PA, United States
**Intermediate*
Gov Ballroom B

IC 34: A Practice Guide for Wheelchair Assessments
Mary Shea, MA, OTR, ATP, Kessler Institute for Rehabilitation, West Orange, NJ, United States
Teresa Plummer,PhD, OTR, ATP, Belmont Univeristy, Vanderbilt Children's Hospital, Nashville, TN, United States
**Beginner*
Gov Ballroom CD

IC 35: Powered Standing Mobility in Boys with Duchenne Muscular Dystrophy
Elise Townsend, DPT, PhD, PCS, Massachusetts General Hospital Institute of Health Professions, Boston, MA, United States,
Amy Meyer, PT, ATP, Permobil, Lebanon, TN, United States (M)
*Intermediate
Ryman Studio PQR

IC 36: Empower with Power: How Attitudes About Power Mobility Can Affect Outcomes
Deborah Pucci, PT, MPT, ATP, Rehabilitation Institute of Chicago, Chicago, IL, United States
Brenda Canning, OTR/L, Rehabilitation Institute of Chicago, Chicago, IL, United States
**Intermediate*
Ryman Studio PQR

IC 37: Why Wheelchair Prescription for Independent Propulsion Matters and How to Do It
Lauren Rosen, PT, MPT, ATP, St. Joseph's Children's Hospital of Tampa, Tampa, FL, United States
Josh Anderson, TiLite, Kennewick, WA, United States (M)
**Intermediate*
Ryman Ballroom AD

IC 38: Activities of Suppliers During Provision of Wheeled Mobility and Seating Devices
Stephen Sprigle, PhD, PT, Georgia Institute of Technology, Atlanta, GA, United States
James Lenker, PhD, OTR/L, ATP, University at Buffalo, Buffalo, NY, United States
**Intermediate*
Ryman Ballroom CF

IC 39: Postural Support for SCI: Theory, Products, and Opinions
Cynthia Smith, PT, ATP, Craig Hospital, Englewood, CO, United States
Diane Thomson, OTR/L, Rehabilitation Institute of Michigan, Detroit, MI, United States
Jessica Pedersen, OTR/L, ATP, Rehabilitation Institute of Chicago, Chicago, IL, United States
**Intermediate*
Gov Ballroom AE

IC 40: Understanding and Teaching Advanced Wheelchair Skills (Session 1)
Darrell Musick, PT, Berkeley Bionics, Berkeley, CA, United States
**Beginner*
Exhibit Hall Ryman 4 - 5 - 6

10:15 AM
Break
Ryman Exhibit Hall B 4-5

10:45 AM – 11:45 AM One-Hour Sessions

IC 41: The Changing Perception Towards Disability and Wheelchair Users and its Impact on Seating Interventions and AT Provision
Impact on Seating Interventions and AT Provision
Bart Van Der Heyden, PT, The ROHO Group Europe, Destelbergen, Belgium (M)
**Advanced*
Gov Ballroom CD

IC 42: Special Considerations for Transporting Clients with Special Needs
Delia Freney, OTR/L, ATP, Kaiser Permanente, Castro Valley, CA, United States
Susan Johnson, CPST, Columbia Medical, Santa Fe Springs, CA, United States (M)
**Beginner*
Ryman Studio PQR

IC 43: Investigating Clinically Relevant Cushion Characteristics Via Laboratory Testing
J. David Mccausland, ROHO, Inc., Belleville, IL, United States (M)
Mark Greig, P.Eng, Sunrise Medical, Longmont, CO, United States (M)
**Intermediate*
Gov Ballroom B

IC 44: Diagnosis...More Than Just Words
Brenlee Mogul-Rotman, BSc (OT), OTR, ATP, OT (Reg. Ont.), Toward Independence, Richmond Hill, ON, Canada
**Beginner*
Ryman Ballroom AD

IC 45: Clinical Standards in Specialized Services
Simon Hall, Central Remedial Clinic, Clontarf, Dublin, Ireland
**Intermediate*
Ryman Studio MNO

IC 46: Water Sports: Seating in an Unstable Environment
Leif Nelson, DPT, ATP, CSCS, Department of Veterans Affairs, New York, NY United States
Chad Kincaid, CP, PT, Grand Junction VA Medical Center, Grand Junction, CO United States
**Beginner*
Ryman Ballroom CF

IC 47: I Know the Best Product for My Client, But Will it Be Funded
Claudia Amortegui, MBA, The Orion Consulting Group, Inc., Denver, CO, United States
**Intermediate*
Gov Ballroom AE

IC 48: Understanding and Teaching Advanced Wheelchair Skills (Session 2)
Darrell Musick, PT, Berkelet Bionics, Berkeley, CA United States
**Intermediate*
Exhibit Hall Ryman 4 - 5 - 6

11:45 AM – 1:00 PM

Lunch
Ryman Exhibit Hall B 4-5

1:00 PM – 3:00 PM Two-Hour Sessions

IC 49: Seating and Positioning Fairy Godmothers: Real Live Cases in an Interactive Game-Show Format
Ginny Paleg, DScPT, Montgomery County Schools, Silver Spring, United States
**Advanced*
Gov Ballroom AE

IC 50: Assessment Issues for Individuals with Spinal Cord Injuries
Faith Savage, PT, ATP, The Boston Home, Natick, MA, United States
**Intermediate*
Gov Ballroom CD

IC 51: Wheelchair Basics and Reimbursement for Wheelchair Therapy Services
Kitty Stogner, PT, ATP, Southeastern Assistive Technology Solutions, LLC, Brandon, MS, United States
**Beginner*
Ryman Ballroom CF

IC 52: The Power of Choice - Talking, Computing, ECU's Through the Power Wheelchair
Nicole Wilkins, OT, Sunny Hill Health Centre for Children, Vancouver, BC, Canada
Roslyn Livingstone, Dip COT, MSc (RS) Sunny Hill Health Centre for Children, Vancouver, BC, Canada
**Advanced*
Gov Ballroom B

IC 53: It's More than 4 Wheels!
Assessment and Prescription in the Community
Sheila Buck, B.Sc. (OT), Reg. (Ont.), ATP, Therapy NOW! Inc., Milton, ON, Canada
**Beginner*
Exhibit Hall Ryman 4 - 5 - 6

Paper Sessions

There will be 6 rooms running simultaneously. Attendees will be able to move between rooms to attend papers of their choice. CEUs will be available for the paper sessions, however, attendance at five papers will be required.

Paper Session 1 – Outcomes

Ryman Studio M

PS 1:1 A Retrospective Look at Seating & Mobility Options for Lower Extremity Amputees
Jennith Bernstein, PT, Robin Skolsky, Shepherd Center, Atlanta, GA, United States
**Intermediate*

PS 1:2 Do Standing Programs Make a Difference
Sheila Blochlinger, PT, ATP, Megan Damcott, Richard Foulds, Bruno Mantilla, Children's Specialized Hospital, Mountainside, NJ, United States
**Beginner*

PS 1:3 The Transfer Assessment Instrument for Measuring Transfer Performance
Alicia Koontz, PhD, RET, ATP, Laura McClure, PhD, VA Pittsburgh HealthCare System, Pittsburgh, PA, United States
**Beginner*

PS 1:4 Interface Pressure Mapping: New Evidence for the International Protocol
Jillian Swaine, OT, Michael Stacey, Rosemary Mason, University of Western Australia, North Fremantle, Wa Australia, Australia
**Intermediate*

PS 1:5 Development and Usability of an On-line AT Outcome Measurement Database
Richard M. Schein, PhD, MPH, Andi Saptono, MS, Mark R. Schmeler, PhD, OTR/L, ATP, & Bambang Parmanto, PhD, University of Pittsburgh, Pittsburgh, PA, United States
**Intermediate*

Paper Session 2 – Service Delivery

Ryman Studio N

PS 2:1 Introducing Fieldwork Students to Wheelchair Seating & Mobility
William Mattingly, Sara Mellencamp, Frazier Rehab Institute, Louisville, KY, United States
Mary Ellen Buning, PhD, OTR/L, ATP, University of Louisville, Frazier Rehabilitation Institute, Louisville, KY, United States
**Intermediate*

PS 2:2 Collaboration in the Wheelchair Evaluation Process for the Pediatric User
Mary Bacci, MS, ATP, University of Illinois at Chicago, Highland Park, IL, United States
Catherine Kushner, The Eisenhower Cooperative, Chicago, IL, United States
**Intermediate*

PS 2:3 Pressure Relief and Common ADL Activities
Keith Grewe, ATP, Cardinal Hill Rehab, Lexington, KY, United States
**Intermediate*

PS 2:4 Improving Service Delivery Throughout the Rehab Continuum
Jennith Bernstein, PT, David Kreutz, PT, ATP, Robin Solosky, Shepherd Center, Atlanta, GA, United States
**Intermediate*

PS 2:5 Changing Lives Through Recovery: A Comprehensive Team Approach
Sheila Blochlinger, PT, ATP, Children's Specialized Hospital, Mountainside, NJ, United States
**Beginner*

Paper Session 3 – Research 1

Ryman Studio O

PS 3:1 A Telerehabilitation Approach to Guide Therapists to Prescribe Mobility Assitive Equipment
Ana Allegretti, PhD, Mark Schmeler, PhD, Richard Schein, PhD, University of Pittsburgh, Pittsburgh, PA, United States
**Intermediate*

PS 3:2 Microclimate Measurements with Human Subjects on Custom Carved Cushions
Evan Call, Weber State University, Centerville, UT, United States
**Intermediate*

PS 3:3 Comparison Between 2 Points and 4 Points Seat Belt in Patients with CP
Martino Avellis, PT, Andrea Cazzaniga, Veronica Cimolin, Luigi Piccinini, Manuela Galli, Anna Carla Turconi, Fumagalli Srl, Ponte Lambro, Italy
**Intermediate*

PS 3:4 Comfort and Stability of Wheelchair Backrests
Eun-Kyoung Hong, MS, Jonathan Pearlman, PhD, Brad Dicianno, MD, Rory Cooper, PhD, University of Pittsburgh, Pittsburgh, PA, United States
**Beginner*

PS 3:5 Identifying Generic Back Shapes from Anatomical Scans to Advance Seating Design
Jonathan Pearlman, PhD, Rory Cooper, PhD, Brad Dicianno, MD, Eun-Kyoung Hong, MS, VA & University of Pittsburgh, Pittsburgh, PA, United States
**Intermediate*

Paper Session 4 – Research 2

Ryman Studio P

PS 4:1 Vibration Dampening Characteristics of Wheelchair Cushions
Yasmin Garcia Mendez, BS, Jonathan Pearlman, PhD, Rory Cooper, PhD, Michael Boninger, MD, University of Pittsburgh, Pittsburgh, PA, United States
**Beginner*

PS 4:2 Paper Cancelled

PS 4:3 The Wheelchair Assessment: Results of a Qualitative Study
Teresa Plummer, PhD, OTR, ATP, Belmont Univeristy, Vanderbilt Children's Hospital, Nashville, TN, United States
**Beginner*

PS 4:4 Custom Molded Seating: Is Softer Better
Jill Sparacio, OTR/L, ATP, ABDA Sparacio Consulting Services, Downers Grove, IL, United States
**Beginner*

PS 4:5 Mobility Device Use and Satisfaction among People with Multiple Sclerosis (MS)
Ana Souza, MSPT, Annmarie Kellerher, MS, OTR/L, ATP, CCRC, Rosemarie Cooper, MPT, ATP, Rory Cooper, PhD, University of Pittsburgh, Pittsburgh, PA, United States
**Beginner*

Paper Session 5 – Case Studies 1

Ryman Studio Q

PS 5:1 Creating Molded Seating for An Adult with Tone which Supports Movement
Karen Kangas, OTR/L, ATP, Private Practice, Shamokin, PA, United States
**Intermediate*

PS 5:2 Around We Go: Custom Anterior Supports in Conjunction with Molded Seating
Deborah Pucci, PT, MPT, ATP, Rehabilitation Institute of Chicago, Chicago, IL, United States
Denise Harmon, ATP, National Seating and Mobility, Lombard, IL United States
**Intermediate*

PS 5:3 Design, Re-design, Repeat: A Holistic Approach to Seating a Veteran Client
Deanna Baldassari, MS, OTR/L; Melissa Oliver, MS, OTR/L, CBIS, McGuire VA Medical Center, Richmond, VA, United States
**Intermediate*

PS 5:4 Supporting, Not Stressing the Autonomic Nervous System: Two Case Studies
Jean Zollars, MA, PT, Jean Anne Zollars Physical Therapy, Inc., Albuquerque, NM, United States
**Intermediate*

PS 5:5 Neuromuscular Spinal Deformities In Children: Challenges of Custom Molding.
Michele Audet, MMSc, PT, ATP, Children's Healthcare of Atlanta, Stone Mountain, GA, United States
**Intermediate*

Paper Session 6 – Case Studies 2

Ryman Studio R

PS 6:1 Single Switch Access: The Story of One Boys Independence
Jay Doherty, OTR, ATP, SMS, Pride Mobility Products Corp., Exeter, PA, United States (M)
**Intermediate*

PS 6:2 Twenty-Four Hour Postural Management for Adults
Linda Norton, OT Reg.(ONT), MScCH, Margot McWhirter, Shoppers Home Health Care, Etobicoke, ON, Canada
**Intermediate*

PS 6:3 Paper Cancelled

PS 6:4 I Deserve Filet Mignon: Best Practice vs. Compromise in Equipment Prescriptions
Douglas Whitman, OTR, ATP, UCP of NYC, Bronx, NY, United States
Amy Bjornson, OT, Sunrise Medical, Neutral Bay, NSW, Australia (M)
**Intermediate*

PS 6:5 Let's Roll! A Team Approach to Achieving Optimal Rolling Dynamics
Jacqueline Wolz, MSPT, Randy Potter, ATP,CRTS, Eastern Colorado Healthcare Systems - Denver VAMC, Denver, CO, United States
Jim Black, Top End, Pinellas Park, Fl, United States (M)
**Intermediate*

3:00 PM

Break

Ryman Exhibit Hall B 4-5

3:30 PM – 5:00 PM ISS Practice Forum

" Love What You Do - Need a New Place to Do It "
Chair: **Jean Minkel, PT, ATP,** Minkel Consulting, New Windsor, NY, United States
Deanna Baldassari, OTR/L McGuire V A Medical Center; Richmond, VA United States
Christin Krey, MSPT, ATP Shriners Hospital for Children; Philadelphia, PA United States
Wayne Ryerson, Gillette Children's Specialty Healthcare; St. Paul, MN United State
David Algood, MS, Permobil; New Lebanon, TN United States
**Intermediate*

Governors Ballroom

5:00 PM Adjourn

5:00 PM – 6:00 PM

Ryman Studio L

RESNA SMS Cocktail Hour
Curious About the RESNA SMS Credential?
Enjoy some time with friends, and hear from the first people to earn the SMS credential (Seating & Mobility Specialist). Why did they decide to take it? What was the hardest part of the exam? How did they study? In what way will they use the credential? Meet others who are interested and get a chance to talk to them in a casual atmosphere.

7:00 PM: ISS social event Honky-Tonk

The World Famous Nashville Palace is across the street from the Opryland Hotel. The venue is a short walk from the hotel and shuttle service will also be available.

Event Supported by;

- **Permobil, Inc.**
- **Quantum Rehab**
- **Sunrise Medical**
- **United Seating & Mobility**

- **Clarke Healthcare**
- **Otto Bock Healthcare**
- **Star Cushion**

Saturday - March 5, 2011

8:00 AM
Continental Breakfast

8:30 AM – 9:30 AM One-Hour Sessions

IC 54: Out and About: Reducing Injury via Vehicle Wheelchair Lifts and Van Conversions
Joan Padgitt, PT, ATP & Ryan Crosby,ATP, Eastern Colorado Healthcare Systems - Denver VAMC, Denver, CO, United States
**Beginner*
Ryman Studio PQR

IC 55: Beyond Seating:Enhancing Function & Fun with Children through Adaptive Equipment
Jonathan Greenwood, PT, MS, NDT, PCS, Northeast Rehabilitation Hospital Network, Salem, NH, United States
**Intermediate*
Gov Ballroom B

IC 56: Focusing on Breathing in Adults with Cerebral Palsy
Jessica Pedersen, OTR/L, ATP, Rehabilitation Institute of Chicago, Chicago, IL, United States
Jill Sparacio, OTR/L, ATP, ABDA Sparacio Consulting Services, Downers Grove, IL, United States
Fran Dorman, PT, MHS, Clinical Services Bureau, New Mexico Department of Health, Albuquerque, NM, United States
**Intermediate*
Ryman Ballroom CF

IC 57: Designing a Pediatric Power Wheelchair from a Therapeutic Perspective!
Penny Knudson, OT, Otto Bock Health Care GmbH, Duderstadt, Germany (M)
Clare Wright, OT, Leckey Designs, Belfast, Northern Ireland, United Kingdom M)
**Beginner*
Ryman Ballroom AD

IC 58: A Problem Solving Model for Wheelchair Seating Assessment
Kelly Waugh, PT, MAPT, ATP, Assistive Technology Partners, Denver, CO, United States
**Intermediate*
Gov Ballroom AE

IC 59: Medicare 101 for the Clinician Prescribing Seating and Mobility Products
Elizabeth Cole, MSPT, U. S. Rehab, Waterloo, IA, United States
**Intermediate*
Gov Ballroom CD

9:30 AM Break

9:45 AM – 10:45 AM One-Hour Sessions

IC 60: Dynamic Seating: Why, Who and How
Suzanne Eason, OTL, St. Mary's Home for Disabled Children, Norfolk, VA, United States
**Intermediate*
Gov Ballroom B

C 61: Powered Mobility and the Effects on Visual/Perceptual Deficits
Casey Emery, OTD, OTR/L, Banner Good Samaritan/Touchstone Rehab, Phoenix, AZ, United States
Teresa Plummer, PhD, OTR, ATP, Belmont University, Vanderbilt Children's Hospital, Nashville, TN, United States
**Intermediate*
Gov Ballroom CD

IC 62: Head Positioning: Problems or Possibilities
Kathryn Fisher, B.Sc. OT, ATS, OT Reg.(Ont), Shoppers Home Health Care, Toronto, ON, Canada
**Intermediate*
Gov Ballroom AE

IC 63: To Power or Not: Powered Mobility and the Obese Client with Venous Stasis Ulcers
Jenny Lieberman, MSOTR/L, ATP, Mount Sinai Hospital, New York, NY, United States
**Intermediate*
Ryman Ballroom CF

IC 64: Emphasizing Usability During Wheelchair Specification and Configuration
Steven Mitchell, OTR/L, ATP, Cleveland VA Medical Center, Cleveland, OH, United States
**Intermediate*
Ryman Ballroom AD

IC 65: Oh the Places You'll Roll... Encouraging Adolescent Independence
Andrina Sabet, PT, ATP, Cleveland Clinic Children's Hospital for Rehabilitation, Cleveland, OH, United States
Madalynn Wendland, PT, ATP, PCS, Cleveland Clinic Children's Hospital for Rehabilitation, Cleveland, OH, United States
**Intermediate*
Ryman Studio PQR

11:00 AM Closing Session Supported by Permobil, Inc.

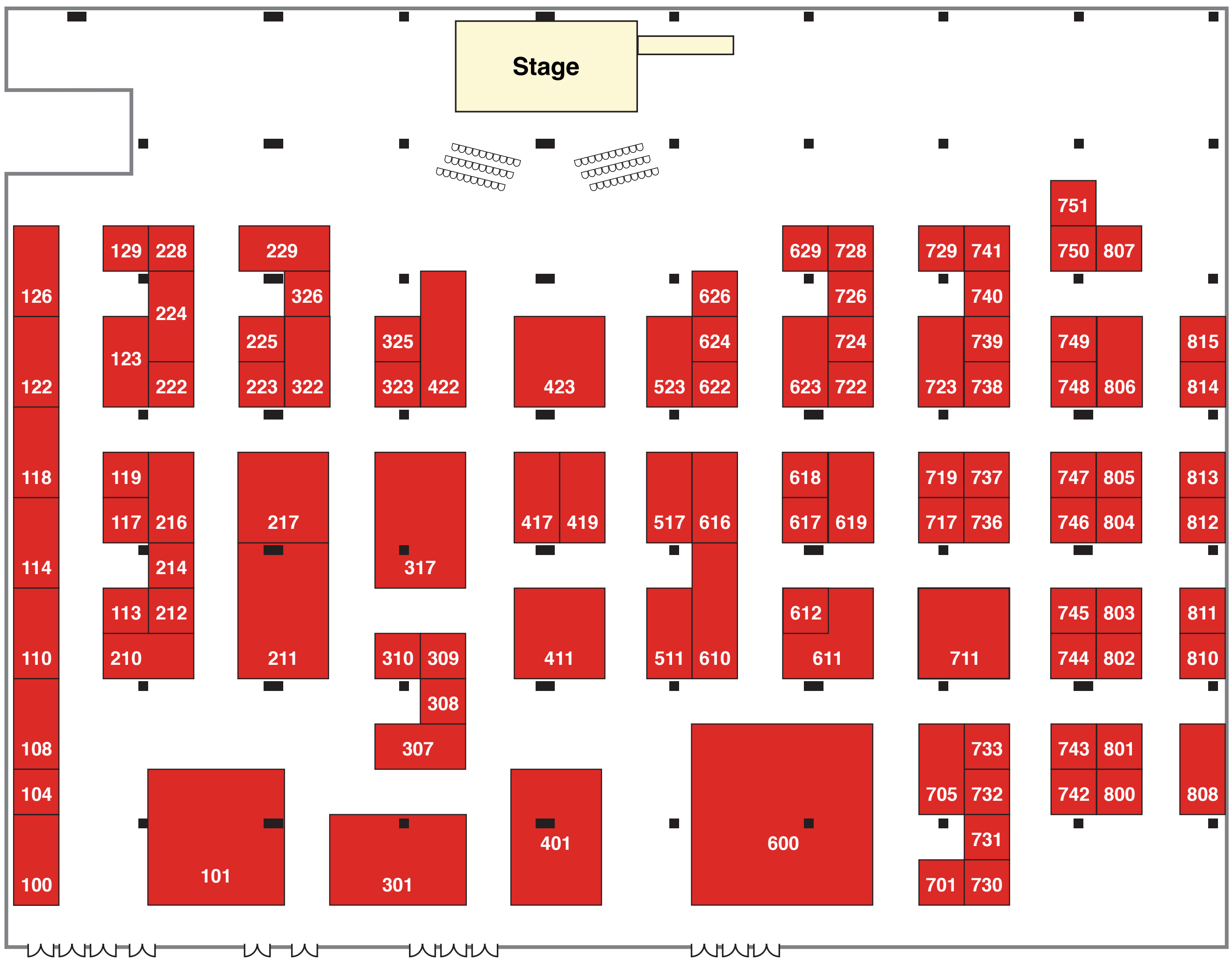
Governors Ballroom

"In an Instant"

Lee Woodruff, Author, Freelance Writer and Contributing Editor, ABC's Good Morning America

When a roadside bomb severely injured her network journalist husband Bob Woodruff, Lee Woodruff discovered how quickly life can change—and what you can learn from surviving a crisis.

> When Lee Woodruff's husband, ABC's then newly appointed co-anchor Bob Woodruff, was hit by a roadside bomb while covering the war in Iraq, Lee and Bob's life instantly changed. Woodruff speaks with grace and humor about her own family's experience and their approach to the crisis that befell them, one that resulted in healing and strengthening of her whole family. A contributor to ABC's Good Morning America on home and family topics, Woodruff is impatient with today's perception of the perfect working mother. To attain "super-woman" status by effortlessly balancing work, home and parenting, is an impossible ideal. Woodruff frankly discusses how a family crisis forced her to reassess her priorities, as well as dispense with the idea that she could do it all and achieve perfection. She delivers an anecdote-filled presentation demonstrating how we can all learn to check the "cape" at the door and still tap into our own superpowers.



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Thursday

March 3, 2011

GS1:1 Participation: The Ultimate Outcome

Kendra L. Betz, MSPT, ATP

Learning Objectives

Upon completion of this session, participants will be able to:
1. Describe three aspects of their day-to-day work that directly influences participation by the clients they serve.
2. Identify two program development priorities targeted at maximizing participation outcomes for the clients they serve.
3. Determine three additional sessions at ISS that support participation outcomes.

Participation in everyday life activities is the primary focus of the work we do as rehabilitation and assistive technology professionals. Whether the client is fully self-sufficient or reliant on others to support basic needs, the technologies we recommend and the education and training we provide is instrumental in supporting the individual to participate to their greatest capacity in a multitude of environments. Yet, we are challenged everyday to demonstrate the value of our work as evidenced by reimbursement challenges, limited treatment time, and the pressure to measure outcomes. Too often, the unique and valuable services we provide are limited to controlled clinical settings with limited opportunity for long term follow up to gauge the results of our work as a benefit to the client. If and when there is an opportunity to measure outcomes, the single pivotal factor to evaluate is participation. Regardless of the technology provided or the context in which the device is used, participation in activities that are inherently valuable to the individual provides the strongest evidence for the value of our work. This session will highlight participation outcomes by demonstrating the transition of clinical care to real life applications in home, school, community, work, and recreational environments.

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GS 1.2: Being an Advocate in Today's Service Delivery Process – Do We Have a Choice?

Ann Eubank, MSSW, OTR/L, ATP

One of the key aspects to why it is difficult to secure funding for appropriate assistive technology may be the lack of collaboration between the consumer, the clinician and supplier. Few citizens are equipped to be effective advocates on their own behalf. People with disabilities often have knowledge and experience that can help, but may be unsure of how to publically express their opinions (Keilhofner, 2004). It is imperative the assistive technology professional have a working knowledge of the steps to consumer self-advocacy. With awareness of the economic, cultural, social and political issues that affect the consumer true collaboration is possible, resulting in educated consumers and positive policy change. Since the 1970's, the disabled community has embraced an empowering model of disability called the minority model. It posits that disability lies not within the person, but in the environment that fails to accommodate people with disabilities and in the oppressive societal view of people with disabilities. Yet, today's health care system continues to operate under the medical model, placing focus on the disability itself.

People with disabilities are commonly viewed as not having the power to determine their needs or express their opinions. By the 20th century, the paternalistic idea that people with disabilities could be rehabilitated and normalized into society was established. This perspective evolved into the medical model, which views disability as a medical problem that resides in the individual. Disability is seen as a defect or failure of a body and therefore as inherently abnormal and pathological. The medical model, which prevails today, focuses on an individual's limitations and offers a top-down treatment process. Medical care is seen as delivered by experts and the individual is viewed as a passive recipient of services. This model lends itself to oppression of people with disabilities, as it does not offer collaboration nor does it empower people to take an active role in their medical decisions. This process of empowerment is important for understanding and improving the lives of people with disabilities; it allows them to gain control over events and outcomes that affect their lives.

If clinicians adopt the view that disability is a deviation from the norm that must be cured or repaired through medical expertise, rather than an empowerment view, such as the minority group model, they may, unwittingly and contrary to their intentions, collude with social oppression of people with disabilities. The disability community needs to learn from the civil rights movement and that "when others speak for you, you lose" (Charlton, p. 3). People with disabilities are oppressed when medical, political or cultural decisions are made about them without their full participation.
The World Health Organization released the modern definition of disability in 2001 entitled the International Classification of Functioning, Disability and Health (ICF). While this definition includes the concept that socio-cultural factors can negatively influence access to health care, there is also a socio-political definition of disability. That is, a disability is a consequence of a disabling environment rather than the organic limitations of the disease process. Further, this lack of empowerment is political, in that people with disabilities do not have a large national organization of disabled individuals comparable to other interest groups. People with disabilities may be invisible to the politically powerful, whose decisions positively and negatively influence their opportunities for power. While there may not be conspicuous opposition to the struggles of people with disabilities, there is resistance to appropriate and adequate funding for the care of those with disabilities. The oppression of people with disabilities also results from paternalistic and charitable sentiments that reflect sympathy and pity. Such depictions further serve to impede the emergence of politically powerful groups of citizens capable of confronting the policy-making processes that would ensure equal representation.

To further articulate the concept of physical disabilities, it is beneficial to have an understanding of oppression. One form of oppression is marginalization, which refers to being excluded from participation. According to the ICF, participation is manifested as the physical, social or intellectual involvement in an activity. Individuals with physical disabilities state that health care professionals are part of the problem regarding their opportunities for participation. By focusing on the client's impairment rather than addressing the environmental barriers, health practitioners reinforce the misconception that disability is an individual matter or deviation from the norm rather than a societal matter. Disability scholars assert that people are disabled not by their impairment but rather by social oppression.

Conversely, empowerment is the process by which people gain control or mastery over valued events, outcomes and resources. According to Rappaport (1987), "empowerment is a construct that links individual strengths and competencies, natural helping systems, and proactive behaviors to social policy and social change" (p. 569). In other words, empowerment defeats oppression.

The disability rights movement has historically been a self-help movement and has sometimes taken an adversarial role toward professionals whom they have seen as not overly supportive (Beaulaurier & Taylor, 2001). It is therefore, imperative that clinicians understand how their practices may be influenced greatly by the biomedical model and that they might, unintentionally, contribute to the oppression of people with disabilities. Today's managed care settings may call for clinicians to be more cognizant of both personal and political empowerment as increasing caseloads and decreasing social service budgets threaten the self-determination of people with disabilities. It is incumbent on clinicians to emphasize empowerment objectives rather than mere compliance with medically prescribed treatment plans or psychosocial clinical interventions. This concept parallels the independent living movement's perspective on empowerment in that as people with disabilities move away from dependence on health care professionals to more self-direction, or "client/patient mentality" to "consumer mentality", they take the role of an informed and empowered consumer, not the passive role of a patient.

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GS 1.3: Reality: The Case of the Stolen Scooter- And Other Possible Dilemmas

Dave (Crash) Harding, MPA

Learning Objectives

At the conclusion of this session, participants will be able to:

- See the value of humor as a tool to confront difficult issues.
- Insure one's dignity as a consumer/user of powered mobility devices and other durable medical equipment.
- Understand that all things are not in our control and consider how this affects friends and family

This session will address concerns about maintaining control of the purchase and use of powered mobility equipment from a consumer perspective, thereby enabling people with disabilities to participate in every aspect of everyday life. The importance of humor as a means of coping with difficult situations is not insignificant; and hopefully this will be an enjoyable tour through the literal ups and downs of dealing with everyday problems. I refer to this process as "in your face, sometimes in the mud rehabilitation". That is, not taking one's self too seriously when confronted with everyday issues.

The concept of respect for others and self is encouraged by the use of "person first language" when we interact with each other as health care practitioners¸ educators and consumers of goods and services. The consumer advocacy approach to acquire this needed equipment should likewise be conducted in a respectful manner, without the sometimes heralded confrontational demand.

There are going to be instances when government regulations or insurance coverage sets limits on what equipment will be provided, the frequency with which this can be replaced, for example once every five years for a power wheelchair, and limiting purchase of such equipment from a limited number of authorized vendors. Certainly, every problem cannot be easily resolved. The examination of these options will point out the tension between limited financial resources, needs of consumers, quality of the delivery system, and the impact felt by all parties involved. Hopefully, through this dialogue, we can encourage an atmosphere of cooperation, understanding, and respect for each other's positions, promoting a win, win, win mentality.

P 1: Perceived Quality of Life of Children Who Participate in Wheelchair Sports

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Objective

The purpose of this study was to examine the relationship between participation in organized community-based recreation and perceived quality of life of children with physical disabilities.

Method

The study process included five stages: participant recruitment, quantitative data collection using a survey tool, qualitative data collection using individual interviews, data coding and analysis, and identification of themes. A mixed method, cross-sectional design was used with thirteen participants completing individual interviews and surveys. Participants in this study were acquired through ABLE Youth, a non-profit organization in Nashville, Tennessee. The program is designed for children ages three through high school that have physical disabilities and use a wheelchair for mobility. ABLE Youth introduces children to wheelchair sports, providing opportunities for them to interact with peers, be a part of a community, and actively participate in competitive sports events. All participants were involved in ABLE Youth programs, engaged in at least one Super Sports Saturday, were currently using a wheelchair for mobility, were between the ages of 5 and 18, and were willing to participate in the study with appropriate signed consent forms. Quantitative data was collected using the Pediatric Quality of Life Instrument (PedsQL™).

Results

The raw scores from the PedsQL™ were linearly transformed into a reverse score, where a higher score signifies a higher perceived quality of life. The mean scores were then broken down by subsection: physical functioning (76.32), emotional functioning (75.87), social functioning (78.08), and school functioning (77.33).

The qualitative data used a phenomenological approach to collect information using individual interviews. When asked to identify things they enjoyed doing, what makes a good day, and what makes them happy, the participants commonly reported three types of activity: physical, social, and sedentary activities. When asked to identify characteristics that make them special, the participants indicated a positive self-identity as a wheelchair user, positive attitude, and empowerment by their abilities and future goals. Therefore, the themes identified by the investigators that impact the participants' positive perceptions of their quality of life include physical activity, socialization, having a choice, identity as a wheelchair user, positive attitude, and empowerment by their abilities and future goals. When asked to identify things they do not like to do and what makes a bad day, the participants commonly reported that school and school-related responsibilities negatively impacted their perceived quality of life.

Discussion: We concluded that participation in ABLE Youth contributed to a positive perception of quality of life for the participants in ABLE Youth. Although causation was not established by this study, the themes that were identified are a contributing factor in the participants' perceived quality of life. ABLE Youth offers its members an opportunity to be physically active, socialize, and make choices. Participation in the organization plays a key role in helping individuals form their identity in a positive and safe environment. Implications for seating and mobility practitioners include the need to be knowledgeable about sports chairs and the benefits of participation in wheelchair sports. Awareness of activities in which clients already participate may also help practitioners select appropriate wheelchairs and seating systems.

P2: Bariatric Seating and Positioning: Lessons Learned in an Urban Medical Center

Nettie Capasso, OTR/L, ATP, RD
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Summary

According to the Centers for Disease Control and Prevention (CDC), in 2007 and 2008, approximately 1/3 of adults in the United States were considered to be obese. 30.9% of Americans are considered to be clinically obese (AOTA, 2007). Rehabilitation professionals consider primary and secondary forms of obesity when evaluating and designing seating systems (Minkel, Taylor, Johnson, Canning, 2007). As the number of individuals with obesity rises, rehabilitation professionals will be increasingly required provide functional seating solutions for this special population.

Discussion

During the past decade at the Rusk Institute, we have been faced a limited budget for appropriate bariatric size and weight capacity wheelchairs. We have also encountered additional challenges in accommodating our clients' varied and unique proportions. For a client with a pear shape or posterior redundant tissue we may position the back above the gluteal shelf. Clients with lateral redundant tissue require increased seat width which results in decreased accessibility to the push-rims and ineffective wheelchair propulsion. We may provide a pressure relieving cushion which supports the trochanters and ischial tuberosities. We then create a perimeter around the lateral borders of the cushion to support the redundant tissue. For clients with an apple shape or anterior redundant tissue we need to accommodate the increased hip extension caused by the redundant tissue, shift the center of gravity over the rear wheel to facilitate self propelling and prevent the client from sliding forward in the chair. We accomplish this by adapting the back of the wheelchair to provide the increased seat depth necessary.

At the Rusk Institute we have implemented low tech solutions to address the needs of our bariatric clients. This poster presentation outlines some common solutions to the challenges we face. Case examples will be provided to illustrate these interventions

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P 3: Wheelchair Cushions and Temperature When Exposed to Direct Sunlight

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P 4: Space Tube, for Welfare and Rehabilitation Technology

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P5: The effects of power tilt and recline during a rehabilitation process of a patient with Traumatic Brain Injury- A case study

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This study aim to report a clinical practice about the effects of tilt and recline during the rehabilitation process of a patient with Traumatic Brain Injury-TBI, to compare the use of the fixed tilt and recline with few angulations with the dynamic tilt and recline, to indentify outcomes related with functionality, comfort and improvements on the quality of life.

Method: A 61-year old, male, TBI caused by a gun shot in April/2002. The patient had tetraplegia and cognitive impairments, dependent partially on Activities of Daily Living-ADL. The intervention was performed in two steps, first focuses the positioning with fixed tilt and recline and after the comparison of the positioning with power tilt and recline to verify the improvements related with functionality, comfort and quality of life.

Results: the rehabilitation team had thought that would be appropriate to have a fixed angle of tilt and recline, where the patient would be positioned at 90 degrees of hip, and knee flexion to avoid the extensor pattern. In order to positioning the head, there was an elastic band around the forehead attached to the head support, but the patient demonstrated frustration and discomfort with this position. After this outcomes, the second option was positioning with power tilt and recline and after this second procedure it was observed that the patient responded much better to the therapies when he started using the power tilt and recline, with more functionality and comfort and this outcomes were also perceived for the caregivers that after this procedure were more receptive and participative on the rehabilitation process. The patient comfort was related with the increase of the time seated in a wheelchair. The functionality observed during the rehabilitation process was the improvement on visual functions, reach, respiratory functions, transfers by the caregivers and also self-steam reported by the patient's family. As a conclusion this study showed relevant clinical application about the use of the power tilt and recline related with the quality of life of the patient and also his caregivers.

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IC 1: ISO Interface Pressure Mapping Guidelines - Combining Expertise and Evidence

Kim Davis, MSPT, ATP
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The following is an excerpt from the ISO Technical Guide for the Clinical Application of Pressure Mapping, focusing on the seated posture. It is a working draft. It will remain in draft format until accepted at the international level through the ISO process.

1. IPM Sensor Mat Preparation, Infection Control and Cleaning:

a) Infection Control - Follow Manufacturer's recommendations for specific mat care.

   i) Wash hands/wear gloves. Follow Universal Precaution guidelines. Remove gloves when you stop touching the client, e.g. to use the laptop or digital camera.
   ii) Encase the IPM sensor mat in a thin protective bag (e.g. thin plastic) to ensure that infection control is maintained for client safety and to prevent cross-contamination. This also protects the IPM mat from damage due to exposure to body contaminants and other harmful fluids. Note: Use of a plastic bag may affect the mat performance, e.g. it may promote hammocking, especially if the mat's ability to conform into the cushion contour is hindered. Be aware there may be sliding and changes in body position relative to usual seated posture.

b) Consult the manufacturer for appropriate cleaning and decontamination or sterilization instructions should fluids come into contact with the sensor mat.

c) Perform a basic system check - Place the IPM sensor mat on a firm, flat surface, such as an evaluation ma table. Sit briefly on the sensor mat and observe the corresponding image.

   i) Is there an image present?
   ii) Is the computer/USB port connection recognized?
   iii) Does it look like a buttock and represent the seated position? Check to make sure a proper buttock profile is represented.
   iv) Are there missing rows/columns, irregular peaks or flashing values?
   v) If the display looks suspicious, first check the sensor mat set-up (e.g. no wrinkles), cable connections, correct calibration file, pressure calibration range etc. If everything checks out correctly and the sensor still reads improperly, consider re-calibration.
   vi) If the image appears correct, continue with the IPM process.

d) Select desired software / statistic features and be consistent for comparison. Most IPM software packages offer the ability to select the isobar range, preset settling time, record time, data averaging, destination file (see below for more in-depth file management information instruction) etc.

2. Clinical Ipm Assessment and Data Acquisition:

1. General tips for IPM usage:
   a. In addition to collecting data when seated in the wheelchair, IPM may also be used with the client sitting on edge of a mat table. This provides a useful baseline measurement to precisely define weight bearing areas, check if asymmetries are fixed or flexible, determine location of postural supports (using hands) and amount of force needed to correct / reduce asymmetries. In this way, the clinician is capitalizing on the visual feedback utility of IPM to guide clinical decision-making.
   a) Verify bony landmarks by palpation. Visualize and correlate to IPM readings.
   b) Note that wound dressings can affect pressure readings, often elevating values.
   c) Note clothing may interact or interfere with IPM findings at bony prominences or create false peak pressure readings away from bony prominences.
   d) Gauge client's endurance and tolerance to transfers and adjustments.
2. IPM sensor mat recording configuration:
   a) Consistently orientate the sensor mat on the surface during the client session. This avoids confusion during map interpretation. For example, the sensor mat cable should be placed in the same orientation (e.g. front, left).
   b) Place the sensor mat on the cushion to assure the buttocks will be fully captured by the mat. This usually is accomplished by having the rear row of the sensor mat behind the posterior edge of the seating surface.
   c) If the wheelchair is small, use caution regarding sensor mat folds at the edges. Be aware that the sensor mat may display errant pressures that might skew the overall sensor mat data (e.g. average pressure).
   d) Make sure the mat is relaxing into the contour of the cushion to avoid hammocking. Use hands to smooth the mat into the contour as needed. The ability of the sensor mat to conform to these contours is essential for understanding the surface's ability to redistribute pressures. (see Sources of error)
   e) Avoid the use of transfer boards if there is risk of damaging the sensors – check with manufacturer. Adequate help may be required to safely transfer the client into position for the IPM session, e.g., assisting with lifting the patient to minimize shear forces induced into the mat during transfer.
   f) Make sure the sensor mat is still in place after the transfer – squared on the cushion, without wrinkles. Re-adjust as needed. Note: use of a plastic isolation bag often contributes to the mat sliding out of place during the transfer. Even more notable is that the bag may cause the client to slide forward on the seat. Be extremely cautious with clients who may be predisposed to sliding forward, such as those with poor balance, low muscle tone and/or an open hip angle.

g) Recording an IPM session: Should the wheelchair user be informed about when the data is being recorded?
h) Settling time: Allow time to sit prior to recording the session: this takes into account the time to settle into the cushion (effect of tissue and cushion material creep) and the creep of the sensor.
   i) Settling time varies based on differences in tissue and cushion material – cushions composed of time-dependent materials take longer to settle into. Cushions which are air-filled or comprised of elastic foam have a short settling time (by ~one minute) in contrast to cushions with viscous materials – viscous fluid or viscoelastic foam - which take longer (up to 5 minutes or more).
   ii) Variations in temperature can affect certain cushion materials' response to loading. For example, a viscoelastic foam cushion which has been stored in cold temperatures may initially be stiffer and take longer to settle into. For this reason it is best to have all cushions at room temperature before undergoing IPM assessment.
   iii) Settling time should be consistent across each cushion/seating surface within an IPM client session. For client safety, total maximum sitting time during the IPM evaluation should not be exceeded if sitting duration limits are in place (e.g. due to current pressure ulcer).
   iv) For IPM systems which allow in-field versus factory only calibration, the creep correction time factor for the calibration should be set to match the outer margin of cushion creep for a given set of cushions typically assessed. Please review manufacturer's guidelines on creep correction management. Note: This requires further scientific verification.
i) Record baseline data of client in current equipment and positioning to capture usual posture and equipment set-up. Place the sensor mat as close to client's tissues as possible. Note: If the client typically sits on a transfer sling or incontinence pad, leave these in place for the baseline reading if possible. Additional layers such as these could be contributory factors toward pressure problems, requiring assessment.
j) Note the peak pressures, palpate to verify matching of bony prominence to peak(s) and label accordingly.
   i) Palpating may be performed by placing the hand either under the sensor mat or between the mat and body.
   ii) Side entries are generally easiest for palpation of the greater trochanters or ischial tuberosities, however, this may be difficult with armrests and sideguards in place. The client may need to lean (or be leaned) to the side slightly to position the hand. Once the bony prominence is located, the client resumes an upright position, sitting on the clinician's hand. This must be done otherwise the prominence will not correlate with the original peak on the mat.
   iii) IPM software allows for labeling the bony prominences on the image directly or noting the corresponding coordinates. Note: All peaks are not always caused by a bony prominence. Other causes could be a clothing seam, pocket, wallet, objects under or in the cushion etc.
k) Save session, frames or a representative average frame as Baseline for Current Equipment and Position.

3. Documentation and File Management (for baseline IPM data)
   a) Enter client information (use note or evaluation section in IPM software)
      i) ID#/name (observe privacy guidelines)
      ii) Date
      iii) Equipment set-up (baseline)
         (1) Cushion model, age, width x depth
         (2) Back support model
         (3) Wheelchair model, width x depth
         (4) Seat to back angle
         (5) Seat tilt
         (6) Foot support (thigh loading- distribution of pressure?)
         (7) Other relative comparison data
      iv) Posture - Note postural deformities or asymmetries
      v) Upper and lower extremity position – as pertinent for pressure redistribution
   b) Determine risk level via standardized scale (e.g. Braden, Norton or Waterlow scale) or use low, medium, high based on sensation, mobility, history of pressure ulcer and frequency of pressure relief.
   c) Use a consistent file naming protocol for each client and for all IPM sessions.
   d) Determine IPM session save-to location- this can be configured in many different ways. The goal is for an orderly, easily retrievable file. Folder naming can be configured by:
      i) Clinician
      ii) Client name/ID
      iii) Date of evaluation

4. Photo documentation: Use correlative photo or video documentation to reflect posture and seating set-up and label accordingly. IPM software can insert the photos or videos into the sessions. Be sure to obtain a photo release statement.

5. After the baseline IPM data is collected, transfer the client to perform a full mat evaluation in supine and sitting. It is at this point that skin inspection and IPM assessment in short sitting at the edge of the mat can be performed.

6. Perform cushion and cover inspection while the client remains on the mat table.
   a. Inspect cushion and cover for defects or excessive wear.
   b. If cushion is in good condition, first determine that the problem is not merely a set-up issue with the cushion itself or with the wheelchair/seating configuration.
   c. Make changes in cushion as needed/appropriate, then re-do IPM.
   d. Assess for other postural changes or seating adjustments needed before abandoning original cushion (need to rule it out).
   e. If the current cushion is deemed to have inadequate pressure redistribution qualities, proceed to evaluation of additional cushions.

7. Repeat steps 2-5 for additional cushions trials:
   a) Select a small sample of cushions (2-3) based on client needs (risk level, pressure distribution goal – envelopment vs off-loading, posture, balance, temperature, continence).
   b) Adjust postural supports as needed to accommodate differences in trial cushion(s).
   c) Be consistent with postural support across cushions (thighs supported, arms on armrests or lap, etc).
   d) Completely off-weight mat between readings, via a quick offload. This re-sets the sensors to minimize the effects of sensor creep. Perform relative comparisons. There is no magic pressure threshold beyond which pressure ulcer formation occurs. 32mmHg is NOT a valid threshold and should not be used. Refer to section on Interpretation of Data regarding important factors for comparative techniques.
   e) Use IPM primarily to rule out/exclude versus make definitive selection.
   f) IPM should not be sole deciding factor. Additional considerations for cushion selection include:
      i) Postural stability
      ii) Functional mobility – transfers
      iii) Weight of cushion
      iv) Heat / moisture
      v) Perceived comfort
      vi) Complexity - maintenance and set-up requirements
      vii) Client's ability to perform or direct care
      viii) Ability to provide client and care-giver education
      ix) Number of care-givers / staff turnover
      x) Ability to provide follow-up as needed
   g) Static IPM assessment should be followed by a dynamic loading assessment (see below)

8. If additional contributing factors and support surfaces are suspected, proceed to further IPM data collection for the following:
   a) Additional seating surfaces (e.g. car, commode, shower chair, etc)
   b) Bed (especially if typical position involves Head of Bed elevation)
   c) Dynamic loading/remote monitoring - Simulation of activities (e.g. take movie during propulsion, transfer, etc).
      i) Center of pressure tracking – refer to data interpretation section
      ii) Assess loading /pressure over time - – refer to data interpretation section

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IC 2: Complex Rehab Technology Separate Benefit Update

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The Goal

1. The goal of a separate benefit is to improve and protect access to Complex Rehab Technology products and services for individuals with significant disabilities and medical conditions.
2. Complex Rehab Technology
3. Medically necessary, individually configured devices that require evaluation, fitting, adjustment or programming
4. Designed to meet the specific and unique medical, physical, and functional needs of an individual with a primary diagnosis resulting from a congenital disorder, progressive or degenerative neuromuscular disease, or from certain types of injury or trauma
5. Current Separate Benefit Category activities relate to individually configured manual and power wheelchair systems, adaptive seating systems, alternative positioning systems and other mobility devices. Other products may be added in the future.

Why Pursue Separate Benefit

Significant challenges threaten access to CRT products and services for individuals with disabilities
These threats (coding, coverage, payment) will only increase unless meaningful changes are made…..it will get worse
The purpose of a Separate Benefit Category is to improve and protect access to these products and services for these individuals

Five Objectives

1. Develop clearer and more consistent coverage policies that appropriately address the unique needs of individuals with complex disabilities.
2. Establish stronger and more enforceable Supplier Standards to promote better clinical outcomes and consumer protection.
3. Obtain formal recognition of product-related services and costs to allow for appropriate funding.
4. Provide future payment stability to ensure continued access to products and an environment that encourages research and development.
5. Produce an improved coverage and payment system that can serve as a model for Medicaid and other payers to follow.

Activities To Date

- Sept 2009- Steering Committee formed
- Oct 2009- Organizational Conference
- Dec 2009- Begin Work Group meetings
- March 2010- Discussion Paper published
- April 2010- Congressional Fly-In (CELA)
- May 2010- Avalere Health Group report
- Aug 2010- ITEM Coalition endorsement
- Jan 2011- Proposal Paper published
- Jan 2011- Legislation Language drafted
- Jan 2011- Legislation Cost Estimate
- Feb 2011- Pursue Congressional sponsors
- Feb 2011- Meet with CMS
- Feb 2011- National Call-In Day
- Feb 2011- Congressional Fly-In (CELA)

Consumer Access Document

- Entitled "Ensuring Consumer Access to Complex Rehab Technology…Requirements for Maximizing Outcomes"
- Outlines funding policy and process details needed to maximize outcomes for those needing CRT
- Single document around which all stakeholders can advocate for CRT
- Will be shared with Medicare and other payers and policy makers
- Supporting organizations can sign on

Final CRT Proposal Paper

- Follow up to previous "Discussion Papers"
- Detailed outline of proposed changes:
- Products and Coding
- Coverage and Documentation
- Payment
- Supplier Standards
- Designed to provide education, allow input, and generate support
- Copy available at www.ncart.us

Products & Coding Changes

- Current HCPCS codes, as appropriate, will be designated as CRT codes
- These codes will only be available through accredited CRT companies
- Modifications and additions will be made to codes that currently contain both CRT products and non-CRT products to segregate CRT from DME
- Product quality standards would be created for CRT items
- New codes will be added for "uncoded" products

Coverage & Documentation Changes

- A pathway will be established requiring beneficiaries seeking permanent wheeled mobility who have certain diagnoses and/or clinical presentations go through a CRT Evaluation to ensure they receive the most appropriate equipment
- Coverage criteria for CRT will be based on a beneficiary's functional abilities and limitations, rather than specific diagnoses or other highly prescriptive and limiting criteria
- The "in-the-home" restriction that exists within Medicare policies will not apply to CRT
- The primary responsibility for clinical documentation will be shifted from the physician to the Occupational Therapist and/or the Physical Therapist
- Documentation requirements will be appropriate and clearly defined to help reduce unreasonable administrative burdens
- CRT will be covered in Skilled Nursing Facilities for beneficiaries who could transition out into the community if provided with these assistive products

Payment Changes

- Only accredited CRT companies will be able to provide and bill CRT
- All CRT products would be exempt from Competitive Bidding
- CRT codes would be repriced using a modified "gap filling" methodology which would allow for inclusion of CPI increases since 2000 (in line with pricing of orthotics and prosthetics)
- New fees for existing CRT codes would be limited to a floor of the 2009 fee schedule and ceiling of 10% above those amounts

Supplier Standards Changes

- The Complex Rehab Technology company (CRTC) will be required to have the capability to service and repair all equipment it supplies
- At the time of evaluation, the CRTC must provide the beneficiary with written information about how the beneficiary will receive service and repair after delivery of the equipment
- The CRTC must employ at least one qualified rehab technology professional (RTP) per location and this individual will be required to show additional evidence of competency in the provision of seating and mobility
- A reasonable transition period will be provided to allow individuals to secure this new qualification
- A CRT Service Delivery Matrix was created to identify key activities and responsibilities

Next Steps

- Continue to distribute Proposal Paper for review, input, and support
- Secure Congressional sponsorship to introduce legislation
- Generate meetings, messages, and grassroots activity to pass legislation
- Continue Work Group activities to develop draft regulatory policies and changes
- Work with CMS on regulatory matters

All stakeholders need to work collectively to achieve the stated goal.......

To improve and protect access to Complex Rehab Technology products and services for individuals with complex disabilities and medical conditions

For additional information contact Don Clayback, NCART Executive Director, at 716-839-9728 or dclayback@ncart.us or any other Steering Committee member

IC 3: Choosing The Best Cushion: How Do We Really Get There?

W. Darren Hammond, MPT, CWS
Sharon L. Pratt, PT

Objectives:

1. Review the mechanisms and resulting forces that occur while load is applied to various cushion materials.
2. List 3 different load redistribution options, which are utilized in design and construction techniques when fabricating cushions.
3. Review the step-by-step thought process in critically choosing a wheelchair cushion.
4. Explain the quantifying methods used to compare and contrast cushion materials surfaces.

It seems that the process involved in selecting clinically appropriate seat cushions for our wheelchair seated clients has switched gears somewhat from a purely artistic approach to perhaps a more evidence based or science based thought process. This is a welcome change in our industry and one we can all embrace. Regardless of what funding source we are accessing, we have to be accountable with our documentation of the assessment, goal forming and product selection process.

This two-part interactive program provides a unique approach to assessing the differences between seating support surfaces with specific clients. The fist part provides foundational knowledge of an alternative approach to the way the health care community chooses various seating support surfaces when discussing skin integrity, positioning and stability. A basic overview of scientific mechanisms by which load is applied and the resultant forces, which occur, will be discussed. Using scientific principles, the majority of the first part of the discussion will review the materials and the various design methods used to construct cushions in order to provide specific therapeutic benefits. In addition, participants will gain a greater understanding of varying load redistribution properties used to achieve specific clinical outcomes. Finally, quantifying methods used to compare and contrast wheelchair cushions will be discussed.

Using specific case examples, the second part of the discussion will take the foundational knowledge presented and demonstrate the thought process in the clinical decision making of choosing the most appropriate wheelchair cushion for various individuals using a wheelchair. A thorough step-by-step process in the cushion selection of actual clients will be reviewed. Discussion will revolve around the specific needs of each client while also considering the design and construction of various types of cushions when attempting to achieve a specific clinical outcome. Specific examples will be reviewed to demonstrate how various quantifying methods were also used in the thought process to ensure the best patient outcomes were achieved.

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Slide Presentation:

Available upon request

IC 4: The Physical Assessment

Jean Minkel, PT, ATP

Summary:

- Overview of the Assessment Process - Function, Environment, Client interview and input.
- Demonstration of Supine Assessment.
- Hands-on demonstration of the supine and sitting mat evaluation.

Introduction:

This course will present a methodology for assessment of a person who is in need of external postural support for function and comfort while in the seated position. The assessment is broken down to the component parts of pelvic mobility, lower extremity range of motion, spinal alignment in both supine and upright sitting and finally the resulting position of the head and upper extremities. Clinical findings, including pelvis obliquity, scoliosis and tight hamstrings will be discussed to assist the participants in integrating the clinical findings with determination of effective postural supports for the person to achieve the greatest amount of comfort and function.

Method:

The supine & sitting mat evaluation

Supine on the Mat Table

- <u>Pelvis & lumbar spine:</u>
  Anterior & posterior pelvic tilt, pelvic obliquity and pelvic rotation.
- <u>Hips:</u>
  Flexion, abduction, adduction, ext. & int. rotation
- <u>Knees:</u>
  Hamstrings length
- <u>Feet:</u>
  Dorsi and plantar flexion, inversion & eversion
- <u>Trunk, shoulder, neck and head position</u>
  (ex kyphosis, scoliosis, cervical ROM)

Sitting on a Firm Surface

(Correction of Flexible deformities OR accommodation for fixed deformities found in the supine position)

- <u>Posture & Balance</u>
- <u>Pelvis</u>
  Ant. & post. tilt, obliquity, rotation, palpation of I.T
- <u>Lower extremeties</u>
  Hip flexion, knee extension, ankle dorsiflexion
- <u>Trunk support</u>

Results:

Participants will be guided through a decision making process based on the information collected during the supine and seated assessments. Of particular note will be the person's sitting balance (hands free, hands dependent or prop sitter), the presence or absence of skeletal deformity and a determination if the deformity is fixed or flexible. For flexibility deformities, strategies which allow for correction of the deformity will be shared; while for fixed deformities there will be an emphasis on accommodation to the deformity.

Discussion:

Though the use of multiple teaching methods including observing the instructor's demonstration and then having a hands on opportunity to practice the presented assessment method, participants will gain first hand knowledge of how to use their own hands to collect critical information regarding a person's postural support needs. The course will emphasis how to analyse these findings in an effort to plan an effective postural support treatment plan.

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IC 5 : An Introduction to Economic Evaluation of Health Care Interventions

Bryce Sutton, PhD

Economic evaluation is an accepted method in the appraisal of health care interventions that is increasingly being used by private and public sectors to determine reimbursement, coverage, and funding decisions. In the wake of recent US government health care reform, comparative-effectiveness and cost-effectiveness evaluation will play a greater role in the adoption of health care technologies. Despite the emphasis on comparative research and the budget impact of health interventions and technologies, there is a paucity of economic evaluations in the rehabilitation literature.

Economic evaluations seek to add the dimension of cost in addition to intervention effectiveness to answer questions in the direct comparison of alternative treatments or technologies, for example: 1) if two treatments are equally efficacious which treatment option should be chosen, 2) if one treatment is more efficacious, is the added effectiveness worth the additional cost, 3) if one treatment is less efficacious is the reduced effectiveness acceptable given the lower cost. The answers to these questions directly affect decisions made by providers and the quality of care for patients.

In this two-hour instructional course participants will learn about the different types of economic evaluation with examples gleaned from the rehabilitation literature, focusing on the interpretation of results and a discussion of the implications for patient care. Upon completion of the course participants should be able to distinguish between different types of economic evaluation, identify relevant costs and classify costs according to the perspective of a patient, provider, or society as a whole. Examples of cost-effectiveness and cost-utility data will be presented and emphasis will be placed on the use of cost-effectiveness results to guide health care decision making. This course assumes no previous knowledge in health economics.

Objectives

1. Participants will be able to distinguish between accounting and economic costs.
2. Participants will be able to classify costs according to patient, provider, and societal perspectives.
3. Participants will be able to define and distinguish between different types of economic evaluations of health interventions including:
    a. cost-effectiveness
    b. cost-utility
    c. cost-benefit.
4. Participants will learn about alternative methods for indirect elicitation of preferences and quality adjusted life years.
5. Participants will learn to calculate incremental cost-effectiveness ratios and net monetary benefit.
6. Participants will learn how to interpret incremental cost-effectiveness ratios among competing alternatives.

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IC 6: Custom Sooner = More Meaningful and Lasting Outcomes

Thomas R. Hetzel, PT, ATP

Introduction.

Why, in the absence of a progressive neuromuscular or other disease, is the chronic deterioration of postural alignment and function so often regarded, even excused, as a normal result of long term sitting?

As medical and pharmacological care has evolved over the past decades, newborns are surviving events that a decade or two ago may have been deemed hopeless and fatal. Likewise, people are surviving and living long lives following traumatic events. The key word above is “events”, not disease. Cerebral Palsy, Spina Bifida, Stroke, Spinal Cord Injury, Brain Injury, to name a few, are not diseases, but disabling events. The event itself does not result in a progressive condition, but the disability associated with the event can present with varying degrees of progression depending on numerous intrinsic and extrinsic factors. Seating is the art and science of managing the extrinsic factors in an effort to influence the intrinsic towards improved health and mobility.

We are the first generation of wheelchair seating professionals to witness the effects of these events on and associated with aging. Clearly there are differences between aging with and without a disability. For the person aging with a disability the changes can be slow and insidious. Charlifue et al., recognized multiple system degeneration over time in the Spinal Cord Injured population, and stated that true decline is more likely to be detected when the aging process begins to interfere with function. What can be done earlier to delay or even prevent this decline so it does not reach the threshold level of functional impairment? Are we too tolerant of or even missing early signs of age related changes that may respond to certain interventions if applied in a timely manner?

Aging With a Disability.

Certain outcomes related to historical wheelchair prescription are becoming increasingly well documented. Additionally, current literature provides an increasingly comprehensive picture of aging with a disability. Though much of the published work does not directly implicate or measure seating and mobility prescriptions’ effect on the aging process, the list of issues at the forefront of discovery parallels limitations and concerns often expressed in seating and mobility assessments.

The trauma associated with long-term use of the upper extremities for manual wheelchair mobility is a prime example (Collinger et. al.). The advent of tools and related research that objectively measure these stresses, in conjunction with practice-based observations has made it especially clear, for one example, that promoting the use of manual mobility for people with cervical level SCI is a recipe for functional disaster. This discovery has led to a dramatic change in seating and mobility prescription for this population. This model of discovery moving rapidly into practice should be emulated by our industry as the body of knowledge surrounding issues of aging with a disability expands.

Fatigue

Fatigue is well recognized as an outcome related to accelerated aging, and it is of particular concern as it has a number of negative effects on health problems, disability problems, perceived temporal disadvantage and on quality of life. (McColl et al.). Interestingly, fatigue has been found to be greatest among people with spinal cord injury of shorter duration as compared to people with longer duration (McColl et. al.). Are people resigning themselves to a perception of lower energy levels as they age with a disability? Are their reports based relative to recent memories of pre-trauma lifestyle and energy levels? The finding clearly speaks to the need for maximizing efficiencies in function and mobility early on in an effort to decrease fatigue and improve quality of life.

Pain

Pain is another common complaint of people with disabilities. Nosek et al. found that 94.5% of women with disabilities reported interference from pain, and 93.7% from fatigue over a one year period. Immobility and pain have also been linked. Jensen et. al., when studying chronic pain among persons with myotonic dystrophy and facioscapulohumeral dystrophy, found that prevalence of chronic pain is not associated with aging as strongly as it is related to immobility. Respondents using a wheelchair or cane reported the highest level of pain over those who did not use an assistive device for mobility. The connection between postural changes associated with age and pain has also been considered (Salisbury et al.). Postural deterioration over time has been well documented. Vogel et al. looked at complications associated for adults with pediatric-onset spinal cord injury and found that 40% had scoliosis, and 69% had pain. Once again these findings support aggressive and early intervention to preserve dynamic postural health for sustained mobility and pain management.

Skin Integrity

Skin, as an organ, changes over time. These changes are magnified for people aging with severe disability. These progressive changes result in a reduction in the skin’s tolerance of the extrinsic factors; pressure, shear, heat and moisture. Current practice and research have led to recognition of risk variables that are independently associated with pressure ulcers. Salzberg et.al. identified 7 independent factors out of a list of 15 from a previously published scale. These independent factors were established for risks related to paralysis: level of activity, level of mobility, complete spinal cord injury, urinary incontinence or moisture, autonomic dysreflexia, pulmonary disease, and renal disease. Notice that pressure is not identified as an independent risk factor, therefore it must be coupled with other factors to create risk for pressure ulcer development, e.g. pressure and time (as a measure of immobility), or pressure and moisture with shear. Recognize, however, that the mobility component presents as a clear and consistent factor.

Functional Capacity

Any prolonged and persistent static posture could be deemed as pathological.

The absence of active mobility in and out of a variety of postures may predispose a person to chronic destructive postural tendencies that can lead to further impairment of mobility and functional capacity. Lung capacity and expiratory flow in standing is significantly superior to those measured in sitting and especially "slumped" posture (Lin F. et. al). Support of well balanced, dynamic and upright posture in sitting clearly influences functional capacity.

Seating and Mobility Prescription

So we see that fatigue, pain, over-use syndromes, functional capacity, postural deterioration, and skin integrity are all correlated with mobility and activity. Pain, as cited above, appears to have an even greater correlation with immobility than with aging itself. One's attention to age-related changes, and the discouraging statistics outlined above, should give all seating and mobility professionals pause. Are we doing all that can be done, and are we doing it in a timely fashion?

Immobility is the common thread coursing through all the literature reviewed for this paper. It is clear to this author that any seating and mobility intervention that does not improve a person's level of activity and mobility may not positively impact the frightening list of issues faced by our clients and customers as they age with their respective disabilities. How then do we improve the likelihood of restoring and preserving mobility?

Custom Sooner, Rather Than Later

As posture deteriorates, especially into asymmetry, the spine flexes and rotates and the facet joints approximate and limit movement. The further one's posture deviates from midline and balanced, the greater the mechanical advantage of gravity for increased pull and destruction becomes. When flexibility through midline is lost so does one's ability to sit at midline. The greater the spinal asymmetry, the greater the negative impact on mobility. Any loss of mobility will likely result in complications previously outlined.

Historically, custom seating has been reserved as the last ditch option once all else has failed over a significant period of time. By the time people are identified for custom seating, they are likely to be presenting with significant loss of mobility secondary to postural deterioration with lack of flexibility towards correction. This loss of mobility is likely to result in increased fatigue, pain, skin breakdown, loss of functional capacity, and a myriad of other complications. Custom seating options, to some extent, have influenced this delay as traditional options were not a reasonable match for the active user. They were heavy and bulky, did not manage heat and moisture, could not be adjusted to accommodate growth and development, and had a mixed record, at best, for pressure management at bony prominences. The latest generation of custom seating overcomes the shortcomings related to earlier custom interventions. Custom seating can now be applied in a fashion that is skin safe, lightweight, breathable, thin in profile and growable.

Identifying candidates for early intervention with custom seating is critical. Funding sources require that all reasonable and less costly options be ruled out. Seating and mobility professionals should be very critical and have clear criteria for ruling out lesser options. They should resist the temptation to accept an outcome that is less than optimal, but perceived as "good enough". Sitting straight and upright at rest, and promotion and preservation of movement and flexibility through midline are the core building blocks for functional activity and mobility. It is important to recognize that a consistent and persistent asymmetrical postural tendency, even in the presence of flexibility and tolerance of correction, will likely require asymmetrical intervention to support a midline and balanced posture. If lesser options do not fully achieve the desired outcome, one can now consider custom options for correction and promotion of active and mobile postures, rather than simply face the future likelihood of custom options to merely accommodate and stabilize immobile postures. The earlier the intervention, the greater the likelihood of meaningful and lasting functional outcomes will be. Preservation of activity and mobility can be expected to have a positive impact on fatigue, pain, functional capacity, skin outcomes, and likely many more meaningful benefits.

Conclusion

Seating and mobility professionals will better serve their clients by raising the bar for outcome measures associated with simple off the shelf modular seating. In the absence of a progressive neuromotor or other condition, they must resist the temptation to see postural and functional deterioration as a normal outcome of aging with a disability. Every incremental loss of mobility will have an impact on the factors listed. Your customers are not likely to mention changes or pursue help until a decrease in functional mobility impacts their quality of life, and by then it may be too late to intervene in a fully restorative fashion. It behooves us all to recognize early signs of deterioration and intervene quickly. Rule out simple interventions and be at the ready with custom should the situation warrant.

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IC 7: Best Practice Workshop Pediatric Power Mobility

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At the international Conference on Posture and Wheeled Mobility 2010 a best practice workshop on the use of power mobility with children took place. The main purpose was to discuss the evidence base for power mobility (PM) with children and begin the process of achieving international consensus. The RESNA position paper on the application of power wheelchair for Pediatric users (Rosen et al., 2009) was used as a basis for discussion. Recommendations were made to modify and expand the original position paper to include more recent research, information on training and also to include the child and family's perspectives.

As a way of moving this process forward, a literature review has been completed and the current research evidence for pediatric power mobility will be presented along with a discussion of expert opinion and unpublished evidence. Using audience response units, the group will reach consensus on the scope and content of a new draft position paper that will be made available for consideration by RESNA and its European counterpart.

In 1987 Hays suggested that there are four different groups of children who can benefit from PM:

1. Children who will never walk e.g. severe cerebral palsy (CP), Spinal muscular atrophy (SMA) types I and II, severe arthrogryposis, multiple limb deficiencies or high level spinal cord injury (SCI)
2. Children who have inefficient mobility e.g. moderate CP, C6 or C7 SCI, higher level meningomyelocele, Osteogenesis Imperfecta
3. Children who lose the ability to walk or to walk efficiently e.g. neuro-muscular diseases, acquired brain injury, SCI
4. Children who need mobility assistance for a period of time e.g. young children with meningomyelocele, children who may later achieve walking through surgical interventions; children with medical or arthritic conditions

Historically PM tended to be reserved for older children, once all other forms of mobility had been tried and found to be ineffective. It was often seen as a last resort. However, contemporary thinking in rehabilitation is undergoing a shift from emphasizing normal movement to emphasizing meaningful participation in age appropriate activities. Children and families may use a variety of mobility solutions depending on the environment or activity (Wiart & Darrah, 2002).

Infants, toddlers and children with moderate to severe motor impairments are often unable to move around and explore their environment to facilitate learning and development. PM is an evidence based intervention that can be used to enhance spatial, vestibular, visual, language, cognitive and social skills in infants and young children with moderate to severe motor impairments and can be used as a compensatory strategy for toddlers and children who cannot otherwise be active and participate with their peers. PM can also be considered an option for teenagers who may have once been community ambulators but can no longer ambulate long distances and have becomes limited in their ability to participate due to mobility limitations.

Clinical Implications

Children who can use a joystick can become functional drivers with minimal training between 18 and 24 months of age. (Butler, Okamoto, & McKay, 1984)

Children with more complex motor and sensory disabilities can begin to learn power mobility skills around 14 months of age and become proficient around 20 months. (Jones, 2004)

With access to specialized PM equipment, it may be possible for infants to have augmented PM experience at 8 months when their peers are also beginning to move independently. (Lynch, Ryu, Agrawal, & Galloway, 2009)

More intense, specialized training may be helpful for young children to assist with initial skill acquisition followed by practice in natural environments. (Jones, 2004)

A PM device can be used to promote psycho-social development as well as functional mobility e.g. self-initiated movement (Butler, 1986; (Deitz, Swinth, & White, 2002), independence (Bottos, Bolcati, Sciuto, Ruggeri, & Feliciangeli, 2001), understanding of cause-effect (Nilsson & Nyberg, 2003), increased receptive language (Jones, 2004), cognitive (Lynch, Ryu, Agrawal, & James C Galloway, 2009) and social skills (Tefft, Guerette, & Furumasu, 2011;Ragonesi, Chen, Agrawal, & Galloway, 2010)

Using PM at a young age will not impede development of ambulation or other motor skills. (Bottos, Bolcati, Sciuto, Ruggeri, & Feliciangeli, 2001); Jones, 2004; Paulsson & Christofferson , 1984)

Children with conditions that limit early functional mobility (who may walk at older ages) may benefit from PM to promote overall independence and psycho-social development (Lynch, Ryu, Agrawal, & Galloway, 2009)

Children with conditions that fluctuate and limit mobility at times may benefit from PM to enhance participation in daily life.

For children and adolescents with inefficient mobility, power mobility may enhance participation in daily life. (Wiart, Darrah, Hollis, Cook, & May, 2004); Wiart, Darrah, Cook, Hollis, & May, 2003; Palisano, Hanna, Rosenbaum, & Tieman, 2010)

Power wheelchairs for children and adolescents with neuromuscular disease should be ordered with tilt in space and electronics that can accommodate future changing access needs (Richardson & Frank, 2009).
Readiness assessments such as the PPWST summarize problem solving and spatial relations skills. This may assist therapists in identifying children who can readily learn to use a joystick operated power chair. It is not appropriate for children with multiple and complex disabilities who may use switches or other access methods. (Furumasu, Guerette, & Tefft, 2004)

There is a continuum of PM skills from learning the concept of movement to the control of steering. Clinician's should be aware of where children are on this continuum in order to develop an appropriate training program to enhance PM skills (Nilsson, Nyberg, & Eklund, 2010: Durkin, 2009)

Children functioning at early developmental levels may learn to use switches and joysticks in a PM device more easily than with toys or computers (Nilsson & Nyberg, 1999)

Children with severe intellectual impairment can learn to use a power chair functionally but potential cannot be based on a short term trial. (Bottos, Bolcati, Sciuto, Ruggeri, & Felicangeli, 2001; Nilsson, Nyberg, & Eklund; Odor & Watson, 1994)

Time and environmental support are very important – and can have more influence on successful learning of PM skills than individual abilities. In other words, children who spend more time in the PM device and are supported in their learning by those around them are more likely to be successful in learning PM skills. (Bottos, Bolcati, Sciuto, Ruggeri, & Feliciangeli, 2001; Nilsson, Nyberg, & Eklund, 2010; Odor & Watson, 1994)

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IC 8: It's More Than 4 Wheels! The Assessment, Seating and Mobility in the Community

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Why do we do what we do? Can you justify your prescription to the client and third party payers? What information do you really need to gather in the community in order to complete a thorough and successful prescription? Is a MAT assessment required? And then, once the wheelchair is delivered we often hear the following concerns: "Where are the footrests?", "The client is sliding", or "Why doesn't the client look the same as when the chair was prescribed?"

Completing a thorough but yet concise assessment has always been a challenge in seating mobility and is even more of a challenge when carried out in the community setting. It is imperative to gather appropriate assessment data but with time constraints as well as environmental challenges inherent in community settings this can prove to be a daunting task for the community therapist. A good seating evaluation involves assessment and consideration of many client factors including physical, functional and lifestyle. These and many other factors play a role in determining the prescription of seating components and wheelchair frames/design. How do product design features meet specific client needs? How do you know what cushion or back will work the best? Does the chair design and set up really make a difference? How do you balance the client's needs and wants for function with theoretical concerns for pressure management and postural support? Establishing a list of priorities and goals is essential in developing a seating system that will not only meet the client's physical needs, but also address functional and lifestyle concerns. Just as important is the need to ensure that the prescribed wheelchair and seating system is set up appropriately on delivery. As well, it is important that care givers are trained on the set up of the chair, functioning of the client in the chair, and transfers into the wheelchair in order to maximize positioning and function. With respect to education, can we learn from what we do on a daily basis? Do our past mistakes help us to learn more about how positioning affects mobility, and how that combination affects functionality?

When determining the seating support it is important to determine the client's tolerance for correction. If they are not tolerant, they will not be comfortable. One also has to consider if the contours provided are reasonable for consistency for a transferred position. The cushion must stabilize the client, but remember that often the cushion doesn't position the client, the caregiver does. If a consistent position is not achieved, will the client be at risk for skin issues as well as discomfort? Is positioning different from stability? Positioning is often achieved through a change in contour, where stability is a matter of control of balance points. Therefore do we need to consider both seating contours as well as their affect on client balance and functional mobility. This is completed during the simulation phase of the assessment. This workshop will review the assessment and simulation process and how the data gained affects the set up and functionality of the wheelchair and seating after the fact.

It is difficult to measure comfort as this is a subjective component. Often the sense of comfort comes from a feeling of being "held or that of a security blanket". Do we need to look at these subjective factors to enhance comfort which will enhance sitting tolerance and possible overall functioning? Comfort for one person may have a whole different meaning than that for the next. Sitting tolerance with resultant time components may be a measurable and objective identifier of comfort.

The M.A.T. Assessment

Pelvic and sacral range of motion
- posterior pelvic rotation
- anterior pelvic rotation
- pelvic obliquity
- lateral pelvic rotation

Trunk range of motion
- kyphosis – anterior curvature
- scoliosis – lateral curvature
- rotation
- rib hump – rotoscoliosis

Lower extremity
- hip range of motion – stabilize the pelvis first – internal/external rotation, flexion, extension, ab/adduction
- knee ROM (to measure hamstring length as related to seating) – stabilize the pelvis, maintain hip at sitting angle, assess knee extension/flexion
- foot range – inversion, eversion, plantar flexion, dorsiflexion

Upper extremity
- shoulder flexion/extension for propulsion/reach
- shoulder retraction
- elbow/wrist range of motion
- grip strength

Assessment Findings

1. Is the pelvis flexible or fixed?
   Will your intervention need to reduce a flexible deformity or accommodate a fixed deformity?
   How will the position affect function or wheelchair mobility?
2. What hip range is required to determine the angle between seat surface and back?
3. Do hamstring muscles have enough flexibility to allow feet to rest on standard footplates?
4. Are the spinal curves flexible or fixed?
   Will intervention need to reduce a flexible deformity or accommodate a fixed deformity?
5. How much support is needed to maintain agreed upon positions?
6. Where will the supports need to be located?
7. What surface materials and sizes are required to maximize pressure relief, but not interfere with function?

Postural Control vs. Pressure Distribution

Postural control is applicable for clients with decreased ability to maintain an upright sitting posture. This impacts their functional capacity based on weakness, abnormal tone or orthopedic deformity. Improved postural control begins with central/ proximal stability, initiated with pelvic stabilization. It is important to provide even pressure distribution over weight bearing surfaces for clients who do not have the ability to shift weight independently, who have sensory impairment or emaciation or for clients with asymmetrical alignment – i.e. hip dislocation or obliquity. Posture and seating is dynamic in nature through out the day and over time. Individuals change as they grow and develop, and their need for postural support or pressure relief changes as well. For individuals with progressive disorders, the need for postural support or pressure relief will likely increase over time.

Prevention, Correction or Accommodation

All three may be incorporated into one seating system. i.e. prevention of pressure or further deformity, correction of a partially flexible scoliosis and accommodation of windswept legs.

1. Prevention of abnormal postures, orthopedic deformities and/ or pressure problems.
2. Correction of abnormal postures and functional orthopedic deformities that are flexible and will enhance function. Healing/ correction of causes of pressure problems.
3. Accommodation of abnormal postures and orthopedic deformities which are structural (fixed) in nature. To provide comfort, enhancing or preserving functional ability and ease of management.

Predictors for skin breakdown

- Level of activity – does the cushion promote stability as well mobility to complete activities?
- Level of mobility – does the cushion promote the ability to mobilize the wheelchair, as well as mobilizing within the cushion (leaning, reaching)?
- Moisture, incontinence – does the cushion promote air flow to reduce heat?
- Shearing/vibration – does the cushion promote movement when needed or prevent it when required?

Design Criteria: Product Considerations

1. Support Medium – ability to maximize surface contact area, material stiffness/immersion, product segmentation to break up surface tension, migration vs. immersion
2. Shape – pressure re-distribution, positioning features (pre ischial shelf, trochanteric shelf, anterior medial/ lateral contour, sacral support)
3. Comfort – softness or firmness of the surfaces
4. Stability, vibration reduction, shear reduction – adjustability of the surface
5. Maintenance
6. Cover – moisture protection, air flow, surface texture, friction properties
7. Weight
8. Durability
9. Aesthetic design, plushness
10. Product application after prescription

The most important consideration in providing comfort is that the cushion does not work in isolation. The wheelchair set up, back support, pelvic support, arm rest height, head control and foot support will all affect client comfort, based on their activity level and function. Therefore any changes in a seat cushion must be followed by reassessment of all other seating components, and wheelchair set up for mobility.

After The Assessment: Wheelchair & Seating Set up in the Home

1. Common Problem Areas
2. Seat belt use
3. Tray use
4. Armrest height/arm pads for support (especially in power)
5. Seat height
6. Footrest height/method to put foot on footplate
7. Cushion placement – forward/back, side to side, reversed, upside down
8. Slings, pads and other things!

Seating System Set-Up

- Mounting the seating system in the chair is just as critical as the product being applied.
- Height- back support in relation to PSIS and lower back hardware
- Angle- back, seat, canes
- Portability – multiple use, hardware slippage
- Affect on chair depth, seat depth, leg angle, centre of gravity, back cane interference, R.O.M. of arms

Landmarks for Proper Positioning

- Space behind knee to edge of cushion
- Space under knee to top of cushion
- Height of headrest in relation to the head
- Space behind buttocks and back edge of cushion
- Space from seat cushion up to initial contact of the lower back on the back support
- Orientation of the ASIS
- Space between pelvic positioning belt and ASIS

Center of Gravity

- Refers to the “Balance Point” of an individual in relation to the wheelchair
- Forward C.O.G. improves responsiveness of the wheelchair and allows easier propulsion
- Rearward C.O.G. improves stability of the wheelchair for “First Time” users
- Affected by Axle position, Caster placement, and Caster orientation

Seating Considerations for Wheelchair Set Up

- Centre of gravity changes for kyphotic postures or changes in hip/pelvic angles, weight changes
- Centre of body over axis or rear wheel to maximize mobility and stability
- Too forward – hard to push, hard to tip
- Too far back – chair tippy backwards, difficult to steer, may sit in kyphosis to stabilize self

Shoulder/Chest Supports, Headrests, Trays, Elbow Supports, Anterior Pelvic Supports, Foot Supports

- What is your goal and that of the client? Three points of positioning/forces
- If everything needs to be tied down, then the relationship of the pelvis to the trunk may not be correct

Transfer Techniques for Maximal Wheelchair Positioning

Anyone will slide out of a chair to achieve a more comfortable position. Therefore, prior to seating the client, ensure the cushion is correctly aligned, additional extra sheets and covers are removed, and footrests and arm rests are set to comfortable levels. Most importantly ensure that the chair and cushion are those assigned to that client. Custom seating for one person may create pressure ulcers for another. It is critical that all lift slings are removed after transfers to avoid pressure points and shearing.

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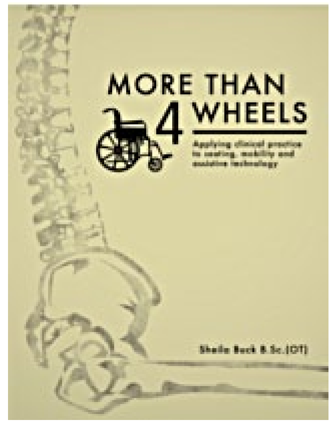
More Complete Information On This And Related Topics Can Be Found In:

"More Than 4 Wheels: Applying clinical practice to seating mobility and assistive technology"

A comprehensive resource manual for assessment and prescription of seating, mobility and related assistive technology.



Available at: www.sheilabuck.ca

IC 9: Winter Sports & Recreation: Adaptive Options & Assistive Technologies

Kendra Betz, MSPT, ATP

Objectives

Upon completion of this session, participants will be able to:
1. Describe five options for winter sports and recreation participation for individuals with physical, sensory and cognitive impairments.
2. Discuss three fundamental necessities for providing seating interventions in adaptive sport technologies.
3. List three resources for adaptive winter sports and recreation participation.

For cool weather enthusiasts and those "stuck" in cold winter environments, a realm of options exist for winter adaptive sports and recreation participation. However, many people with disabilities and most professionals working in the seating and mobility industry are not fully aware of the available activities and adaptive technologies relative to winter sports. When most people think of "adaptive sports", wheelchair basketball and handcycling immediately come to mind. They usually do not initially consider the wide range of "cool" winter adaptive opportunities for individuals with disabilities. For those seeking the thrill of speed, the rush of aerobic conditioning, or just leisurely fun, a multitude of winter adaptive sports and recreation options are available to support involvement ranging from novice participation to elite competition.

A wide realm of winter sports and recreation adaptive options and technologies are available in the sports of alpine skiing, cross-country skiing, biathlon, ice hockey, snow-shoeing, and curling to name a few. Participation and technology options are available for individuals who have the ability to stand and walk and for those who use either manual or power wheeled mobility devices full time. Winter sports opportunities vary for those who present with physical, cognitive and/or sensory impairment; therefore consideration of the necessary functional skills for successful participation is critical.

AT professionals play in an essential role in adaptive sports and recreation applications. In addition to assisting the client to identify activity options with consideration of disability specific limitations, AT professionals can apply specific clinical skills and knowledge to facilitate successful implementation of a chosen recreational activity. AT professionals prescribe and modify equipment to optimize performance, biomechanical efficiency, skin protection and comfort. Mobility skills and equipment management training is provided to maximize function while minimizing injury risk. Comprehensive client education promotes consistent integration of a chosen activity in everyday life. Regardless of the winter sport or recreation activity, AT professionals have much to contribute toward participant performance, safety and positive outcomes.

Table 1: Winter Sports by Physical Disability Group

	Amputation Les Autres	Blind/Visually Impaired	Spinal Cord Injury/Disorders	TBI/CP/Stroke
Alpine Ski	•	•	•	•
Nordic Ski	•	•	•	•
Biathlon	•	•	•	•
Snowboard	•	•		•
Curling	•		•	•
Sled Hockey	•		•	•
Snowmobile	•	•	•	•

For each activity discussed, the adaptive technologies utilized for that sport will be reviewed in a compare/contrast format to allow the audience to understand similarities and differences in the wide realm of adaptive equipment options available. Seating interventions for sports equipment to optimize support, skin protection and performance will be highlighted.

1. Alpine Skiing

- Competitive Events: Downhill, Slalom, Giant Slalom, Super-G, Super Combined (downhill and two slalom races – first time contested at Paralympics in 2010). Mono-X at Winter X Games.
- Athletes: upper and/or lower extremity amputation, SCI/D VI, TBI, CP
- Technology/Equipment: standing skiers often utilize standard ski equipment, with or without outriggers. Sitting skiers use mono-skis and outriggers. Athletes with VI ski with a sighted partner. Standing athletes with below-knee or above knee amputation may utilize a specialized prosthetic limb while skiing.

2. Nordic (Cross-Country) Skiing

- Competitive Events: Women – 1 km, 5 km, 10 km (sitting) and 15 km (standing and VI). Men: 1 km, 10 km, 15 km (sitting) and 20 km (standing and VI). Relay: three sections, three athletes with varied disabilities, technique requirements.
- Athletes: upper and/or lower extremity amputation, SCI/D, VI, TBI, CP.
- Technology: standing skiers often utilize standard cross-country ski racing equipment. Sitting skiers use a sit ski frame with Nordic skis beneath and utilize short poles for propulsion on snow. Athletes with VI ski with a sighted partner. Standing athletes with below-knee or above knee amputation may utilize a specialized prosthetic limb while skiing.

3. Biathlon (Nordic skiing and Target Shooting)

- Competitive Events: Short distance (7.5 km) with target shooting between 2.5 km loops. Long distance: Men and standing /VI women (12.5 km). Sitting women (10 km).
- Athletes: same as Nordic; all skiers shoot from prone on belly, including sit-skiers.
- Technology/Equipment: same as Nordic for skiing. Rifles (low powered air guns) for target shooting. VI athletes utilize electronic sound support for aiming while shooting. Athletes do not carry the rifles while skiing.

4. Snowboarding

- Competitive Events: Determination underway.
- Athletes: upper and/or lower extremity amputation, SC/D, VI, TBI, CP.
- Technology/Equipment: Snowboard and board boots; custom boot fitting may be needed. Outriggers, instructor support devices.

5. Wheelchair Curling

- Competitive Events: One tournament. Two teams compete to advance.
- Athletes: Various disabilities; all use wheelchairs. Both men and women, "mixed" teams. Four players compete for each team.
- Technology/Equipment: wheelchair required (wheels locked when throwing), curling stones, curling sticks (optional), extras.

6. Ice Sledge Hockey

- Competitive Events: One tournament; round robin. Games include three 15-minute periods.
- Athletes: typically lower body impairment, competitive teams are dominated by athletes with lower limb amputation, VI do not compete. Six players on ice during competition.
- Technology/Equipment: ice sledge with skate beneath, adaptive hockey sticks - short, spiked on one end to propel on ice.

7. Snow-shoeing

- Competitive Events: none; excellent aerobic conditioning, outdoor fun
- Athletes: upper and/or lower extremity amputation, SCI/D, VI, TBI, CP.
- Technology/Equipment: Snow shoes, poles/outriggers/ crutches.

8. Snowmobiling

- Competitive Events: Winter X-Games
- Athletes: upper and/or lower extremity amputation, SCI.
- Technology: snowmobile, seating interventions.

Winter Paralympics Overview

Approximately 600 athletes compete in five events at the Winter Paralympics. Events which include 1) Alpine (downhill) skiing, 2) Nordic (cross-country) skiing, 3) Biathlon, 4) Ice Sledge Hockey, and 5) Wheelchair Curling. While variable for each event, the disabilities represented at the Paralympics include amputation, visual impairment (VI), Spinal Cord Injury and Disease (SCI/D), Cerebral Palsy/ mild Traumatic Brain Injury and "Les Autres", meaning "all others". Athletes participating in the Paralympics must meet criteria for "minimum disability". To facilitate fair competition and race results, there is a specific classification system for each sport whereby athletes are grouped together relative to the function preserved with respect to disability related impairments. Specific information on classification is available at www.paralympic.org/Sport/Classification/index.html. The Paralympics is not to be confused with the Special Olympics which are reserved for athletes with intellectual/cognitive impairments.

The International Paralympic Committee (IPC) is the global governing body of the Paralympic Movement and organizes both the Summer and Winter Paralympic Games. The first Paralympic Winter Games took place in Ornskoldsvik, Sweden in 1976. The Paralympic Games follow the Olympic Games (two-three weeks later), alternating between summer and winter events every two years. Since 1988, both the Summer and Winter Paralympics events have been held at the same venues as the Olympics. In the word "Paralympics", "para" does not refer to "paraplegic" as many often assume. Instead, "para" refers to "parallel" or "alongside", relative to the Olympic Games. The 2010 Winter Paralympics were held at venues in Vancouver and Whistler, British Columbia. The 2012 Summer Olympics and Paralympics will take place in London. The 2014 Winter Olympics and Paralympics will take place in Sochi.

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IC 10: RESNA Standards Volume 4: Wheelchairs and Transportation

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Background

We assume that products for persons with disabilities, especially those relied upon for daily activities, meet our expectations for design, technical performance, cost benefit, reliability and safety. Prior to 1980, there was no mechanism in place for people who use wheelchairs or those who prescribe or pay for them to obtain objective, comparable product information to allow informed selection. Voluntary industry standards provide this information and help to improve product quality and safety through 4 components or areas of requirement: design, testing, performance and disclosure (e.g., labeling, presale literature, user instructions).

Today, the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) is accredited by the American National Standards Institute (ANSI) as an organization to develop voluntary national consensus standards for technologies used by persons with disabilities. RESNA's Assistive Technology Standards Board has a number of committees developing standards for mobility devices, support surfaces, adaptive sports equipment, emergency stair travel devices and more. One of these committees is Wheelchairs and Transportation (WHAT). RESNA WHAT is completing several years of rigorous work and finalizing the long awaited Volume 4: Wheelchairs and Transportation. Committee members are volunteers who are manufacturers, therapists, engineers and agency reps that have met 1-2 times a year for the past 6 years to bring Volume 4 to completion.

Voluntary industry standards that apply to wheelchairs used as a seat during transportation have been updated and rolled into one volume. Volume 4 will contain three standards that address the wheelchair, the wheelchair seating system, and the wheelchair tiedown and occupant restraint system (WTORS) that anchors the wheelchair to the floor of the vehicle and retains the passenger within his or her wheelchair. It is anticipated that Volume 4 will be published in 2011 and available for purchase through RESNA. The standards are technical documents purchased and applied by manufacturers wanting to create products that comply with these industry standards. Therapists, suppliers, parents and interested consumers need to understand the scope of the standards and how to apply the disclosed information to make decisions about purchasing or configuring devices.

The Standards in Volume 4: Wheelchairs and Transportation

Providing effective occupant protection in a motor-vehicle crash is a "systems problem" that involves the vehicle, the vehicle seat, and the occupant restraint system, therefore the standards in this volume address each of these issues. Two of the standards in Volume 4 are a consolidation and updating of existing standards. The WTORS standard, previously known as the Society of Automotive Engineers recommended practice SAE J2249, will now become RESNA WC18. Many of you are already aware of RESNA WC19, the standard for a crash-tested and easy to secure wheelchair, which was passed back in 2000. This standard has been updated and improved based upon experience with the standard to date. Since WC19 tests a specific wheelchair and seating system, a new standard, RESNA WC20, will make allow manufacturers to independently test complete wheelchair seating systems consisting of a seat, a back support, and attachment hardware that can be paired with wheelchair frames from WC19-compliant wheelchairs.

WC18: Wheelchair Tiedown and Occupant Restraint Systems (WTORS) for Use in Motor Vehicles

This standard, which updates SAE J2249, applies to WTORS comprised of a device for wheelchair tiedown and system of belts for restraining the wheelchair-seated occupant. For people who are unable to transfer from their wheelchairs when they travel in motor vehicles the wheelchair must serve as the vehicle seat. This usually means that the occupant restraint system (i.e., seatbelt) installed by the vehicle manufacturer cannot be used to provide protection in a crash. In addition, the wheelchair must be secured to the vehicle floor so that it does not transfer forces onto the occupant and/or become a hazard to other passengers in a collision or sudden vehicle maneuver. Providing crash protection for the wheelchair-seated occupant requires after-market equipment (i.e., WTORS) to provide effective wheelchair securement and occupant restraint.

The standard encourages the design, testing, installation, and use of WTORS that will provide effective wheelchair securement and occupant restraint for forward-facing adults and children in frontal collisions. The primary purpose is to reduce the likelihood of serious injuries to wheelchair-seated occupants involved in frontal vehicle crashes. However, WTORS also increase safety during normal travel.

Since WTORS manufacturers are not able to control the end use of their products, the standard requires evaluation using a nominally worst-case 30-mph, 20-g frontal sled impact test using an 187 lb (85 kg) surrogate wheelchair and a midsize adult male crash dummy to dynamically load the wheelchair tiedown and occupant restraint system.

WC19: Wheelchairs Used as Seats in Motor Vehicles

A vehicle seat must be designed and constructed to provide support for the occupant under impact loading and during rebound, thereby controlling occupant kinematics. This allows the seatbelt to perform effectively and minimizes occupant contact with interior vehicle components. Furthermore, a vehicle seat should not contribute to occupant injuries in a crash.
For people with disabilities who cannot transfer from their wheelchairs when traveling in motor vehicles, the wheelchair must serve as the vehicle seat and allow proper use of WTORS to secure the wheelchair and provide occupant restraint. The purpose of the RESNA WC19 standard is to promote occupant safety and reduce the risk of injury for motor-vehicle occupants who are seated in their wheelchairs. This is accomplished by applying basic occupant protection principles to the development of design and performance criteria for wheelchairs used as seats in motor vehicles.

In this standard, a "wheelchair" Is considered to be a seating system comprised of a frame, a seat and wheels that is designed to provide support and mobility for persons with physical disabilities. This term includes manual wheelchairs, power wheelchairs, three-wheel scooters or power operated vehicles (POVs), and specialized seating bases such as tilt in space frames. A wheelchair that complies with all the requirements of this standard is considered to provide a reasonable measure of safe and effective seating during vehicle ingress/egress, during normal vehicle movements, and during a vehicle collision.

There are many makes, models, and styles of wheelchairs in use, and few, if any were designed to serve as a seat in a motor vehicle. It is the purpose of this standard to encourage the design, testing, and use of wheelchairs that will enable and enhance effective wheelchair securement and occupant protection in a frontal collision, offering comparable crash performance to that provided by the vehicle seat installed by the vehicle manufacturer. While the primary concern is to reduce the potential for injury to wheelchair-seated occupants that may be involved in a frontal vehicle crash, the standard also addresses issues of wheelchair performance related to vehicle access, maneuverability, and stability under normal operating conditions. It is also anticipated that achievement of improved occupant protection through effective wheelchair securement will result in increased comfort and security for wheelchair-seated occupants during normal travel. This standard should not be used to discourage people with disabilities from using motor vehicle transportation, or to limit access to and availability of transportation services.

This RESNA standard specifies several key features for a WC19 wheelchair. It shall:

- Have at least four permanently labeled securement points that can withstand the forces of a 30 mph, 20 g impact,
- Have specific securement point geometry that can receive a securement end fitting hook of a specified maximum dimension,
- Be designed to accommodate the proper use and positioning of vehicle-anchored belt restraints,
- Be equipped with anchor points for an optional integrated pelvic belt, such that the wheelchair and pelvic belt will withstand a 30 mph/20 g impact, and
- Provide a standard interface on the pelvic belt to connect to a vehicle-anchored shoulder belt.

WC20: Wheelchair Seating Systems for Use in Motor Vehicles

For wheelchair users who remain seated in their wheelchairs while traveling the wheelchair and seating system play an important role in protecting the occupant in a crash. The wheelchair and its seating system must provide a stable support surface under normal driving maneuvers, as well as crash conditions. The seating system should reduce the likelihood of "submarining" under the pelvic belt, as well as maintain the occupant's position in a crash to promote effective occupant restraint. Wheelchairs and seating systems that are not designed to withstand crash level forces place their occupants at an increased risk of injury in a crash.

RESNA WC19 applies to wheelchairs tested with a specific seating system. However, seating systems are often provided as after-market products, independent of a wheelchair frame and assembled by the rehab technology supplier. Therefore, requirements must be defined for seating systems alone, independent of a specific wheelchair frame. RESNA WC20, adapted from ISO 16840-4, defines such requirements.

RESNA WC20 establishes design requirements, performance requirements, and requirements for product labeling and manufacturer literature, for complete wheelchair seating systems consisting of a seat, a back support, and attachment hardware. The standard does not currently address seat-integrated frames. It applies to seating systems intended for installation on base or seat frames of manual and power wheelchairs that provide securement points and belt-restraint anchor points as required by RESNA WC19. The seating system may or may not include postural support devices. It applies to seating systems intended for use by adults and children who are transported facing forward in all types of motor vehicles. Seating systems that comply with this standard are intended to be used with wheelchair bases that have been successfully tested to WC19 requirements.

The dynamic test requirement is representative of a 30-mph/20g frontal impact. This dynamic test is conducted using a surrogate wheelchair base that is able to accommodate a variety of types and sizes of commercial seating systems. During the test, the surrogate wheelchair base is secured using a 4-point surrogate tiedown, while the occupant is restrained using a lap and shoulder belt. The test dummy is selected according to the intended occupant weight usage guidelines established by the seating manufacturer. WC20-compliant products must accommodate placement of crashworthy seatbelts and so are given a rating based upon this factor. The standard also specifies requirements for the seating system manufacturer with respect to product labeling, installation instructions, user instructions and warnings.

Learning Resources

1. The website of the RERC on Wheelchair Transportation Safety at http://www.rercwts.org/ has been developed to provide education and resources for increasing the use of standard-compliant products during transportation. Use the menu or the search function to find:
   - Consumer and Peer-reviewed Publications
   - Standards overviews and updates
   - Justifying funding for WC19 Wheelchairs and Seating
   - Downloadable Crash-test videos and PPT/video presentations
   - Training resources
   - List of Crash-tested wheelchairs
   - Answers to frequently asked questions (FAQs)
2. RideSafe Brochure providing information on traveling more safely in motor vehicles while seated in a wheelchair (English and Spanish): http://www.travelsafer.org/
3. Guidelines for use of Secondary Postural Support Devices by Wheelchair Users During Travel in Motor Vehicles: http://www.rercwts.org/info
4. The RESNA Position Paper Wheelchairs Used as Seats in Motor Vehicles: http://www.rercwts.org/info
5. The RESNA Technical Standards Board: http://resna.org/technical-standards/assistive-technology-standards
6. The Industry Profile on Wheeled Mobility (2009): http://t2rerc.buffalo.edu/pubs/ip/index.htm
   Within this document look for the chapters:
   Chapter 4: Voluntary Industry Standards for Wheelchair Technology by Hobson, DA & Axelson, P. p 79-125.
   Chapter 5: Wheelchair Transportation Safety by Bertocci, GE & Buning, ME. p 126-151.

IC 11: Engagement: How to Build a Healthy Rehab Industry

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en·gage·ment [en-geyj-muh nt]

–Noun

1. the act of engaging or the state of being engaged.
2. an appointment or arrangement: a business engagement.
3. betrothal
4. a pledge; an obligation or agreement
5. employment, or a period or post of employment, esp. in the performing arts.
6. an encounter, conflict, or battle
7. Mechanics . the act or state of interlocking.
8. engagements, Commerce. financial obligations.

-Synonyms

1. Contract
2. Promise

http://dictionary.reference.com/browse/engagement

Introduction

The Rehabilitation Equipment Industry has been under scrutiny and under significant financial pressure for the last several years, and given the state of the economy and the clamor to reform healthcare, the pressure is not likely to lessen in the near future.

In 2009 Medicare implemented a 9.5% cut in reimbursement for complex rehab equipment, initiated a competitive bid process for consumer power, and put in place a significantly more restrictive diagnosis vs. needs driven standard for both chairs and support surfaces.

Medicare has eliminated the first month purchase option for Group 2 power putting even more financial burden on providers.

Cash strapped State Medicaid Programs and private insurers have followed suit with cuts of their own.

Our collective response to these changes has, to this point, been reactionary and somewhat short sighted. The resulting policy changes have been mixed in their outcomes but overall the results are decidedly negative.

The blame game: As an industry we have collectively failed to see the shortcomings of our own industry; we have done a poor job policing ourselves; we have failed to support what we have learned to be fact experientially; we have a vain understanding of business economics; we have unsuccessfully engaged and empowered the consumer; we have manufactured products to the level of payment without a collective long term plan of action; we have been apathetic as a community.

During our presentation we will explain what we see as the fundamental problems and realities that must be recognized and addressed before we can move forward. We'll take a closer look at the "blame game" dynamics and address the following problems and opportunities.

- The most fundamental problem facing our industry is MONEY and a diminishing supply of it, complicated by a growing need for more of it.
- Reaction to real and perceived fraud and abuse within the industry.
- Lack of Evidence Based Practice within the industry as a whole.
- Lack of consistent and broad scoped self-advocacy by consumers.

Throughout our presentation we will discuss the necessity for engagement and how it will build a sustainable industry?

- What resources are out there?
- Engaging the Clinical Team
- How to empower the consumer to want to be engaged.
- Engaging the consumer groups.
- Engaging yourself and your company.

Ultimately we will discuss the key components in making this all come together and work.

- We will discuss an action plan.
- How we can check and measure if we are being successful.

Who is responsible to see it through?

If we are to recover as an industry and advance as a specialized service within the allied health community we must make a long term commitment to cultivate a sustainable industry with goals that are common and beneficial to all involved

IC 12: Disparities in wheelchair type, wheelchair skill level, and community participation by payer source

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Introduction

Provision of state-of-the-art, individualized, and customizable wheelchairs is a major component of the rehabilitation process after SCI. (1) Wheelchair type and characteristics, however, may facilitate or even act as a barrier to people successfully regaining independence and reintegrating into society. (2) Hunt has demonstrated that vulnerable people from minority backgrounds with low socioeconomic status, public sector insurance (Medicare and Medicaid), low socioeconomic status, and older individuals were more likely to receive standard wheelchairs than those more customizable. A study by Chaves et al. found that individuals with SCI perceived wheelchairs as being the most significant factor limiting participation – even greater than their impairment. (3) More recently, Wee et al. reported wheelchairs as one of the most influential factors that impact activity in persons with a mobility impairment. (4) Given the critical role of wheelchair technology in returning individuals with SCI to the community, the overriding aim of this study was to supplement the evidence base on provision of wheelchair technology in the population with SCI. The specific objectives were to identify and describe any differences in the population with SCI by payer and then identify disparities in wheelchair provision. The objective of this study is to determine disparities in wheelchair prescriptions and payer sources, the differences in wheelchair skill levels, and the relationship to community participation.

Objectives

Upon completion attendees will be able to:

- Compare scores on high level wheelchair skills test items to the type of wheelchair used
- Compare scores on high level wheelchair skills test items to community participation
- Identify if there is an influence of the payer source on the type of manual and power wheelchair obtained

Methods

his study was Multi-center cross-sectional study of 6 SCI Model System Centers. 299 participants using a manual and power wheelchair for primary means of mobility one year or longer after the SCI participated in a structured interview to collect payer source, wheelchair breakdown, and activity limitations. A Wheelchair Skills Test (WST) was administered to collect functional mobility. A data logger was attached to their wheelchair that measured many things including distance, speed, and time in the wheelchair.

Results

In decreasing order of frequency, there were 96 participants in the Medicaid/DVR group, 93 in the Private/Prepaid group, 44 in the Medicare group, 40 in the WC/VA group, and 26 in the Self Pay group. All payers groups had a preponderance of males (range 72.7-85.0%), with the Medicare group having the lowest proportion and the WC/VA group having the highest. The Medicaid/DVR group was the youngest (37.5 years, range 18-63 years), followed by Self Pay (38.7 years), Private/Prepaid (41.5 years), WC/VA(45.8 years), and Medicare (46.9 years) groups. Range of duration of injury was10.3- 13.1years, with the Medicaid/DVR group injured the shortest amount of time and the SelfPay group injured the longest. Whereas the Private/Prepaid, WC/VA and Self Pay groups had a majority of Caucasians enrolled (75.3%, 70.0%, and 61.5%,respectively) African-Americans were the most common race in the Medicaid/DVR group (60.4%). The Medicare group had a more equal distribution by race with Caucasians and African-Americans the most frequently represented races (47.7% and 36.4%, respectively).

The WST showed differences between manual wheelchair categories. Participants with a K0009 had a higher total score in the WST of 84.5%, specifically in higher-level skills including wheelies and stairs. 36.7% of the participants with private insurance received a K0009 manual wheelchair. Self-pay participants had the highest rate of K0004 (25%) and Medicaid had the highest rate of K0005 (81.8%). The K0005 wheelchair group also had the highest rate of breakdowns (53.5%) with a higher rate of injuries, missed work, and missed medical appointments.
Data logger analysis on 132 manual wheelchairs showed age to be significantly ($r=-.225$, $P< 0.01$) related to average speed traveled per day. Whites were found to travel significantly further ($P< 0.01$) and accumulate more minutes per day ($P< 0.01$) compared to minorities. Individuals who were employed traveled significantly further ($P< 0.01$), faster ($P< 0.01$), and for more minutes per day ($P< 0.01$) compared to those who were not employed. A moderate relationship ($r=.245$ to $.390$) was found between wheelchair mobility data and CHART total score.

Conclusion

Medicaid participants showed a higher rate of K0005 wheelchairs compared to private insurance, along with lower wheelchair skills, more breakdowns effecting community participation and safety respectively. Findings indicate the efficacy of a quantitative method to track wheelchair mobility in community settings, which could serve as a way of identifying community participation for individuals with SCI and possibly uncovering additional aspects of participation.

Support

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IC 13: Incorporating Programming & Consumer Education for Power Positioning Use

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Clinicians often prescribe tilt in space seating systems citing the pressure relief benefits of this form of repositioning as medical justification for funding. This applies to the prescription of power seating, but there are inconsistencies regarding how this information is disseminated to consumers. Several recent studies have explored how clients typically use power positioning systems (amount of tilt and/or recline, frequency of use). Although these studies have had relatively small sample sizes, they suggest that while most consumers with tilt systems make small (< 15 degrees) changes of position with some frequency throughout the course of the day, very few utilize the full range of tilt available (1,4,5,8,12). This implication is concerning as several studies have suggested that tilting 45 degrees or more is necessary to achieve the optimal off-loading of seated pressure.

One of the components which none of these studies include is the education/instruction of how the power positioning system should be used. In response to these published finding, a survey was written and posted online specifically for clinicians who prescribe power positioning systems. The intention of this project was to gain a broad perspective of how therapists determine the power positioning needs of consumers and how they educate consumers about the use of the power positioning systems. Responses gathered from North American therapists over the past 12 month period will be reported.

Based on the results of this survey, this course hopes to provide initial training guidelines for power positioning system use. This will also include recommendations for discharge materials which would be helpful in increasing compliance with power positioning use.

This session will examine findings from a clinician survey regarding how education & training is provided for the use of power positioning systems.

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IC 14: Ethics and Certification: Raising the Bar of Professionalism

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Upon completion of this session, the participants will

- Gain an in-depth understanding of the RESNA Standard of Practice and Code of Ethics as they relate to daily practice;
- Be aware of their responsibility to recognize breaches of these standards and follow up with the correct agencies;
- Identify at least 3 avenues to report fraud and abuse.

Abstract

Certification validates proficiency in a core knowledge area, but best practices go beyond the knowledge and require adherence to the highest ethical standards and professional conduct. One of the core missions of certification, besides professional recognition, is to protect the consumer and to provide consumer safeguards. RESNA has a Code of Ethics and 22 detailed Standards of Practice to help define the fundamental concepts and rules essential to promote high standard among those certified. RESNA's Complaints Review Committee also serves under the Professional Standards Board to adjudicate in matters relating to potential violation of these standards. Case examples based on actual complaints will be used to illustrate a range of unscrupulous practices and reporting mechanisms to self-police our industry.

IC 15: Do You Have Your Client's Back?

Jacqueline Macauley PT., ATP

Introduction

Is a back support an accessory or a necessity? Is the prescription complete when the mobility base and the cushion have been decided? Why do we not give equal consideration to the back support? Why is there still such prevalence of sling back upholstery? Is it only complex clients that require this intervention? This presentation will highlight the importance of appropriate back support for all wheelchair users from the standpoint of maximizing postural support/stability, pressure distribution, comfort and function. The consequences of inadequate or inappropriate back support will be emphasized..

Background
The Seated Position

The human body is not designed to be in the seated position for prolonged periods of time[1]. It is a dynamic, segmental system that changes position frequently to engage in functional tasks, activities and rest. For many wheelchair users this is not an option and static sitting often for up to several hours per day is the norm. In sitting , the pelvis and thighs form the base of support with the trunk, head and neck balanced above this base. This is potentially unstable as the pelvis can tilt and move in all directions [1, 2,3]. It therefore follows that the pelvis must be considered the key point of control when considering postural intervention, as it's position will directly impact the pelvic spinal relationship, the position of the upper trunk, shoulders, head and neck. [2,3,4]. It must be understood that the pelvis is a three dimensional structure, acted upon by gravity and cannot only be addressed (re: stability) from underneath i.e. via the cushion. A back support to provide, at least, postero-lateral pelvic support is essential to achieve an optimal position for stability. Ideally if the pelvis is stabilized in a neutral midline position, thoracic extension is promoted and this facilitates upper extremity function [2] Back support is critical to maintain spinal alignment, even with an intact neuromuscular system, due to the effects of gravity and fatigue.

Potential Problems with Long Term Sitting

There is consensus in the literature that long term static sitting can result in a high prevalence of secondary pathological complications. These include pressure ulcers, back and neck pain, postural deformities, joint contractures ,LE edema and impaired physiological functioning eg. respiratory function.[1,2,3,4,5,6] While it is obvious that the cushion and mobility base need to be examined to address these complications, back support, or lack thereof, may be a key contributing factor.

Postural deformities

Posterior Pelvic Tilt:. Sling back upholstery may either cause or accentuate this posture as it stretches out over time and therefore does not provide adequate support or stability[7,8]. A back support that is either too high, too upright or conversely too low may force the individual to adopt a position of PPT for stability.
Anterior Pelvic Tilt: may also be caused or accentuated by a back support that is too high or too vertical. It may also be the result of excessive lumbar contour causing the client to intentionally move away from it
Scoliosis/Pelvic Obliquity:Scoliosis may be caused or accentuated by sling upholstery , a backrest that is too wide or has inadequate lateral support, in a client that has decreased trunk control or issues with fatigue. This will be expecially evident in a client with an assymmetrical presentation accentuated by lack of postural support.

It must be noted that while the literature supports the view that postural support is required to counteract the negative secondary complications of long term sitting, there is less information on where to apply the appropriate support, what support is appropriate, how much….Rather the emphasis is on individual assessment of a client in terms of postural, functional and environmental needs and desires. Many of the examples cited above are the result of clinical observation and experience.

Skin: Beyond Postural Stability

Often overlooked is the idea that the back can also be considered a loading surface for pressure distribution. If a back support has intimate contact with the spinal curves and thoracic extension is facilitated then the clients back functions as a loading surface. Since pressure equals mass divided by area the pressure on the seated surface will decrease if the back is taking load. This can be clearly seen with pressure mapping but requires futher study.

Yarkony and Chen (1996) cited by the PVA Consortium [9] have noted that sling upholstery of the seat and back can result in pelvic obliquity and kyphotic posture which is associated with increased risk of pressure ulcers as well as deformity and discomfort. Engstrom[2] and Buschbacher[10] have both noted that the use of a contoured back to stabilize the trunk and pelvis reduces shear forces on the seat.

Pain and Discomfort

With the complex client the need for posterior and lateral support is likely obvious – but what about the active client? Mechanical (nociceptive) back pain is often the result of prolonged sitting with the joints and soft tissues in an end range, poorly aligned position – often PPT. This is true of the non-disabled population so must have ramifications for the wheelchair seated client. The prevalence of back pain among wheelchair users is significant – Samuelsson(1996) cited by Arthanat[4] reports 84%. While this encompasses more than nociceptive aetiologies it is evident that prevention/minimization of pain deserves consideration in the prescriptive process. Active users often utilise sling upholstery in an effort to keep the mobiity system as lightweight as possible but potentially at considerable cost over the long term. Tension adjustable upholstery would appear to be a better choice to maintain pelvic alignment and decrease the stress on the spinal discs and soft tissues but is dependent upon actually being adjusted periodically. They do ,however, stretch and wear out,cannot provide rigid stabilization [11] Additionally they are not contoured and can only provide posterior support.

Back pain and discomfort has been extensively studied by the ergonomics industry as it relates to occupational long term sitting eg. office workers, drivers and airline pilots to name a few. A plethora of literature exists and an entire industry has developed around the best way to decrease postural pain/fatigue and optimal support for seated tasks. International standards have been developed and are strictly adhered to for health and safety reasons. In relation to back support the general recommendations are – lumbar support that is preferably adjustable[12,13,14], correct seat height and contour to match the shape of the spine[12,15], adjustability in seat to back angle[12,-15], seat tilt angle[12,15] and positional change out of habitual postures[12-15]. It would seem that there are some lessons to be learned from the field of ergonomics and that postural support initiated immediately post injury would be prudent for our active clients, in terms of long term spinal health and pain prevention. Little evidence currently exists to support this claim, however, further investigation is warranted as pain is widely recognised as a major contributor to poorer outcomes, decreased participation and quality of life[16]

Choosing a Back Support

The type of back chosen is determined through a comprehensive evaluation – physical assessment, postural assessment in supine and sitting and functional assessment. The client's needs and desires, lifestyle, enviromental and transportation needs must be given due consideration if a good outcome is to be optimized[1,3]. Goals can then be determined and translated into equipment parameters - ideally providing adequate support and alignment without restricting functional activity[1,2,4,6]

Types of back Support

Various types of back supports are available - sling upholstery, tension adjustable upholstery, commercial backs (some of which allow varying degrees of customization) and custom molds. This represents a technology continuum and each type has a design intent and associated pros and cons.

Key Features of a Solid Back Support

To achieve an optimal outcome the solid back support should be

- Appropriate height – ideally to promote thoracic extension and facilitate UE function.
- Appropriate contour – to match the clients shape, support upright trunk position and maintain optimal pelvic position
- Appropriate depth – to provide lateral stability if not using laterals
- Angle adjustable – to provide postural stability for function,
- Comfortable
- Easy to handle - for transportation
- Lightweight

Aesthetically pleasing

Historically there has been limited use of solid back supports often for the reasons of poor fit, limited adjustability, weight and handling issues. Technology continues to advance and many of these issues have been addressed and should continue to improve to ensure that clinical benefits are not hampered by the equally important technical and practical issues.

What does the research say about back supports?

While there is much written about the importance of postural support and seating systems in general, there is a scarcity of specific information on back supports i.e.: comparing/ contrasting different types. While the benefits may seem obvious, minimal supportive evidence is available. May et al found little correlation between type of back support and functional task performance[17] except for functional reach. Conversely Chesney et al [18] did find a correlation between improvements in comfort and propulsion when using a manufactured back. Makhsous et al[19] found that a user adjustable lumbar-pelvic-thoracic support improved postural stability which increasing time efficiency and quality of functional reach. From an end user perspective Trail et al[8] notes that sling backs rate as one of the most undesirable features of a seating system for ALS clients.
Just because the evidence base is currently limited, does not mean that our clinical knowledge base is unfounded. Clearly an opportunity for research is evident and critical to demonstrate the efficacy and effectiveness of our interventions, improve patient oucomes and justify costs.

Conclusion

The prescription process is only two thirds complete when the mobility base and cushion have been chosen. According to Engstrom[2] "for the seat to be fully functional , it needs to be in harmony with the backrest". The seat provides the base of stability, the backrest stability and balance for function. While seating is always the essential first step, it is always essential to think beyond the seat.

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IC 16: Get Your Hands on a Stander - How to Properly Set Up and Fit Standing Devices

Amy Meyer, PT, ATP and Andy Hicks, ATP

Why Stand?

Standing is an activity capable individuals perform up to 70-80+ times per day. There are many physiologic benefits to standing and upright weight bearing. The medical benefits of standing are strongly supported by research. Likewise, the complications of immobility are also supported and include: decreased bone mineral density, increased risk of pressure ulcers, increased development of joint contractures, impaired bowel and bladder function, decreased respiratory function, and increased gastrointestinal problems. According to the RESNA Position on the Application of Wheelchair Standing Devices, "Standing is an effective way to counterbalance many of the negative effects of constant sitting.",

Osteoporosis

- Loss of bone mineral density occurs with a lack of mechanical weight bearing through the longitudinal axes of the bone (Wolff's Law). The compromised bone is more prone to fractures and complications.
- Dynamic loading of the skeletal system has been shown to be the most effective for improving bone mineral density.

Pressure ulcers

- Individuals also use standing for more effective pressure relief – reducing the risk of pressure ulcers without negatively affecting one's line of sight. It has been documented that people who perform a regular standing program have fewer pressure ulcers.2, 3, When a person achieves an upright position, the pressure is most effectively removed from their seat and back surfaces – the most common areas at risk for skin breakdown in a seated individual. 14,

Contracture Management/ Skeletal deformities

- Standing is an effective way to elongate muscles which are typically shortened in the seated posture (including iliopsoas, abdominals, hamstrings, and the gastrocnemius/soleus complex.)
- During sitting the lumbar spine tends to flatten. The act of standing promotes a natural lumbar lordosis to establish a more erect trunk, thereby reducing the risk of kyphotic thoracic deformity which would limit respiratory capacity and hinder upright postural alignment.

Vital Organ Function (Gastrointestinal, Cardio-Respiratory, Bowel, Bladder)

- Standing in an upright position with trunk extension, vital organ capacity improves and is less restricted. Gravity is able to assist with digestion, bowel movements, bladder emptying, and also provides improved breathing/chest expansion (increasing vital lung capacity and lessening the risk of pneumonia.)3 This not only improves oxygen consumption, but also will allow the standing individual to speak with improved volume due to greater breath support.
- Standing also improves circulation providing cardiovascular benefits.2
- Bowel and bladder function have been studied extensively (primarily in patients with spinal cord injuries). These studies show that there is: reduced risk of urinary tract infections3 (likely due to gravity assisting with bladder emptying – eliminating residual volume in the bladder), decreased amount of free calcium in the urine resulting in reduced risk of kidney stones and their complications,, , fewer bowel accidents have been reported by users who perform a regular standing program, and fewer episodes of constipation.2, 3,

Spasticity Management

- Weight bearing has been shown to have an immediate and significant effect on reducing muscle spasticity. This is consistent and aligns with current teaching regarding weight bearing (proprioceptive input) and its effect on inhibiting muscle tone. This enables safer transfers, improved positioning as well as providing a more effective and restful sleep.

Functional Benefits (including but not limited to the following):

- Improved vertical range of reach (kitchen counters, medicine and kitchen cabinets, refrigerator, sinks, drawers, closets, clothes hangers, thermostats, light switches, etc.)
- Improved psychological well being as well as improved productivity at work or at school (visual stimulation, access to educational opportunities, proprioceptive input, appropriate peer interaction, etc.)
- Improved participation in Mobility Related Activities of Daily Living (MRADLs)
  - Toileting (enables some male users to use a public urinal independently, upright positioning promotes bladder emptying – whether catheterizing or self eliminating)
  - Feeding (promotes access to food preparation including grocery shopping, cooking, washing dishes, reaching items in kitchen cabinets and refrigerator/ freezer)
  - Dressing (may reduce spasticity for improved ability to complete dressing tasks, improves access to closets, hanging clothes, and drawers)
  - Grooming (increased vertical position improves access to bathroom mirrors and sinks)
  - Bathing (improved access to obtain bathing supplies such as towels, soap, etc.)

Fitting And Use of Standing Devices:

Not every standing device is the same: each manufacturer/model has its own unique design, mechanism, and options for standing. Therefore, no "cookbook" exists to provide instructions for properly fitting and using ALL standing devices; however, there are some general rules of thumb.

- Proper seat depth and lower leg measurements are critical for appropriate fit.
- Accurate lower leg length measurement is also extremely important.
- Knee support placement varies with each manufacturer, but is ultimately placed appropriately by the evaluating therapist, and should be snug, but not tight. Examples:
  - For EasyStand products – knee supports are recommended to be placed directly over the knees.
  - For Permobil/LifeStand standing wheelchairs, the knee supports should be placed just below the knees.
- Some standing devices have the option of using various techniques to achieve standing. It is important to understand when different standing sequences are indicated for use.
  - Prone standing is beneficial to facilitate active extension and has various developmental advantages.
  - Supine standing allows gradual progression to upright for individuals with orthostatic intolerance. Also, dependently transferring a client in the supine position may be the safest option for some individuals.
  - Sit to Stand standing provides the client with the ability to have multiple functional positions (sitting, standing, and anywhere between) and is ideal for individuals who transfer independently. This type of standing can best accommodate hip/knee flexion contractures.
  - Multi-positional standers provide use of different types of standing as needed. Some will also allow a combination of sit to stand and supine to stand which is beneficial for clients with significant weakness or paralysis – allowing the body to fully extend before gravity begins to effect the client's positioning in upright.

Dose

- According to the Snyder Boston Study, it is feasible to have non-ambulatory children participate in a rigorous standing program. The weight bearing "dose" affects BMD at the calcaneous but the benefits appear to be transient if the intensive standing program is not sustained. The intensive use of standing devices (7.5 hrs to10 hrs a week) may have a beneficial effect on BMD of weight bearing bones in non-ambulatory children.
- More frequent standing throughout the day has been shown to have a greater impact on bone density, gastrointestinal function,2,3 bowel/bladder function,2, 3, 20 respiratory function,3 and management of spasticity.2, 3, 21

Funding Solutions

It may be difficult to obtain funding for standing devices because a Medicare Policy Article (A19846) falsely claims standing is "not primarily medical in nature." Even so, when challenged, standers have been successfully funded through various third party payers including: Medicaid, Medicare, Private Insurance, Veteran's Administration, Vocational Rehabilitation, etc. Additionally, private funds and fund-raising have been used to supplement any co-pays or items denied by insurance companies for standing devices. It is critical that the industry continues to seek funding for standing devices to improve access to this essential technology. Each manufacturer offers assistance for navigating the funding process.<?>

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IC 17: Providing Powered Mobility for the Severely Involved Child

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9.1.1. Children as Clients Children with disabilities have needs that are significantly different from adults with disabilities. Their seating and mobility systems must adapt or adjust to them as they grow physically and mature cognitively. Parents must be educated as to the importance of psycho-social development in children with independent wheeled mobility and not view them as a failure if walking is inefficient. The approach to successful intervention involves asking clients – and their families, siblings or other caregivers – for input about activities and interests, such as dressing, eating, chores and hobbies, environments of use (i.e., home or school) and transportation needs. Parents are typically an integral part of meeting the child's needs. They are primary advocates for their children's needs. And, as primary caregivers, they must express their own needs for their children's wheeled mobility devices.

Seating and mobility systems function to facilitate or support physical, cognitive and social development. Self-initiated movement is crucial for the development of a young child's cognitive, emotional and psycho-social development.[4][5] For children who are unable to move about independently, assistive devices such as walkers, wheelchairs and or powered mobility devices offer a means of independent exploration, locomotion and play. Independent mobility has been related to improvements in a host of skills, including spatial awareness skills, hand-eye motor coordination, visual perceptual skills, spontaneous vocalizations, improved sleep habits, disposition, initiation of contact with others, motivation to explore and an increased ability to interact meaningfully with peers.[6][7][8][9] Unfortunately, many children with disabilities are 262 not given the opportunity to acquire independent mobility, especially at a young age when the stimulus of mobility is so critical in influencing development. 9.2. An Overview of Client Needs People who require seating and mobility evaluations have a wide variety of needs. However, some generalizations can be made. Individuals, no matter their age, want to be comfortable. Pain and discomfort, which can range from distracting to intolerable, are often motivators for seeking professional help. People must be able to maximize their function in valued activities of daily living (ADL). Independent control of their environment through mobility is especially important to the development of young children. Interacting with their indoor and outdoor environments, reaching, touching and exploring spontaneously to quench their curiosity enables them to grow developmentally and psycho-socially. In summary, the motivators for seeking intervention are comfort, independence and the ability to be mobile. Thirty years ago, there were few wheelchair and seating technologies available to assist persons with physical disabilities. Today, a plethora of powered and manual wheelchair and seating technologies available exists. The challenge is to match client needs to specific wheelchair technologies and components. This requires knowledge of the client's diagnoses and potential risks such as pressure sores from sitting, and the implications of the diagnoses for a client's present and future functional needs and their present and future mobility environments. Clinicians, in partnership with rehabilitation technology suppliers, who are familiar with product features and the compatibility of components, recommend mobility and seating solutions to meet client

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IC 18: AusCAN Risk Assessment for Sitting Acquired Pressure Ulcers

Jillian Swaine , OT
Michael Stacey, MD

Learning Objectives

At the conclusion of this session, participants will be able to:

1. Discuss the need for a novel risk assessment tool for sitting acquired pressure ulcers that is designed specifically for subjects with spinal cord injury.
2. Evaluate the postural and emerging biomechanical factors that have been associated with sitting acquired pressure ulcers in subjects with a spinal cord injury.
3. Critique the methodology and expected outcomes of this multicentre international study.

Background

Sitting-acquired pressure ulcers (SAPUs) are a subset of pressure ulcers that generally develop on the load-bearing regions of the bony pelvis during sitting – most commonly under the ischial tuberosities, greater trochanters, coccyx and less commonly, on the sacrum [1]. SAPUs are prevalent in individuals who have a spinal cord injury (SCI) [2-3]. A SAPU is also believed to be a deep tissue injury (DTI) with soft tissue damage in the subcutaneous tissues adjacent to the bony prominence where the highest stresses and strains occur during the load-bearing activity of sitting [4]. This external loading is characterised as the weight-bearing pelvis pressing down onto the buttocks and onto the associated soft tissues such as the gluteus maximus muscle, fat and skin layers [1]. There is tissue compression or deformation that leads to occlusion of the viscoelastic blood vessels and subsequent to tissue ischemia [5].

The development of a sitting acquired pressure is one of the most significant complications of SCI [6]. Their incidence ranges from 23% to 33% or more per year and up to 85% over the course of a lifetime [2, 7-8]. In the United States, nearly 50% of the 1.4 million people [7, 9-12] who rely on wheelchairs for mobility develop tissue breakdown at the load bearing bony prominences of the pelvis. SAPUs generate significant health problems, health costs, loss of income, and personal suffering for individuals with spinal cord injury. The presence of a sitting acquired pressure ulcer may lead to prolonged nursing attendance for dressings, periods of hospitalisation, muscle flap surgery or even death due to sepsis. For the individual this may significantly interfere with their lifestyle. It may require long periods where they are unable to sit, and may significantly affect their general health due to prolonged soft tissue or bone infection [13].

Numerous factors contribute to the development of SAPUs in persons with SCI [2-3, 7, 14]. These factors have often been evaluated in separate studies, but their contributions relative to other known factors have not been assessed in a large multi-factorial study. One such biomechanical factor is elevated pressures at the interface between the soft tissues of the buttocks and the seat cushion [1, 15].. To date, only one published study has demonstrated this relationship. In that study, peak interface pressures between the buttocks and the seat cushion were associated with a higher incidence of SAPUs in elderly nursing home residents sitting for longer than six hours cumulatively on a foam wheelchair cushion [1]. The contribution of other biomechanical risk factors to the development of SAPUs in SCI is the subject of further research [4, 16-17]

Previous studies have identified single factors that are associated with SAPU in SCI subjects. Commonly used risk assessment tools do not evaluate many of these factors, and have not been validated for SCI subjects. There is a critical need to evaluate multiple factors prospectively in order to develop a risk assessment tool for SAPU in SCI subjects.

Aims

1. To identify factors associated with SAPU following SCI and to develop a risk assessment tool specific for subjects with SCI.
2. To determine the costs and impact on quality of life of a SAPU in subjects with SCI.

Methods

Commencing in the second half of 2010, 640 patients with SCI will be recruited from 5 spinal units in Australia and up to 5 spinal units in Canada. Half will have recent injury and half will have had an injury at least 10 years previously. All subjects will be followed for 3 years.

Parameters to be documented at entry:

- Demographic data
- Date and level of injury
- ASIA impairment scale
- DNA collection for genetic polymorphisms

Parameters to be evaluated at regular intervals during the study –

- Level of function
- Degree of spasticity
- BMI
- Waist circumference
- Wheelchair seating system
- Seating position/posture
- Interface pressure mapping metrics
- Cumulative sitting time
- Bladder and bowel incontinence
- Evaluation of tissue overlying the ischium with ultrasound
- Psychosocial assessments (anxiety, depression, self efficacy, substance abuse)
- Quality of life measures
- Co-morbidities
- Routine blood markers

In subjects who develop pressure ulcers, the costs of treating pressure ulcers and the impact on their quality of life will be evaluated.

Results

Subjects will be categorised into those who do or do not develop a pressure ulcer. Risk factors will be evaluated by logistic regression analysis. From those data a risk assessment for SAPUs in subjects with SCI will be developed.

Conclusions

Accurate assessment of individuals at highest risk of developing a SAPU after SCI will enable the appropriate use of expensive methods of prevention.

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IC 19: Positioning for Children with Cerebral Palsy Pre and Post Orthopaedic Surgeries

Denise Peischl, BSE
Liz Koczur, MPT, PCS
Carrie Strine, OTR/L

Abstract

We will discuss children with cerebral palsy who have benefited from surgical interventions related to orthopaedic deformities. Children with high tone, particularly cerebral palsy, are prone to muscle contractures and spinal deformities including scoliosis and kyphosis. Standard of care can include intrathecal baclofen pump implantation, VDRO, Spinal fusion, and soft tissue lengthenings. This talk will cover seating and positioning options, both pre and post surgical intervention. The talk will address issues that prevented proper positioning and the various non surgical attempts to delay surgeries. It will conclude with how the surgical interventions improved seating and positioning and overall quality of living.

Objectives

Attendee will be able to:

- define common orthopaedic surgeries for the child with cerebral palsy.
- Attendee will understand the impact surgical interventions have on seating and positioning of the child with cerebral palsy.
- Attendee will be more informed regarding the immediate changes required in seating and positioning after the surgical intervention

IC 20: Integrating Outcome Measures into Daily Practice, Custom Seating, Outcome Survey and Cases

Lori Knott, MSc (OT-PP), BSc (OT), ATP
Kevin Phillips, ATP, SMS

Learning Objectives

At the conclusion of this session, participants will be able to:

- understand the use and benefits of measuring outcomes.
- apply the results to practice standards.
- identify appropriate application of Orthotic Seating.

Abstract

Why would you want to spend your valuable time tracking outcomes? After viewing the 2009 ROHO forum "Why measure outcomes?" we decided to test the viability of Outcome Measure implementation in our daily practice. How would we develop a survey? How would we track the results? How much time would it take out of daily practice, and would the benefits be worth the investment of time? This presentation will review the process this team went through to develop and implement an Outcome Measure survey, analyze the results, and make changes in our practice using the results during a 2 year period.

We focused the outcome measures survey on the application of Ride Custom Seating. The approach to seating on very firm surfaces that employ aggressive tissue loading is a radical departure from the pressure dispersion model of the submersion of clients into soft and/or pliable surfaces such as air, liquid and foams. There are many benefits to aggressive positioning and off loading of bony prominences using the force isolation approach to tissue loading. However, there is scanty research, if any, on the application of orthotic principles to seating, and the measure of outcomes has been primarily anecdotal. Many questions are raised about the long term effectiveness of orthotic seating interventions. Who is a good candidate for it? Who isn't? Are there negative effects of increased loading on specific seating tissue areas for long periods of time? What feedback do users have? This presentation will discuss the results of an outcome measure survey review of clients in two countries who have used Ride up to 4 years, and will give practitioners useful outcome information that you can use to make decisions as to who may be the best candidates for orthotic seating in your practice, and how to avoid potential pitfalls. We will include several cases showing a variety of uses for orthotic seating, in and out of wheelchairs.

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Quality and Outcome Measures for Rehabilitation Programs. Author: Carl V Granger, MD
Destructive Postural Tendencies: Identification and Treatment. Thomas R. Hetzel, PT, ATP
Wheelchair Cushions: Design vs. Materials
Thomas R. Hetzel, PT, ATP

IC 21: Propulsion Training for Everyone

Mark Richter, PhD
Andrew Kwarciak, MS

As we all know, upper extremity (UE) pain is common in manual wheelchair users. Studies have shown that a majority of wheelchair users currently experience UE pain, most likely at the shoulder or related to carpal tunnel syndrome (1,2). The consequences of UE pain include decreased mobility (3,4), decreased quality of life, and the potential need for surgery and/or a powered wheelchair. One of the activities related to UE pain and injury is wheelchair propulsion (5-10). Wheelchair propulsion involves repetitive loading of the UE, which has been linked to median nerve damage (7) and to signs of shoulder pathology (9).

To help reduce UE pain and pathology, a consortium of clinicians and researchers created a clinical guideline (PVA Guideline) for preserving upper limb function after spinal cord injury (11). Based on research findings and clinical practice, the guideline offers numerous recommendations regarding assessment, ergonomics, wheelchair selection and setup, wheelchair training, environmental adaptations, exercise, and pain management. With regards to wheelchair propulsion, the guideline recommends the use of long, smooth push strokes to limit large impacts on the handrim. This simple, yet targeted recommendation is intended to help users reduce force, decrease the rate of force application, and minimize the frequency of propulsion. Clinicians are encouraged to educate their clients on wheelchair propulsion mechanics and to train them to use proper propulsion technique. The question remains: What are the best ways to achieve proper propulsion?

A number of different approaches to propulsion training have been described in the research literature. One set of studies has focused on the effects of propulsion practice in novice users (12-15). The studies demonstrate that improvements in mechanical efficiency and technique can occur as users get acclimated to wheelchair propulsion. With new users, this type of structured practice may help reinforce good technique. Once users have reached a consistent level of performance, additional training using real-time feedback may help improve specific aspects of propulsion. Two studies of feedback on effective force (or the tangential force on the handrim that helps drive the wheelchair forward) found that subjects either could not improve effective force or could only make improvements at the cost of mechanical efficiency (16-17). Kotajari et al. (17) suggested that stroke length (contact angle) and cadence may be more appropriate for feedback training. More recent studies have tested these and additional variables in a single or multi-variable format. A study by DeGroot et al. (18) tested the effects of visual and verbal feedback on wheelchair propulsion biomechanics. Visual feedback was provided on a laptop running the SmartWheel (Three Rivers Holdings, LLC, Mesa, AZ USA) clinical software that was positioned in front of the test dynamometer. The feedback produced immediate improvements in push length and cadence; however, it led to a significant rise in peak force. Indirect increases in peak force were also reported by Richter et al. (19) in a study of single variable feedback. The study used the OptiPush Biofeedback System (MAX mobility, LLC, Antioch, TN USA) to target 6 different propulsion variables (braking moment, cadence, contact angle, peak force, push distance, and smoothness) for improvement. Subjects were able to make significant and specific changes to most variables, particularly contact angle; however, peak force proved difficult to control. Balancing cross-variable interactions may require different forms of feedback including multi-variable strategies. One potential approach to multi-variable feedback training involves the principles of motor learning. Rice et al. (20) created a training software that displays speed, contact angle and cadence in a discontinuous manner. While results from a single subject were promising (training resulted in positive changes to contact angle, cadence, mean force, and rate of force application) additional research is needed to validate the approach.

As we work towards developing a comprehensive propulsion training program, it is important to consider the potential impact of different training techniques. It is also important to appreciate the utility of low-tech approaches. Some aspects of propulsion, such as the position of the hand at the start of the push, push frequency, and the trajectory of the hand throughout the stroke, can be assessed with high-tech tools or through careful observation. Efforts to improve propulsion should not be precluded by a lack of technology. Simple tools such as a tape measure, stop watch and goniometer can be used to assess a user's propulsion and track improvements. Using the recommendations proposed by the PVA guideline and studies of propulsion training as a guide, clinicians can facilitate valuable improvements in propulsion technique.

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IC 22: "24 Hours Postural Management Program" – Apply the program as a daily intervention during all activities

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In a consensus statement on "postural management for children with cp" published in the UK on 2006, the definition of the program was described -

"A postural management program is a planned approach encompassing all activities and interventions which impact on an individual's posture and function. Programs are tailored specifically for each child and may include special seating, night-time support, standing supports, active exercise, orthotics, surgical interventions, and individual therapy sessions."1

The program is applied according to age and to the level of GMFCS of the child. (The GMFCS focuses primarily on differentiating children with CP based on functional mobility irrespective of the type or distribution of the motor disorder).2

Children with cerebral palsy (CP) classified as GMFCS 4 and 5 are most appropriate for the program. All positions and their supportive equipment as well as routine treatment methods for the individual child are taken into consideration. The program should be applied according to the child's initial clinical and functional assessments. Other factors to be taken into consideration are the cooperation level, pain level, sleep disturbances, hip migration percentage, and long-term prognosis.

Research on "24 hour postural management program"

The aims of the program are variable and include goals such as: preventing musculoskeletal deformities, increasing ROM, and improving comfort."24 hour postural management" should facilitate cognitive development and communication skills, and enhance participation and activity.
The equipment recommended for this program includes adaptive seating devices, standers, orthotics, and sleeping systems.

A Literature review of the "24 hour postural management program" reveals limited evidence in only a few published articles, mainly by the Chaily group. The researcher focused on measured the success of using at least two of the three positioning devices (sitting, standing and sleeping) recommended to prevent hip dislocation4. The traditional treatments for subluxated or dislocated hips are soft tissue and bone surgery. Oppose to that It has been suggested that the conservative approaches such as "24 hour postural management programme" and botulinum toxin injections, can be used at an early age and may reduce or delay the need for surgery.3 Significant results were shown in one Chaily study that compared application of a "24 hour postural management" on children before subluxation to a group of children who received no treatment or treatment only after subluxation. Long term outcomes (using percentage of hip migration) showed that the treatment prevented bilateral hip subluxation. 5

Research on "sleep management"

Only seven out of 14 children in a UK sleep management pilot study were able to complete the one year intervention7. The sleeping system provided a 20 degree hip abduction. The outcomes show a significant decrease in percentage of hip migration after one year of lying in the sleeping system. It has been also reported that have found that for those who can tolerate the lying system, there is a significant improvement in positioning for seating and toileting, as shown by the parental questionnaires.

Another pilot study looked at the sleep quality and respiratory function in children with severe cp while using night-time postural equipment8. The researcher concluded that children with severe CP risk respiratory compromise in sleep irrespective of positioning. They suggested that assessment on respiratory function is needed when determining optimal positioning for children using night-time positioning equipment.

Gough8posed the question did 24 hour postural management achieved what the program declare to achieve. He has questioned the efficiency of the strict approach and reviewed the effectiveness of the program components which include - standing, sitting and sleeping according to the participation and activity of the children. He concluded that the decision to apply the program must take into consideration the levels of participation and activity and the demands on children and their families.

In this course we will review the literature on each of the above components and we will briefly describe the orthopedic procedure. We will analyze each component to see if it fulfills its expected goals and will discuss the question of whether the use of the equipment is evidence – based?

We will use the framework of the ICF - International classification of Functioning, Disability and Health to analyze the program and its components.

Learning objectives –

- To introducing the 24 postural management program.
- To explore the evidence based practice of using positioning equipment.
- To understand the pros and cons of this program through the ICF framework and to analyze the provision of such a program.

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IC 23: Controlling the Pelvis – A Practical Guide

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Bob Stickney

It is generally accepted that the pelvis is the building block of posture. All the movements at the pelvis influence all other parts of the body, both proximally and distally. Our ability to stabilize the pelvis greatly affects the sitting posture, comfort and function of the client. In order to stabilize the pelvis we need to look at the surface that the client is sitting on, how it is contoured, what material(s) are used in the cushion and how other seating components such as lateral and medial pelvic/thigh supports, back contours, sacral blocks, and lumbar pads affect the position of the pelvis. These external forces greatly influence the position of the pelvis and how it moves or does not move. We need to determine the forces on the pelvis from all angles – superior, inferior, posterior and anterior. This workshop will focus mainly on the forces that we can apply from an anterior aspect to help stabilize the pelvis.

Limited research has been done to establish the effectiveness of pelvic stabilizers. The majority of the studies/reviews look at the use of physical restraints and lap belts with elderly wheelchair users. Chaves et al (2007) did a literature review of the use of physical restraints and lap belts and made recommendations regarding minimizing risk of injury and seatbelt placement. They concluded that restraints and lap belts can be helpful when used correctly but when used improperly can lead to injury or death. They emphasized the need for education regarding correct positioning and placement of straps on an individual basis. 1 Lacoste et al (2009) looked at “Stability of children with cerebral palsy in their wheelchair seating”. They used a questionnaire that parents and therapists completed. The questionnaire addressed postural stability, instability versus activities of daily living, and how and when the seating system was used. Results showed a high percentage (80%) of instability was reported less than half an hour after the child was placed in their wheelchair. Sliding and posterior pelvic tilt, pelvic obliquity and pelvic rotation were identified as being the main problems of instability. 2 Rigby et al (2001) and Ryan et al (2005) examined the effects of a rigid pelvic stabilization device. Results showed that with the device the child required less re-positioning and that their volitional arm and hand function improved.3,4 McDonald et al (2003) assessed the relationship between pelvic and trunk alignment and force measured through a knee block in children with C.P. Results showed that an increase in force leads to a decrease in pelvic tilt and that pelvic tilt was shown to positively correlate with trunk lateral shift and trunk inclination. An improvement in pelvic position has a secondary improvement in trunk alignment.5 These studies all have limitations but they all demonstrate that the pelvis does affect sitting posture, function and comfort. This further indicates the necessity to strongly focus on the pelvis when providing a seating system and ensure that adequate support is provided.
Our client’s pelvis must be controlled in all planes. Any one omission could allow the pelvis to slide or be thrust out of our optimal choice. The Inferior, posterior, lateral, medial, distal, and anterior surfaces are equally important. The spatial orientation of the seating is another dimension to be considered.

The posterior surface (back of the seating system) and the Inferior surface (seat cushion) are keys to positioning. What the supports are made of can affect how the pelvis is ultimately controlled. The type of foam, the shape, the contours as well as the covering material affect the control we seek.

Foam that is too soft allows the pelvis to sink into it asymmetrically. Too firm a surface is uncomfortable and allows no immersion. The use of anti-thrust blocks, seat wells, leg wedges under the foam, air or gel in a cushion can enhance our seating. Shaped or contoured seats and backs can accommodate body shapes and help build the stable base needed for the pelvis.

Lateral thigh and leg supports are important to maintaining position. They prevent the sideways slide of the pelvis. When combined with medial / distal supports such as pommel abductors, thigh straps, or knee blocks along with good foot support , the legs will not ”pull” the pelvis out of position.

Spatial orientation can help minimize the aggressiveness of the hip controls in the case of tilt and can complicate positioning when recline is needed.

Anterior pelvic supports are often the first to be looked at, usually at our peril. “The hips are sliding… so tighten the belts”. These belts, bars, and other positioners are only going to be effective if the other parts of seating have been addressed. Support of the pelvis in all planes allows the most effective anterior control to be applied.

Anterior hip supports are available in many varieties. These range from simple belts with a myriad of buckle styles to customized hardware mounted to the positioning system.

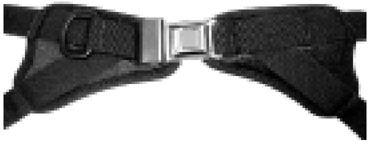
Our approach is from flexible pelvic control to the more rigid control.

Straight hip belts are flexible webbing with flexible mounting. They are anchored to the seat with usually with a 45 degree pull on the pelvis or to pull down on the thighs.

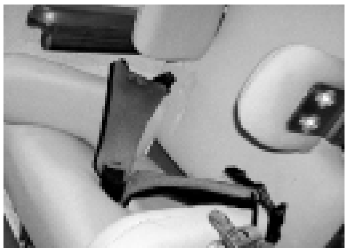
Bifurcate or “Y” belts are flexible webbing with two flexible mounting points. They are anchored to the back and seat to usually net a 45 degree pull or to pull down on the thighs.

Groin straps are two flexible straps mounted in the center of the seat that attach across the upper thighs to a flexible point behind the hips.

Straight



Y-Style (02)



Groin Straps (03)

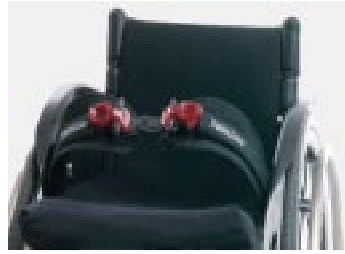
Diaper style (for babies) is like the groin strap but the client sits on the fabric of the strap and it pulls and attaches like a diaper.

Semi-rigid belts are flexible belts with contoured or firm inserts with flexible attachment points.

Ratchet / Snowboard belts are semi-rigid belts with a padded, contoured surface with firm attachment points.

Semi-Rigid

Ratchet

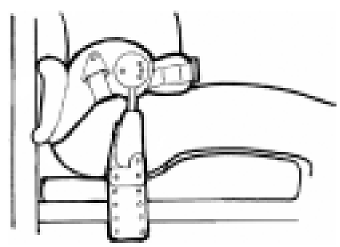


Beck

ARCUfit by AEL is a flexible belt with fixed pelvic lateral support with solid attachment points

Hip Grip by Beneficail Designs consists of contoured pads that “grip” around the pelvis mounted with metal attachment hardware.

ARCUfit



Hip Grip

Rigid-bars are a solid, padded, contoured shapes with metal attachment hardware.
Semi-rigid bars are solid, contoured shapes with more “give” in the padding with metal attachment hardware.

Rigid

Rigid

Semi-Rigid

It is extremely important to assess each client individually and determine, not only their physical needs, but also what type of pelvic support works for their environment. Some of the more complex pelvic controls require the client to be positioned the same way each and every time. The caregiver needs to be educated on the proper positioning of the client and how the device works for positive results. Compromise is sometimes needed to ensure the device chosen matches all the needs of the client and caregiver.

(This workshop will incorporate case studies to demonstrate some principles. Methods of construction and design for some of the more complex solutions will be demonstrated)

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IC 24: The Winning Combination for Court Sports

Jim Black
Paul Schulte

1. Describe how different frame styles apply to specific court sports
2. Understand basic rules and regulations for three court sports
3. Describe how to match a court chair to both a beginner and elite level athlete

The configuration of a court chair requires expertise beyond that needed for everyday wheelchair setup. While basic seating and mobility principles do apply to court chairs, each sport requires unique configurations to comply with sport-specific rules. Wheelchair design will be dependent on the athlete's disability and the athlete's specific role on the court. This presentation will outline the process of court chair prescription, from initial assessment to the final fitting.

The clinician must first review the athlete's goals, including level of competition (recreational and/or beginner, intermediate, or advanced competition) and desired use (single or multi-sport participation). Since court sports require a team for training and competition, it is also important to confirm that the athlete has access to local community resources for the specific sport to ensure product appropriateness.

After the goals and sport selection are confirmed, the next step is matching the product with the athlete. If a general court chair is deemed most appropriate, the clinician and athlete still need to understand sport-specific rules and how that applies to their equipment. Specific rules for four court sports (basketball, tennis, softball and rugby) will be reviewed in detail, including equipment rules and athlete classifications for each sport. The design and configuration of each sport-specific chair will be discussed as it applies to the athlete's specific ability level (i.e. classification) and position in the sport (i.e. offense vs. defense). In addition, the frame materials, adjustable and fixed frame designs, and basic components of a court wheelchair will be reviewed in detail as they apply to each sport and the athlete's unique goals.

The athlete must be fitted in the product, and the product must be balanced appropriately. With court sports, the quickness, balance, and efficiency of the product are essential to achieve optimal rolling dynamics. If the athlete is using the chair for a variety of positions and sports, the athlete must understand how to adjust and maintain the equipment appropriately to achieve success. Since court sports each have specific regulations, the clinician and athlete may require additional support in the process of selecting and fitting a court chair.

This session will provide a 45 minute lecture with numerous photographs and videos to exemplify concepts of Court Sports design and function of the rider. The lecture will be followed by a 15 minute interactive session where participants will have the opportunity to trial and adjust a variety of court chair.

We will cover basketball and tennis wheelchairs, specific options and features of each chair, and how goals and resources can effect product selection. The person prescribing the equipment must understand how disability effects product specification and choices. It is also essential to know how to assess the user's function in the product (i.e. "Ball Pickup test"). The hands-on portion of this presentation will provide the participant an opportunity to "feel" a sports chair, appreciate the difference between chair setups, and also perform a variety of adjustments on the court sports products.

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Friday

March 4, 2011

IC 25: The Relationship Between Driving, Vehicle Modifications and Seating and Mobility

Wes L. Perry, MSBME, ATP, CDRS
C. Dan Allison Jr., MS, ATP, OTR/L

Transportation plays an integral role in today's society. One's ability to access transportation greatly increases the scope of opportunities and choices available. It provides the potential for greater personal independence and opens doors to social, vocational, and recreational pursuits. Conversely, the inability to access transportation can greatly hinder such options. When addressing both personal mobility and transportation goals, it is essential to understand how the fields of Driver Rehabilitation and Seating and Mobility relate and how the different technologies impact one another.

Vehicle Modifications and Adaptive Driving Technologies

Vehicle modifications and adaptive driving technologies can include alternative driving controls, modifications to facilitate vehicle access as either a driver or passenger, and equipment for wheelchair loading and securement.

Primary driving controls (steering, accelerator and brakes) are operated while the vehicle is in motion and directly affect control of the vehicle. Other in-vehicle controls are termed secondary controls, and examples include turn signals, horn, gear selection, etc. Common adaptations to driving controls include modifying the existing control interface (e.g. replacing a knob handle with a "T" or lever), physically extending or relocating controls so they are easier to reach, and changing the force or action required to use controls (e.g. a joystick control used for steering).

Structural modifications are available for passenger or driver wheelchair access. A raised roof or doorway can provide added headroom clearance, while a lowered-floor can provide both added headroom and an appropriate eye level for someone remaining in a wheelchair. If transferring is a reasonable option, a power transfer seat base can position the vehicle seat for easier transfers to/from the wheelchair.

Equipment available for wheelchair transport includes lift systems, ramps, trailers, and cargo carriers. Some equipment is suitable for occupied wheelchairs, while some systems are designed for loading unoccupied wheelchairs only.

Securement equipment can be divided into two categories: manual and powered. The most common, manually-operated devices are tiedown strap systems, while examples of powered docking systems include the EZ Lock and Dock 'N' Lock. Docking systems typically consist of a wheelchair-mounted bracket and floor-mounted station.

Wheelchair Configuration as it Relates to Vehicle Use

Most wheelchair size issues related to vehicle use involve vehicle access, wheelchair loading, or driver positioning.

Vehicle access and wheelchair loading

- Adequate clearance on the lift platform or ramp, through the doorway, and in-vehicle
- Allow additional clearance height to account for the lift arm and docking device when loading an unoccupied wheelchair with an inside-mounted lift
- The use of tilt or recline and removable or flip-back headrest hardware can be helpful when clearance height is limited.

Driver positioning

- Adequate clearance to access the behind-the-wheel area
- An appropriate eye level (height) or line of sight for driving
- In the case of a driver remaining in his wheelchair, the width of a wheelchair may result in positioning the driver off-center to the steering column.
- An excessively long wheelchair can place a driver further away from vehicle controls and establish a potentially inappropriate visual perspective for driving.
- In most cases height issues are accommodated by setting the wheelchair seat-to-floor height accordingly and considering cushion thickness.

Most vehicles provide relatively limited space for a wheelchair to turn. Therefore, maneuverability can be a challenge when accessing a vehicle with a wheelchair. The wheelchair footprint (overall length and width) and turning radius (dictated by overall length and drive wheel position) are the main parameters associated with wheelchair maneuverability. However, front-end and caster configuration play an important role as well. If a wheelchair is too long to turn inside a vehicle, a rear-entry, lowered-floor minivan may offer a solution.

When considering use of a docking station for wheelchair securement, one must first determine whether a corresponding bracket is available for the specific wheelchair. If a bracket exists for the application, one must next ensure the caster width, frame clearance, and front-riggings will allow clearance to access the docking station. In the event an EZ Lock system is used in a driver application, a front stabilizer is required. This stabilizer includes additional hardware, both on the wheelchair and attached to the vehicle floor; consequently, clearance must be available for this as well.

The use of wheelchair armrests can provide beneficial support and alleviate upper extremity fatigue for a driver, but care should be exercised to limit interference with other vehicle equipment. The presence of side guards, which are often incorporated with an armrest, can impede proper placement of a seat belt system. In such a situation, it would be best to consider cantilever style or flip-back armrests that don't include such side guards. Desk length pads and flip-back, swing-away or removable armrests may also be considered to avoid interference with transfers or access to driving controls.

The vehicle environment is dynamic and warrants concern for rear end collisions and the resulting potential of whip lash.

Whip lash can occur even at low speeds, and concern for this is magnified for those with complicating medical conditions. Therefore, one should consider sufficient back and head support. These supports can be provided on the wheelchair, but in some cases, swing-away head supports can be attached to the vehicle as an alternative.

Many power wheelchairs can exceed 400 pounds in overall weight. This should obviously be considered regarding the rated capacity of lift systems. However, it should also be considered regarding a vehicle's GVWR (Gross Vehicle Weight Rating). It is unlikely a wheelchair will directly surpass the GVWR, but in many cases, including lowered-floor minivans, the payload capacity can be significantly limited.

Ramp access to minivans and other, similar vehicles by manual wheelchair users, can often prove a challenge. Wheelchair parameters that can facilitate ramp access include center-of-gravity, wheel placement, and optimum positioning as it relates to propulsion. Equipment that can assist with this task include grade aids, power or climbing-assist wheels, and winch systems such as the Power Pull by Adapt Solutions.

Positioning for Function: Driving

The ultimate objective of a driving evaluation is to provide the individual with a viable plan for community mobility that accommodates that person's highest level of function while maintaining public safety. It is essential to consider positioning for function in the framework of Driver Rehabilitation. Failure to do so can not only lead to access barriers, but also, and perhaps more critically, lead to driving errors, which can have more severe consequences than physical control errors in a stationary environment.

In this context, a functional seating position should result in a stable, dynamic, relaxed posture from which the person is able to engage in the driving occupation. One should consider the following.

- The vehicle environment is predominantly dynamic and not stationary
- Postural stability provides distal mobility

Movement and acceleration of the vehicle can complicate and hinder performance involving human movement, especially when strength or coordination is impaired. Ideally, accommodations to provide added body support and stability should be just that - supportive, but not overly restrictive. Providing this stability may require specific body positioning, the use of support equipment on the wheelchair, or possibly even bolsters attached to the vehicle.

Cushion selection can also play an important role with postural stability. For example, an air cushion may be excellent for pressure relief, but with the dynamic movements of a motor vehicle, it may result in significant instability. Conversely a more firm, contoured cushion may provide stability for better function, but compromise pressure relief. One must weigh the pros and cons of different equipment and consider the comprehensive goals.

Appropriate seating and mobility equipment must meet primary goals including personal mobility, comfort, pressure relief, and postural support. Whenever possible, functional goals should be accommodated as well, and this should include consideration of Driver Rehabilitation and transportation.

Resources

1. www.aded.net – ADED: The Association for Driver Rehabilitation Specialists
2. www.nhtsa.dot.gov - National Highway Traffic Safety Administration
3. www.nmeda.org –National Mobility Equipment Dealers Association
4. www.norcalmobility.com/vehicle-selection-101 - Nor-Cal Mobility: Vehicle Selection 101
5. www.rercwts.org – The Rehab Engineering and Research Center on Wheelchair Transportation Safety
6. www.stnonline.com – School Transportation News Magazine

IC 26: Quantifying Posture According to an International Standard

Barbara Crane, PhD, PT, ATP

Introduction: Posture measurement and ISO 16840-1
The science of wheelchair seating relies heavily on understanding body postures and the postural support needs of clients who use wheelchairs; however this science has been hampered by haphazard development of terminology and methods for measuring seated posture. Uniform, reliable quantification of the whole posture of a seated person has not been possible due to a lack of standard terminology and a dearth of rigorous methods. An international effort to develop new standardized terminology specifically for wheelchair seating began in the mid 1990's and resulted in the internationally adopted 16840-1 ISO standard. The purpose of 16840 Part 1: Vocabulary, reference axis convention and measures for body segments, posture and postural support surfaces is to help clinicians, researchers, and industry professionals quantify a person's seated posture, as well as the dimensions. Locations and spatial orientation of a person's postural support surfaces. This work will also be incorporated into the ANSI/RESNA national standard as a part of Volume 3 of the wheelchair standards. The plan throughout the development of these standards was to provide a foundation that would be useful not only for scientific research, but also for clinical practice in all areas of the service delivery process. Successful implementation should allow clinicians to improve their clinical practice in the area of wheelchair seating.

The scope of the ISO 16840-1 international standard includes definitions of all body measures relevant to seated posture, including body segment positions relative to an external reference axis (absolute body angles) and more traditionally used body segment angles relative to each other (relative body angles). One major area not addressed by the international or national standards is a specific methodology for measuring posture of a wheelchair seated individual. Although there have been methods developed for assessment of standing posture,1 there has been very limited development of methods used for quantifying seated posture. Therapists have been using qualitative assessment measures, such as the Seated Postural Control Measure2 and tools such as goniometers, inclinometers, or specially designed tools3 to document some body segment postures or joint positions relevant to wheelchair seating. None of these methods allows complete depiction of seated posture.

Selected angle measurements and methods:

Although the standard includes information regarding quantification of the linear dimensions of a person as well as the dimensions, locations and angular orientations of postural support devices used in a wheelchair, the focus of this presentation is on the angular measures associated with quantification of the posture of a person seated in a wheelchair. To fully quantify seating posture, the body has been divided into segments, each identified by two or more body landmarks. The angular orientation of each segment has been defined relative to an external reference (absolute angles) or relative to an adjacent segment (relative angles). Angular orientations of body segments are defined in each of three planes – frontal, sagittal and transverse.

Body segments included in the standard are: head, neck, trunk (1-3 segments depending on the plane of measurement), pelvis, arm, forearm, hand, thigh, leg, and foot. The standard describes 13 body segment lines used in sagittal angle measures, 9 used in frontal angle measures and 7 used in transverse angle measures. For each body segment, there are definitions in the standard for its angle relative to a vertical reference line (frontal and sagittal planes) and relative to a defined reference axis for the transverse plane. Work is currently under way to develop a clinical guidelines document that will provide sample methods for measurement of these angles, two of which are included here as examples.

Sagittal Trunk To Thigh Angle (relative angle):

1. Locate body landmarks: Locate the greater trochanter (to approximate the hip joint center), the lateral femoral condyle, and the acromion process (to approximate the lateral lower neck point). The standard offers a formula for calculation of the hip joint center and the lower neck point if greater measurement precision is required.
2. Measure the angle: Place the goniometer center over the greater trochanter. Align the stationary arm along the sagittal trunk line, pointing towards the acromion. Align the moveable arm along the sagittal thigh line, pointing towards the lateral femoral condyle.

Sagittal Pelvic Angle (absolute angle):

1. Locate the sagittal pelvic line: Palpate the ASIS and PSIS and locate the line between the ASIS & PSIS (referred to as the ASIS-PSIS line). Locate the hip joint center (or greater trochanter), and then drop a perpendicular from the ASIS-PSIS line passing through the greater trochanter. This is the sagittal pelvic line.
2. Measure angle: Place the goniometer pivot center over the greater trochanter. Align the stationary arm with the vertical. Align the moveable arm along the sagittal pelvic line, or more simply, perpendicular to the ASIS-PSIS line. Measure the angle created.

Tools for quantifying seated posture according to the standard:

In addition to lacking any specific methodology for measuring posture, the international standard does not make any recommendations regarding tools that might be used in posture measurement. Although standard tools, such as goniometers, inclinometers and plumb lines may be used to measure all described angles; use of these may be cumbersome and time consuming if clinicians wish to measure multiple angles defined in the standard. Since completion of the international standard, rehabilitation engineers and clinicians around the world have been developing tools and methods to facilitate quantification of the angles defined in the standard. Japan has been the primary source of these specialty tools, several of which will be described and demonstrated during this presentation. Tools that have undergone preliminary testing for reliability and validity include: a modified 360 degree goniometer, a new photographic assessment system called Rysis (developed by Takashi Handa, Saitama Industrial Technology Center, Japan) and a hand held device called the Horizon (developed by Taro Kemmoku, Japan). Several pilot studies have been completed to investigate the reliability and validity of these tools with unimpaired subject populations.

Rysis

The Rysis system is a computer software system that processes images of the body taken with a digital camera. The user inputs images taken from the right side, front and above a person seated in a wheelchair. If needed, "indicator bars" (see Figure 1) are used to manually point to a body landmark that would otherwise not be visible in the photo. After all body landmarks are identified, the "calculate" button is clicked, and the body angles are calculated and displayed. This software is available for free from the designer and is simple to use on a basic computer platform. Preliminary studies on the interrater reliability of this system and the validity compared with a three dimensional optical marker system have been performed and results are indicated below.

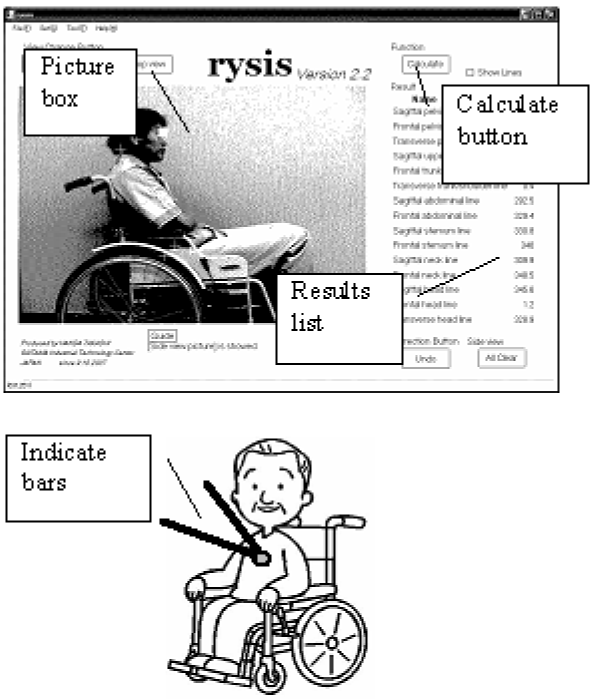

Figure 1: Rysis Photographic Measurement System

The Horizon

The Horizon (see Figure 2) is a hand held tool with a digital display and several modular components. The main components include the digital measurement/display box and several metal attachments that allow for pointers to align with body landmarks and spacers to create adequate length to represent most body segment line lengths. The tool is capable of measuring deviations from a vertical axis in both a horizontal and a vertical position, suitable for measuring sagittal and frontal plane absolute angles. It also has the capability of determining deviations from a pre-set position for transverse plane measurements. This device has not yet been evaluated in the US for its reliability and validity, however there is a study underway to determine the inter- and intra-rater reliability and to compare the results of this tool to those found using the Rysis photographic assessment software.

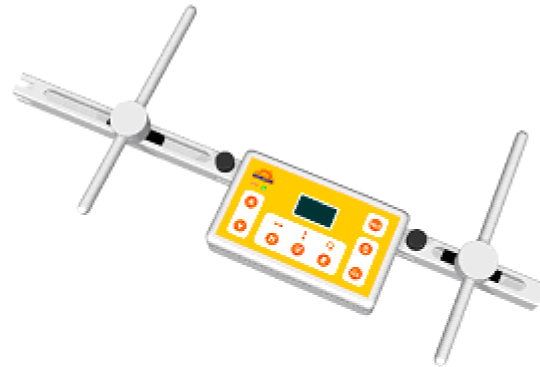

Figure 2: Horizon measurement tool

Reliability and validity issues and impact

Two small pilot studies of the Rysis system were recently conducted at the University of Hartford. Both indicated promising results related to the use of the Rysis system. However there are some concerns regarding the reliability of anatomical landmark palpation, which is not surprising. In the first investigation of Rysis, a comparison of Rysis results with those obtained via the Optotrak motion analysis system was performed. Along with this investigation, the Interrater reliability of Rysis photo processing was assessed by having 3 clinicians identify the anatomical landmarks on the same set of photos. Interrater reliability was assessed using the ICC, model 2,1. Resulting values ranged from a low of ICC (2,1) = 0.891 to a high of 1.0, with one outlier at 0.063 (see Table 1). The only angle with a low value (the sagittal sternal angle) was due to the fact that indicator bars were not initially used for the upper sternal notch, however this landmark was not visible in several of the right side photographs, forcing the clinical evaluators to "guess" at its location. Pearson correlation coefficients of the Rysis angles compared to those determined via the Optotrak were mixed (see Table 2). Five angles were below 0.50, 2 were between 0.50 and 0.70 and 5 were above 0.70. The lowest angle correlation was for the sagittal abdominal angle (0.072) and the highest was for the sagittal pelvic angle (0.903). The five correlations below 0.50 did not reach significance, all remaining correlations were significant. Some of these angles were re-assessed during the second study and Spearman Rho was used to evaluate the correlations. Results varied once again, with a low value of 0.370 and a high of 0.872. While these correlation coefficients are not very strong, there are multiple calculations occurring in the two analysis systems which may explain some of the resulting low correlation values. A third study is currently under way in which we will compare the Rysis results to hand measurement using the Horizon device.

Table 1: Inter-rater Reliability of Rysis Angles (three raters - using the same pictures)

Angle:	ICC (2,1)	Angle:	ICC (2,1)
Sagittal Head Angle	1	Frontal Pelvic Angle	1
Sagittal Abdominal Angle	1	Frontal Neck Angle	1
Sagittal Trunk Angle	0.985	Frontal Sternal Angle	1
Sagittal Neck Angle	0.965	Frontal Abdominal Angle	0.999
Sagittal Pelvic Angle	0.892	Frontal Trunk Angle	0.999
Sagittal Sternal Angle	0.063	Frontal Head Angle	0.891

Table 2: Validity of Rysis compared with Optotrak

Body Segment Angle	Pearson Correlation Coefficient (study 1)	Spearman Rho correlation coefficients (study 2)
Sagittal Pelvic Angle	0.903*	0.662*
Sagittal Trunk Angle	0.815*	NA
Sagittal Head Angle	0.795*	0.686*
Frontal Pelvic Angle	0.721*	0.470
Frontal Abdominal Angle	0.662*	NA
Frontal Neck Angle	0.541*	NA
Frontal Head Angle	0.482*	0.872*
Sagittal Sternal Angle	0.417	NA
Frontal Trunk Angle	0.335	NA
Frontal Sternal Angle	0.327	NA
Sagittal Neck Angle	0.268	NA
Sagittal Abdominal Angle	0.072	NA
Transverse Pelvis	NA	0.370
Transverse Head	NA	0.668*

*Correlation Coefficients Significant at the 0.05 level

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IC 27: Self Advocacy, It's Just Not for Consumers!

Michelle Gunn, ATP, CRTS

Learning Objectives

At the conclusion of this session, participants will be able to:

- learn the necessity of advocacy.
- identify their key state and federal law/policy makers.
- understand the fundamentals of meeting with key individuals.

Abstract

The AT community, especially in the area of seating and wheeled mobility, have been reluctant to be involved in the advocacy arena. On a national and local level, involvement with lawmakers and policy bureaucrats can be intimidating, complicated and confusing.Success of the entire assistive technology community maybe dependant on a cohesive advocacy platform. Professionals in seating and mobility possess the skill, knowledge and passion to communicate effectively with key individuals in law, regulation and policy. Advocacy is critical in service to the consumer population and to the continuation of the profession.This session will describe the many facets of good advocacy. Fundamentals will be explained, advanced concepts in meeting with lawmakers, hosting site visits, working with consumers and other, often overlooked, aspects of self advocacy will be discussed.

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3. Museum of Disability, Disability Advocacy. http://www.museumofdisability.org/advocacy_advocacy.asp

IC 28: Make It and Take It – A Beginner's Guide to Wheelchair Evaluations

Kay Koch, OTR/L, ATP
Brenlee Mogul-Rotman, OT (Reg) Ont.,ATP
Susan Johnson Taylor, OT/L

This interactive instructional session is geared for the professional who is new to seating and wheeled mobility evaluations. This will provide the attendee a hands on and interactive experience to design a seating and wheelchair evaluation. The attendees will be divided into groups for discussion and to design a basic template they can take back and use at their particular setting.

The session will focus on the items that need to be included on an assessment form, as well as exploration of other categories that maybe added depending on the setting. These items include but are not limited to: Identifying information, diagnosis, mobility status, current equipment, goals for the equipment, transportation and home environment and reasons for their referral for the evaluation. The attendee will be able to add additional evaluation elements specific to their setting.

The participants will be guided in designing the framework to follow for the evaluation, with discussion on how the evaluation builds the justification for the wheelchair and the component parts.

There will be a summary and time to share ideas with the group. There is no one universal evaluation, but this session will help with the main points of an evaluation,explain the why and what is needed for a comprehensive assessment that will help patients/clients.

Resources

1. Special Seating: An Illustrated Guide, Jean Anne Zollars, 1996, published by Otto Bock Orthopedic Industries Inc.
2. Assistive Technologies: Principles and Practice. Cook/ Hussey. 1995
3. 2006 Proceedings of the Canadian Seating & Mobility Conference. Workshop 7, 'Reality Hits the Mat'. Available at www.csmc.ca   (archives)
4. Rehab Institute of Chicago Wheelchair Evaluation http://www.ric.org/pdf/Evaluation%20Justification%20Form%20%20Final%20%202006.doc
5. Wheelchairnet.org http://www.wheelchairnet.org/WCN_ProdServ/Consumers/evaluation.html#anchor10118036
6. CSHCN Services Program Wheelchair Seating Evaluation Form- Texas http://www.tmhp.com/Manuals/CSHCN%20Provider/Output2009/09CSHCN-website-39-38.html

IC 29: Influences on the Seated Position

Menno van Etten

Our seated position is influenced by a myriad of parameters. Body parts like feet or upper body, arms or head, wheelchair's leg rest's or seat angle, activities or activity level, gravity, age, disabilities and so on. How do these and all those other functions influence on the clients ability to function as intended? How does a wheelchair set up, like the seat angle, influence the client's ability to eat or to propel a wheelchair or to keep stable while seated?

We have a natural preference to position body parts in a certain way, but are they positioned in a functional most optimal place or are, as an example the feet, positioned and maybe even fixated on the footplates?
We systematically analyze the different parameters. These parameters can - in a way - be divided in 3 groups: parameters identical for all, parameters influenced by ability levels and parameters as wheelchair features. All these parameters are interconnected; by analyzing these one by one create a better understanding for why we are seated as we are.

We will discuss gravity and how to withstand it, seated stability and how to improve it, biomechanical features as pelvis shape and length of hamstrings. What seated position we need to do a specific activity, what the seat angle means to these positions and the functional outcome of this activity. Of course we also will see into the effect changes due to increased age on the seated position. We will also discuss possibilities to increased seated time and what makes a passive or an active seated position.

IC 30: Use of Telerehabilitation in Wheeled Mobility and Seating Clinics

Richard M. Schein, PhD
Andi Saptono, PhD
Mark R. Schmeler, PhD, OTR/L, ATP

Concerns about access to health care have stimulated interest in clinical applications such as remote assessment and intervention in medicine1 and rehabilitation2-4. With the proliferation of advanced technologies, the temptation has been for decision makers to focus on technical features and lose sight to some degree of the clinical or educational problems that they purport to address. From its inception, a major promise of telerehabilitation (TR) has been improved access to health services for people living in underserved or remote areas in which expert health care professionals and facilities are scarce or absent. For people with mobility impairments, access to care and to practitioners with special training in wheeled mobility and seating (WMS) is difficult and cumbersome5-6. Telerehabilitation allows the use of telecommunications technology to provide rehabilitation and long-term support to people with disabilities in geographically remote regions and provides a mechanism for training and educating generalist practitioners. This method of delivering WMS assessments is not intended to supplant existing traditional WMS assessments but rather to provide an alternative method of delivering services.

TR Service Delivery Model

Selection of an appropriate wheelchair is commonly viewed as complex, a byproduct of different theories of seating and mobility as well as abundant options to address users' needs, skills, and resources. Decision-making is difficult because of adjustment to change, the unknown or inexperienced reality of new impairments, and an array of personal and social issues. Selection is inevitably constrained by costs and access to resources. Therefore, wheelchair provision and service delivery for individuals with mobility impairments is a complex and challenging clinical intervention. Few training opportunities to educate clinicians who prescribe wheelchairs are available. Prescription strategies should pertain to priorities of the individual and take into account physical needs, functional environment, funding and other related issues. The scope and depth of evaluation skills of the clinician can vary widely and may impact the wheelchair prescription. The rehabilitation technology supplier must have extensive specialized knowledge of the products available. Each individual involved (e.g.: patient, physician, clinicians, caregivers and other health professionals) have unique attributes such as diverse backgrounds with rapport of client or education that contribute to the evaluation. Healthcare professionals who treat clients in remote areas of the United States have experienced difficulties in obtaining information for appropriate treatment and assessment. During this instructional course, TR barriers and limitations will be discussed as well as how to overcome them to create a TR service delivery model7.

Outcomes:

Practitioners and researchers considering the use of TR for wheeled mobility assessments must first identify functional assessment tools. Although self-report function measures are often used in clinical settings, the optimal approach for assessing functional status has been an ongoing debate. Among practitioners and researchers there are differences in opinions about self-reported measures versus performance-based measures. Performance-based measures were considered more objective, free of reporting bias, sensitive to change, and clinically relevant for determining treatment effectiveness. However, self-report measures are more client-oriented, inexpensive, easy to administer and can provide information about perceived general performance of basic tasks in the clinic or home environment. During this instructional course, results will be discussed based on both performance (i.e. Functioning Everyday with a Wheelchair-Capacity outcome tool) and self-report measures (i.e. Functioning Everyday with a Wheelchair outcome tool) indicating satisfaction8, reliability, and equivalency testing9.

Health Information Technology

The 21st century is a time of innovation for telecommunications health information technology (HIT). Specifically, advancement of the Internet technology has allowed the development of an advanced HIT infrastructure to support TR in WMS clinics. The HIT infrastructure was used to build an integrated system that provided a new cost-effective approach to WMS assessments. The PITT Model is a concept developed within the Rehabilitation Engineering Research Center on Telerehabilitation which became the platform to build the HIT infrastructure10. The model consists of four aspects: open, flexible, extensible, and cost-effective. During this instructional course, results will be discussed based on the verification of needs, design and development, system validation, and system evaluation.

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IC 31: First Time Pediatric Power Users, Problem Solving For Complex Access

Marlene Holder, B.Sc., P.T.
Kathy Fisher, BSc (OT), ATP

Learning Objectives

1. Participants will understand assessment criteria for power mobility.
2. Participants will develop strategies to assess for access to drive control.
3. Participants will be introduced to set-up of specific equipment showing complex access solutions.
4. Participants will understand the importance of considering client's communication needs and how technology can be interfaced with drive control.

Introduction

For some children with severe motor disabilities, a power wheelchair is their first mobility experience and for others it builds on previous experiences. The power wheelchair can allow children independent exploration with decreased reliance on caregivers leading to more age-appropriate interaction with their peers.1,2 With this independence comes a sense of achievement which may not have been reached with previous mobility experiences.1 It is important to think about all children who are not functional in their mobility as potential power mobility users.3 In children with spastic cerebral palsy if certain milestones requiring good trunk control have not been achieved by age three, then the chances of functional independent ambulation is limited.4 Restricted early mobility is associated with the onset of learned helplessness and has a lasting impact.5,6,7 Not all of the children we introduce to power mobility will become power wheelchair owners, but the movement experience may stimulate cognitive development and be a valuable part of their therapy.8 Efficient and independent locomotion can lead to increased confidence, a greater opportunity to make choices and more active participation in their own lives rather than remaining spectators.2,5,8,9 With intervention focusing on participation goals such as keeping up with peers and energy conservation for other activities, introducing power mobility early can assist with achieving these goals and lead to social inclusion and community integration.10,11

Assessment

Prior to starting a power mobility assessment, the child's seating must first be assessed. Without a well supported base of support from which to work, the child will not be set up for success. Assessment for first time power mobility is a complex, team process. The process can be lengthy involving changes in drive control, programming, wheelchair configuration, ongoing training and reassessment.12

The following areas should be considered

Areas to Assess
- Seating assessment
    - Well supported and positioned
- Previous mobility experience
- Driver control access points
    - Most reliable movement
    - Avoid reflexive movements
- Position for vision
- Requirements for position change
- Wheelchair configuration
    - Mid wheel
    - Rear wheel
    - Front wheel
- Consideration of electronic capabilities – inclusion of devices through the wheelchair electronics
    - Communication
    - Seat functions
    - Computer Access/Mouse emulation
    - Environmental controls
- Other mounting needs
    - Life support
- Accessibility – home and school
- Transportation

Criteria for Selection of Driver Controls:
- Points of access – how many and where
- Proportional vs. digital
- Caregiver friendliness
- Electronic requirements of the wheelchair
    - ECU

Driving Assessment
- Movement and exploration
- Variety of environments – quiet and busy
- Ability to problem solve
- Reaction time
- Safety

Some checklists are available to assist clinicians with their assessments of children13,14 but these cannot replace clinical judgment. There are various approaches to introducing powered mobility including driving to learn15 and responsive partners in learning16. Both of these approaches explore learning as an ongoing process moving through various developmental stages of learning, the function of the relationship between the trainer and trainee and the environmental set-up.15, 16, 17

The process of assessment, trial, skill building and reassessment should be thoroughly completed prior to developing the prescription. Sometimes it is difficult to complete the assessment without specific modifications to the equipment. Clinical judgment must be used to determine what equipment and modifications are required for the system to be functional for the child. It can be difficult to determine when enough learning has been witnessed to ensure that the child is safe and competent in their driving to proceed with developing a specific prescription. As with all children, "independence" is individual and age appropriate supervision is needed. Given that a child is still learning and developing it is recommended the equipment be flexible and modular in order to meet ongoing functional and growth needs.

This presentation will utilize case studies to illustrate creative solutions during the assessment and prescription process.

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IC 32: Adaptive Cycling for People with Special Needs

Jennifer Miros, MPT

Recreational biking for children with neuromuscular dysfunction is not well documented in the literature. A systematic review of peer-reviewed articles was conducted using MEDLINE, CINAHL, GoogleScholar, HighWire Press, PEDro, Cochrane Library databases, and APTA's Hooked on Evidence (January 1980 to October 2009). Eleven studies were identified, none of which addressed community biking for children as a randomized controlled study. According to the available literature, cycling in a laboratory and/or clinic setting, using an array of equipment, appeared to benefit children and adults with neuromuscular dysfunction.
One major problem affecting the function and health of children with Cerebral Palsy (CP) is weakness (1, 2) and resultant lack of physical activity. Historically, exercise to promote physical fitness and strengthening was discouraged for children with spasticity, due to the concern that the spasticity and abnormal movement patterns would be enhanced. Current research, however, indicates that resistive exercise does in fact improve strength and function for children with CP. (3,4,5,6)

Inactivity for children with CP may contribute to the development of secondary conditions associated with CP such as joint contractures, osteoporosis, and decreased respiratory and circulatory function. Active exercise and physical fitness helps prevent these secondary conditions. (7) There is increasing recognition of the medical necessity of providing these children with a means of active exercise at school and at home. Parents and families support these perspectives. (8)

There are many adaptive cycling manufacturers and options. These options range from leg-powered upright tricycles, recumbent tricycles and prone recumbent tricycles to arm cycles, and combinations of both arm and leg cycles. Below are Adaptive Tricycle Websites:

- www.freedomconcepts.com-Freedom Concepts Adaptive Tricycles are available in multiple different sizes and styles, including the Discovery, Adventurer, Heritage, Journey, and Adventurer Tandem adaptive tricycles.
- www.thebikerack.com-Creative Mobility puts a positive spin on adaptive bikes and accessories. They offer many different adaptive bike options from multiple manufacturers.
- www.projectmobility.org-Project Mobility: Cycles for Life
- www.versatrike.com-In conjunction with David Black of Rad Innovations, the Versa Trike evolved into a trike that would work for a wide range of abilities.
- www.ambucs.com-AmTryke is a therapeutic Tricycle for children with disabilities. It has a continuous chain mechanism for hand and foot movement.
- www.metootrikes.com-MeToo Trikes™ offers kids with special needs the chance to ride. Adjustable trikes are available in three sizes.
- www.invacare.com/cgi-bin/imhqprd/inv_catalog/prod_cat.jsp?s=0&catOID=-536885351-Invacare makes hand cycles for both older children and adults.
- www.haverich.com-Haverich Orthopaedic Cycles
- www.rifton.com-Rifton offers three tricycles named the Rustler, Ranger, and Wrangler.
- www.freedomryder.com-The Freedom Ryder is a hand powered cycle you steer by leaning your body.
- www.varnahandcycles.com-Varna Innovation & Research Corporation
- www.greenspeed.com.au/ -Greenspeed recumbent trikes
- www.catrike.com- recumbent trikes
- http://www.lightfootcycles.com/trikes.php and www.lightfootcycles.com/ trailertrike.php-Lightfoot Trikes and Trailer Trike. The trailer trike is a self-propelled trailer, designed to be towed behind almost any bike or trike, turning the pair of cycles into an instant tandem.
- www.wicycle.com-Special needs bicycle trailers.

All tricycles are designed so that they do not require significant balance or skilled motor ability on the part of the user. For this reason, adaptive cycling is an ideal exercise for children with CP. Tricycling has the potential to improve strength and cardio-respiratory fitness for walking endurance, gross motor function, and health-related quality of life.

Research studies focusing on the use of tricycles as an exercise activity for children with CP have resulted in supportive evidence for this intervention, for both muscle activation and function. (9, 10, 11, 12) Further research on adaptive cycling as a medical intervention is needed and is under development. (13)

In order to successfully obtain funding for an adaptive tricycle through medical justification, it is important to prove the medical necessity. One means for this is to describe it as a therapeutic mobility device and to detail the therapeutic benefits.

1. Regular use of this product can prevent debilitating conditions resulting from immobility such as skin breakdown, contractures, and orthopedic deformities.
2. Use of the product supports improved cardiovascular health, respiration, swallowing, and development of head and trunk control.
3. Gross motor practice with this device promotes activation and control of lower extremity muscles in a reciprocal pattern and progression line in patterns similar to walking.
4. Long-term benefits include strengthening of anti-gravity muscles, bone and muscle growth, improved eye-hand coordination, opportunity for cognitive growth, and improved confidence, self-esteem, social opportunities and social acceptance.

Another way to obtain funding for an adaptive cycle or therapeutic mobility device is through charitable organizations. There are many organizations that will help with adaptive cycle funding for a person with a disability. Some of these organizations include:

First Hand Foundation–They provide individual assistance for children less than 20 years of age and have a downloadable application form on their website.
Website: www.firsthandfoundation.org

Starlight Children's Foundation–They grant wishes to children between the ages of 4-18. Website: www.starlight.org

Sunshine Foundation–They have a "Dream" program to fulfill children's wishes for children between the ages of 3-21. Website: www.sunshinefoundation.org

Make-A-Wish Foundation–Please refer to the guidelines on their website.
Website: www.wish.org

Variety-The Children's Charity–Provides help with adaptive trikes and medical equipment. Website: www.usvariety.org
Challenged Athletes Foundation– Provides grants for training, competition and equipment needs. Website: www.challengedathletes.org

UnitedHealthcare Children's Foundation-The Foundation provides financial assistance toward the family's share of the cost of medical services.
Website: http://www.unitedhealthcarechildrensfoundation.org

M.O.R.G.A.N. Project-Working together to promote awareness and support of parents caring for their special-needs children, and to enhance the quality of life for these special families. Website: www.themorganproject.org

Hannah and Friends-Nonprofit Organization for children and adults with special needs that gives grants to kids with special needs that need a bike, therapeutic horsemanship or music therapy. Website: www.hannahandfriends.org

Athletes Helping Athletes-A hand cycle can transform a child with disabilities from sitting on the sidelines watching other children play, to participating and excelling in sports. Since 2000, Athletes Helping Athletes has provided hand cycles to over 375 children with disabilities.

Website: http://www.roadrunnersports.com/rrs/content/topic.jsp?contentId=1800024

Community Organizations to Consider:
1. Jaycees
2. Lions' Clubs
3. Rotary Clubs
4. Eagles' Lodges
5. Sertoma Clubs
6. Shriner's Club
7. Moose Lodges
8. Sororities and Fraternities
9. Hospital Auxiliaries
10. American Association of University Women
11. March of Dimes
12. Easter Seals
13. United Cerebral Palsy
14. Knights of Columbus
15. Salvation Army
16. Unions
17. American Business Clubs (AMBUCs)
18. Catholic Charities
19. Lutheran Social Services

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Systematic review done by Ginny Paleg PT, DScPT, MPT

IC 33: The Challenges of Seating for Children & Adolescents with CP & Dystonia

Karen M. Kangas OTR/L

Creating seating systems which support true function and postural control for children with cerebral palsy is challenging. However, when cerebral palsy includes dystonia, and/or an opisthotonic reaction, the challenges are even more daunting.

Observing characteristics of dystonia and their patterns within the child is critical. This cannot happen while the child is simply at rest, nor can it occur with simply a mat assessment. The child must be observed in various activity and in various environments. These are the children whose seating created in a "one shot" evaluation, most frequently doesn't work for most of the time.

With dystonia, a child at rest, can look completely in control of her body, or can seem quite relaxed, or could have an underlying perseverative, singular distal movement, or could have an underlying resting "tremor"-like movement, or could have all of the above. Or, the child at rest, sometimes could have some of the characteristics above, while at other times, not. When upright and engaged in activity, the child can demonstrate (if the pelvis is weight bearing) adequate postural control, and then, it seems, demonstrate almost uncontrollable flailing, extension, through a surge of tone.

When observed more carefully, the surge of tone almost always is precipitated by an unpredictable noise, movement, or by touch. When the extremities move into this surge, however, there is a pattern. This pattern can also be a short sequence of patterns. These patterns appear to be how the dystonic surge is exhibited and needs to be identified in each child specifically. This pattern can include one upper extremity and the opposite lower extremity, or both upper extremities or both lower extremities. The extremities can move into internal rotation proximally, and flail or get "stuck" out or with the upper extremities almost "behind" the trunk. Or the opposite extremity may flex while one extends. (For specific definitions see: "Overview of dystonia" @ www.wemove.org)

In short, a child may have changes in tone at rest, during activity, or when handled. The surge of tone affects one side or upper half or bottom half of the body, or all three, in a sequence of movement. The child in the midst of a surge of tone can appear to be "powerful" or in a "strong" pattern. While at other times, the child's body can appear almost "floppy" or "with no or decreased tone."

If an opisthotonic reaction is also present, the trunk can appear to over-extend pushing the head and neck into hyperextension with the body subsequently moving into an asymmetrical tonic neck reaction, before it can move back into neutral.

Dystonia does co-exist with spasticity, but also exists in isolation. Its surges of power, its underlying postural reactions are not simple and not simply the hypertonicity associated with spasticity or athetosis. Sensory processing is different, and resting and active postures are dramatically different.

What do we do?

Seating for these children must have options. First and foremost, the child must be able to be transported safely on the bus to school, and within the family's transportation. Almost always, this seating for safety requires every strap, contour and support available to include: a 4 point seat belt, or sub-asis bar or 2 seatbelts; adductor pommel; an aggressive wedged seat (pelvis lower than knees); knee block; ankle and foot straps; chest harness and body contoured trunk lateral supports; shoulder retractors; possibly arm troughs with straps at wrists; tray with elbow blocks; large head support, including an occiput support, and all this seating with a tilt-in-space chair, tilted at almost 35-45 degrees. Even with all of this, parts can be pulled, broken, torqued through a surge of tone, but the child's body can be contained while being transported.

However, this seating is totally in the way, for the child to actually use her body to learn in school, to pay visual attention, to manage an augmentative communication device, to access a computer, and/or to drive a powered chair.

When out of the chair, some children appear to have a lot of control of their bodies, and frequently, become insistent about getting out of their chairs and become demanding of the adults to "hold" them for the support they need. Many of these children can demonstrate adequate head and neck control, some can even use an upper extremity in an isolated functional mode.

These children have taught me, more than ever, that we cannot expect a single seating system to be the answer or solution for all day, every day use. We also need to realize, that it is close to impossible to provide a single seating system with enough flexibility to be as strong and stable as it needs to be, and at the same time have removable parts which allow regualar, consistent alteration for activity throughout the day. These childen need several different seating systems, and seating systems which are situationally specific, not seating systems in different bases.

These children also need to be handled quite specifically. Many of them develop strong alliances with certain adults, and will only allow these adults to feed them, or dress them, or transfer them.

Before we begin configuring systems for them, we need to really identify these children's current postural patterns, and then look at their current stage of development.

These children, due to the strapping they require for "safety" are frequently overly strapped too long, and too much movement is restricted. Managing them, requires the least handling. This sounds like an oxymoron, but we must learn to handle their bodies with the least interference, providing the child always with knowledge ahead of time, what is about to occur. I use a counting method to help me with handling. I stand out of their arm's reach and stand still. I talk from here, I then tell them I will count to three, and then kneel, again, out of arm's reach. I tell them I will count to three and move next to them (I do this on my knees). I tell them I will count to three, and then place my hand on their knee, etc. etc. Always I tell them in advance each little step that is to occur, and will occur after I count 1,2,3. I try and approach only from the side, not from the front, and try and manage them proximally, rather than distally. (Children with dystonia can frequently have their hands get caught in your clothing in a fist, and not be able to let go)

I have also discovered that if I can assist the child's body into pelvic weight bearing, the surges of tone decrease and/or disappear. Remember, though, a child's body can't get into pelvic weigh bearing in a wedged seat. Pelvic weight bearing requires the pelvis to be higher than the knees and have some rotation at the trunk.

When working with children with dystonia to access assistive technology, I must alter their seating to one of pelvic weight bearing for postural control to occur. With this very big exception. If the activity is new, if the environment is new, and if the access is new, then I will try and use "judicious" strapping, and look to have the body in contiguous connections to the seating surface, use a slight tilt, and have the head supported under the occiput. I will then use proximity sensors/switches (electronic, zero pressure) at the head site, but only ask the child to "roll" her head from side to side to access the switch. I will ask for only range of motion, not power from the body, as the child becomes familiar with the activity.

If the child has an opisthotonic reaction, I will also use a trunk orthotic (as a barrier to unpredictable touch; contact me via email if you would like instructions and photos of this orthotic) to cover the scapulae and sacrum, so that I can handle the child more readily to move them into a more independent pelvic weight bearing posture.

It must be remembered, however, that it is not static control we are looking for, but rather anticipated, graded movement; without setting off a surge of tone. It is not "our" placement of the body, but rather creating systems within which the child can move her own body on her own as she wishes, to engage in activity, and not lose control. This can't be overly-restrictive, yet not overly free.

My current favorite "out ofwheelchair" seating includes the use of these products:

1. Prime Engineering's KidWalk (can support standing, sitting, transition, and movement)
2. Snugseat's X-Panda and Nandu (can allow for anterior tilt, less restriction, and ensure foot placement on the floor)
3. Rifton's Activity Chair (I have not yet used this with a child, just used it myself, but it appears to allow many of the alterations required, especially in the high/low configuration)

I use with them, Bodypoint's large neoprene chest strap, which I can use around the trunk, and vary with activity and take off or on readily as needed.

It is very important that we really understand the postures of children with dystonia and/or dystonia and spasticity. We must realize that seating will also change for them as they age, or as their bodies change. These children are also children who frequently receive a baclofen pump, and after its use, seating also dramatically changes.

Some additional reading which may be of interest

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8. Important web-site for further reading: www.wemove.org (Worldwide Education and Awareness for Movement Disorders)

P34: A Practice Guide for Wheelchair Assessments

Mary Shea, MA, OTR, ATP
Teresa Plummer,PhD, OTR, ATP

The Wheelchair Service Provision Guide is being developed by the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) Wheeled Mobility and Seating Special Interest Group. The purpose of this guide is to provide an appropriate framework for identifying the essential steps in the provision of a wheelchair. It is being designed for use by all participants in the provision process including consumers, family members, caregivers, social service and health care professionals, durable medical equipment (DME) suppliers, manufacturers, and funding source personnel.

An outline of guide with major content areas is included below.

Literature Review

Nearly 3 million people in the United States use a wheelchair for mobility. Obtaining the correct wheelchair is a complex process and if one is unable to obtain the correct wheelchair it may lead to untoward consequences of injury, contribute to activity limitations, and may impact one's ability to be employed. Unfortunately, there is no consistent measurement standard or procedure for the practitioner who prescribes a mobility device.

The Assistive Technology community has been looking for a standard of practice to aid clinicians and suppliers in the provision of wheelchairs. Professionals are challenged with the need to stay abreast of technology advances, balance productivity and reimbursement issues, and accurately assess their clients' needs and goals. In addition, wheelchair prescription is complex. An individual's specific support and mobility needs must be balanced with environmental accessibility and the wheelchair technology that is available.

Terminology from the International Classification of Functioning, Disability, and Health (ICF) model was utilized throughout the guide relative to its increasing recognition, acceptance, and use amongst health care professions. (WHO, 2003). The ICF model provides a framework (e.g. terminology, concepts) for incorporating the individual, the activity, the technology and the environment into the service provision process.

The concept of Evidence Based Practice (EBP) was employed throughout this guide to help insure that the most appropriate services and equipment are provided to individuals with disabilities. This practice involves the translation of knowledge from the broad area of external evidence to the unique characteristics of the individual. EBP should be applied to the technologies, the processes, and the strategies utilized throughout this guide.

Wheelchair Service Provision Process

The wheelchair service provision process is not simply about assessment and prescription. Providing a client with an appropriate wheelchair requires a full spectrum of services. The wheelchair service delivery model described includes the following components: Referral, Assessment, Equipment Recommendation and Selection, Funding and Procurement, Product Preparation, Fitting, Training, and Delivery, Follow-up Maintenance and Repair, and Outcome Measurement.

The following is an outline of the guide.

Referral

- Identification of Need
- "Referral" to Qualified Professional

Assessment

- Current Technology and the Environment
- Current Technology Used for Mobility
- Environments of Use
- Family, Social Support and Caregivers
- Attitudes Towards Disability and Technology
- Activity & Participation
- Body Functions and Structures
- Client Goals

Equipment Recommendation and Selection

- Equipment Trial/Equipment Simulation
- Client Funding Education & Exploration
- Documentation

Funding & Procurement

- Pre-Determination
- Ordering and Receiving Equipment

Product Preparation

Fitting, Training, & Delivery

Follow-Up, Maintenance & Repair

Outcome Measurement

Three case studies are incorporated to illustrate interpretation of the guide into clinical practice. The case studies reflect three different populations, pediatric, geriatric, and acute rehab/spinal cord injury and three different practice settings: home care, school-base, and dedicated wheelchair clinic in a rehabilitation program.

This guide is the first step in identifying components essential to wheelchair service provision. The next phase of this project is to build upon this guide to develop Clinical Practice Guidelines.

Speaker Information

Mary Shea, MA, OTR, ATP, has been practicing as an occupational therapist for the past 18 years. She has been working with durable medical equipment service provision throughout and is currently the clinical manager of wheelchair services at Kessler Institute for Rehabilitation in West Orange, NJ. Ms. Shea is an adjunct professor in the occupational therapy departments at New York University and Mercy College. She has presented nationally and internationally on wheelchair related technology. Ms. Shea has coordinated a group of stakeholders across the country to develop this Wheelchair Service Provision Guide.

Teresa Plummer, PhD, MSOT, OTR, ATP is an Assistant Professor at Belmont University in the department of Occupational Therapy. Her current clinical practice is in Pediatric Assistive Technology at Monroe Carell Vanderbilt Children's Hospital focusing on wheelchair assessments for children with mobility impairments. Dr. Plummer has over 30 years of clinical practice and has presented nationally and internationally in the areas of mobility and assistive technology. Her recent dissertation was on the current state of practice in the wheelchair assessment and procurement process and she is one of the authors of the guide.

IC 35: Powered Standing Mobility in Boys with Duchenne Muscular Dystrophy

Elise Townsend, DPT, PhD, PCS

This presentation will include two topics:

A. Topic A (30-40 minutes) is a report of preliminary research examining the effects of a motorized standing program on bone mineral density, lower extremity muscle length and health related quality of life in four boys with Duchenne Muscular Dystrophy (DMD).

Purpose: 1) Demonstrate that the use of motorized standing programs is feasible for boys with DMD; 2) Identify challenges that limit the use of standing programs, and 3) Provide qualitative information about bone mineral density (BMD), posture, lower extremity muscle length, functional abilities and self/parent reported health related quality of life before, during and after an 8-12 month standing program.

Materials & Methods: Four 7-12 year-old boys with DMD engaged in a 5 day per week standing program using a commercially available sit to stand power wheelchair. An A1-B1-A2 single-subject design was employed, with A1 as a one month baseline, B1 as the 8-12 month intervention (standing) phase, and A2 as a 4 month withdrawal phase. Measured and outcome variables included: lower extremity muscle length, muscle performance, postural alignment, weight and height and health-related quality of life. Assessments were weekly in A1, monthly in B1 and A2. BMD was assessed using dual energy x-ray absorptiometry (DXA) pre-intervention, mid intervention, immediately post intervention and 4 months post intervention.

Data Analysis: Qualitative and visual analyses of graphed data have been used alongside the Two Standard Deviation Band Method to examine change over time in outcome variables across the three phases of the study.

Results, Discussion and Conclusion: This pilot project provides preliminary evidence for the feasibility of a motorized standing program as an adjunct to current physical therapy management for boys with DMD. Effects of standing on BMD, muscle length and health related quality of life will be reported.

Clinical Relevance: DMD is an X-linked genetic disease that affects skeletal and smooth muscle, causing progressive weakness. Boys with DMD lose their ability to ambulate and become wheelchair dependent for mobility, generally by age 9-12. Adverse effects of immobilization include development of joint contractures and spinal deformities, muscle atrophy, impaired circulation, reduced bowel and bladder function and a dramatic reduction in BMD.

No cure for DMD exists, however recent advances in medical management provide evidence supporting use of long term corticosteroids to delay progressive weakness and prolong walking. An adverse side effect of corticosteroid therapy is heightened loss of BMD and accelerated osteoporosis. Given impaired BMD, alongside frequent falls, fractures are a common and unfortunate occurrence. Thus, physical therapy interventions aimed at fall prevention and maintenance of BMD are desirable. Standing programs have been shown to have beneficial effects on BMD, spasticity and bowel/bladder function in children and adults who require support to maintain an upright position, such as those with cerebral palsy and spinal cord injury. However, no studies have examined the feasibility or potential benefits of standing programs in boys with DMD.

B. Topic B (15-20 minutes) reviews the mechanics and functions of the standing device used for this research and provides information to guide clinicians and families to as they seek funding for standing devices for boys with DMD.

Funding Solutions

- Funding standing devices can present challenges because a Medicare Policy Article (A19846) claims standing is “not primarily medical in nature.”
- Even so, standers have been successfully funded through various third party payers including: Medicaid, Medicare, Private Insurance, Veteran’s Administration and Vocational Rehabilitation.
- Additionally, private funds and fund-raising can be used to supplement co-pays or items denied by insurance companies for standing devices.
- Each manufacturer offers assistance for navigating the funding process, including sample letters of medical necessity and strategies for success.

IC 36: Empower with Power: How Attitudes About Power Mobility Can Affect Outcomes

Deborah L. Pucci, PT, MPT, ATP
Brenda Canning, OTR/L

Those who undergo rehabilitation following a disabling injury or illness experience losses in many aspects of their lives (1, 2, 3), however loss of mobility is a loss that has been demonstrated to be of principal importance to many individuals (1). This is not surprising, as independent mobility is a crucial element of independent living and of quality of life (4). Therapists who work with individuals with a disability in the rehabilitation setting are in a position to help clients to shape their lives after injury or illness. Rehabilitation provides experiences to help the client understand what is possible or potentially possible. Goals for functional mobility that are aimed at improving participation may include goals for ambulation as well as goals for manual or power wheelchair mobility. Though studies have shown that these devices can improve user's activity, participation, and independence with mobility (5, 6, 7, 8), negative attitudes regarding the use of power mobility can impact when or if this method of mobility is introduced in the rehabilitation process (9, 10, 11). Concerns regarding social acceptance, personal identity, prejudices toward the device (10), negative attitudes of others, and stigmatization (12) have all been shown to affect acceptance of mobility devices, while acceptance has been shown to improve with recognizing the need for the device, trial of the device, and experiencing the benefits to one's independence (12, 13, 14). Additionally, evidence has shown that wheelchair skills training can positively affect an individual's independence and quality of life (15, 16, 17, 18, 19, 20). Therapists, therefore, through the use of both quantitative and qualitative assessments and measures (21), can help their clients determine if and when power wheelchair mobility could positively impact independence with mobility and participation in life roles and activities, work with clients to set goals based on the most appropriate mobility device, and develop treatment plans that ensure clients develop the skills to maximize functioning with that device.

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IC 37: Why Wheelchair Prescription for Independent Propulsion Matters and How to Do It

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Josh Anderson

Research has shown that improper wheel position can cause a number of repetitive stress injuries.[1, 2] Rotator cuff tears, elbow, and wrist injuries are common in wheelchair users and need to be prevented when possible. Clearly, preserving upper limb function over a lifetime of wheelchair use is very important and should be something that all seating professionals strive to do. [3]

The issue that is frequently missed when prescribing a wheelchair is how the fit of the wheelchair affects a person's simple everyday function. Many wheelchair professionals focus on fixed rules that they learned in school and as a result they unknowingly prescribe wheelchairs that limit their patients' function. This presentation will discuss areas where function can be improved by selecting the proper fit of the wheelchair.

Chair Width

The width of the chair is made up of several components including seat width, rear wheel spacing and camber. The narrower the overall width, the narrower the doors that the person can traverse. Considering many homes and businesses have narrow doors, the narrower wheelchair may allow access to areas such as bathrooms.

Seat width is one of the most important measures and one of the most frequent areas of improper chair set-up. Many therapists and suppliers were taught that an adult patient should have two inches of seat width greater than their widest point (hip or thigh width). In pediatrics, providers frequently select 3-4 inches to accommodate for potential width growth.

In adults, some accommodation for potential weight gain in people with new injuries may be necessary. If the person was thin and active prior to injury, they will likely remain thin after injury so two inches of seat width is not likely to be needed. The presence of spasticity or active lower extremity muscle function should also be considered when deciding how much growth is necessary. Individuals with no spasticity or lower extremity function are less likely to gain hip width than those with these functions.

For most adults receiving a second, third, etc. chair, their hip width is not likely to change. Questioning them about current weight and any planned gains or loss can establish what width is necessary. With more experience following this population, professionals should learn who is most likely to experience weight gain and be able to judge how to select an appropriate seat width.

The other population that frequently receives chairs that are too wide, are children, as professionals worry about potential growth. Children with disabilities like cerebral palsy typically grow more in depth than they do width. So, if a chair is 4 inches too wide when provided, it is likely going to be 3 inches too wide when the chair is ready to be grown due to a child's growth in height. With this population, it is important to remember that most chairs are "grown" within the five years that the child uses the wheelchair. Because of this, the planned chair width does not need to accommodate five years of growth.

Making chairs too wide leads to difficulty accessing the wheels because people have to abduct their shoulders and cannot rest their arms in a neutral position. This positioning can result in injury.[3] It also decreases stability because it allows and can cause too much lateral movement in the chair when the person does functional activities.

A chair that is around the same width as the person allows them to feel more connected to the chair so they can propel and move more effectively. Wheelchairs users say that more tightly fit chairs allow them maneuver the chair without even thinking about it. They also report less fatigue propelling than when they used a wider chair.

The rear wheel spacing and the camber also affect the overall width of the chair. The closer the rear wheels are to the seat, the narrower the chair will be. The more camber on the chair, the faster they will turn and the better they will maneuver. However, this makes the chair wider so depending on the person's environment and life needs, they may need to sacrifice either function or accessibility depending on their needs.

Chair Depth

Chair depth is comprised of the actual seat depth, the rear wheel position, the front frame angle, and the center of gravity. These adjustments can affect posture, stability, and accessibility. [4] Generally, the longer the overall chair is, the less maneuverable it will be.

Properly adjusted seat depth allows for correct support under the thighs and buttocks. When the seat depth is too long, the seat hits the person in the knees and can cause leg injury or it can cause the user to go into a posterior pelvic tilt. This poor seating position can compromise sitting stability. It can cause the person to round their shoulders forward and propel in a detrimental position for their upper extremities. A seat depth that is too short is not as common of a problem in this type of chair. However, when it does occur, it causes increased pressure under the buttocks and thighs and it can result in a feeling of instability.

When possible, a tighter front frame angle is beneficial to many aspects of function. For people with tight hamstrings, it allows them to sit with a neutral pelvic tilt so they can sit upright to propel and be the most functional. For someone with good trunk function and sitting balance in their wheelchair, a tight front frame angle allows them to access objects in front of them such as counter tops, microwaves, and desks. Without a tight front frame angle, many people have to complete activities from the side, which can result in

injury due to poor biomechanical positions that are assumed when the trunk in rotated and the extremities are reaching across the body.
The center of gravity of a wheelchair can significantly affect function.[5] Frequently, professionals select a center of gravity that is too far back. The further back the center of gravity, the more stable the chair. However, this can make wheel access difficult as the person much reach back instead of down to contact the handrim. In improving stability, it decreases the person's ability to perform skills like wheelies or to safely navigate uneven surfaces, which allows people to propel efficiently.[6-8] For the best function, the center of gravity should be as far forward as the person can use functionally, without risk of injury. For new wheelchair users, this needs to be assessed every few months as the person learns to use the chair, becomes more stable, and can safely use a larger center of gravity. This improves ease of propulsion on all surfaces and can improve accessibility.

Seat Heights

The difference between the front and rear seat height is the slope. Seat slope can affect sitting stability and transfers. Some individuals cannot propel with a flat seat. For individuals with limited trunk control, higher seat slopes can improve stability by allowing gravity to hold the person in the system. People with good trunk control frequently like at least a small amount of slope, as it allows them to rest against the backrest easier. The only potential downside to slope is that it can negatively affect transfer ability. For individuals who have upper extremity weakness, they may not be able to independently transfer out of a seat with a significant amount of slope because they are going against gravity. Accommodations such as a slide board may be necessary to assist them. Every effort should be given to assessing trunk strength and sitting balance to assure the correct seat slope to maximize sitting stability and function.

Aesthetics

The final area that is just as important as the others is aesthetics.[8] When people feel good about themselves, they are more functional and productive. They want to interact with others. The chair is part of their overall appearance and it should basically disappear underneath them. When the chair is properly adjusted to maximize function, the chair is not visible and the person is able to interact with others without a focus on their wheelchair. Even people who like bright colors, differently styles wheels, or other customization of the chair look better and higher functioning when their chair is fit properly.

Improving the fit of the wheelchair to increase function for people who use wheelchairs is an important area of focus and can be achieved if function is discussed and assessed during the provision process and following delivery. Following up with patients months/years after delivering wheelchairs will assist in learning the positive and negative results of the wheelchair process. By paying attention to patients' reports about their activities and limitations, professionals can assure that they are maximizing their patients' function and make necessary changes if they are not.

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IC 38: Activities of suppliers during provision of wheeled mobility and seating devices

Stephen Sprigle, PhD, PT
James Lenker, PhD, OTR/L, ATP

Objectives and Description

To describe the process and procedures required of time and activity studies

To report on the type and duration of activities performed during the provision of wheeled mobility devices
To compare activities of RTSs to those of Techs, and activities required of CRT to those of standard DME.

The provision of wheeled mobility and seating equipment involves myriad activities. Rehabilitation Technology Suppliers (RTSs) and Technicians (Techs) are involved with activities before, during and after an evaluation. To date, little data has been collected documenting the type and duration of activities involved in prescribing wheelchairs and seating equipment. This session will report and discuss the results on a time-activity study performed in Buffalo and Atlanta that documented the activities involved in the provision of seating and mobility equipment categorized as complex rehabilitation technology (CRT) and standard durable medical equipment (DME).

Methods

A list of all companies who provided wheeled mobility devices in Atlanta and Western New York were identified. Contact was made or attempted with all companies to identify those that met the following inclusion criteria:

- Have a minimum of $1.5 million in annual complex rehab sales per company location
- Employ at least 1 rehabilitation technology supplier (RTS) with a minimum of 3 years of experience
- Employ at least 1 technician

Four RTSs and two technicians from both locations were randomly selected from companies meeting the inclusion criteria. Therefore, 8 RTSs and 4 technicians were enrolled in the study. A research assistant followed participants for 2 weeks and recorded the type and duration of activities.

An iPod Touch was programmed to collect the type and duration of activities performed during mobility services. Activities were categorized into 4 primary activities reflecting the state of the equipment delivery process (Table 1) and these were further divided into secondary activities.

Table 1. Primary and secondary activities associated with the provision of mobility equipment

Primary Activity Categories	Secondary Activity Categories
Visit Preparation	Intake/Coordinate evaluation Obtain / prepare trial equipment
Pre-delivery	Assessment/Equipment Trial Home assessment Quoting / Order Parts Assemble WC Travel Time Waiting
Delivery	Load/Unload Equipment Configure/Fit/Test WC Patient Education Travel Time Waiting
Follow-up	Adjust/Test WC Maintenance Repair Quoting/Order Parts Travel Time Waiting
Miscellaneous	Batch phone calls

Defining CRT: Client encounters were classified as CRT or DME using the following CRT criteria

Power Wheelchairs with the following HCPCS Codes:
Group 3: K0848-K0864
Group 4: K0868-K0886

Manual Wheelchairs with the following HCPCS Codes:
K0005 K0009 E1161E1235 E1229
E1236 E1231 E1237 E1234 E1238

C1- Prefabricated seat and/or back	
C2- Made to Measure seat and/or back	
C3- Custom Molded seat and/or back	
C4- Combination pre-fabricated/made to measure/custom molded seat and back system	
Modifier: If the seating equipment included support components (i.e., lateral supports, hip guides, head supports, etc.) then add an "S" modifier was added to the seating equipment code	

Results

- 1015 activities documented
- 864 were designated as activities associated with either CRT or DME devices
- 151 activities either involved multiple clients (i.e., travel to a clinical setting) or were activities for which the device was unknown.

Mobility device classifications across device complexity

	CRT	DME	All
Standard wheelchair (K0001)	2	13	15
Lightweight wheelchair (K0003)	7	18	25
High strength, lightweight wheelchair (K0004)	6	30	36
Ultra lightweight wheelchair (K0005)	168	0	168
Heavy Duty Wheelchair (K0006)	0	2	2
Extra Heavy Duty Wheelchair (K0007)	0	5	5
Other Manual Wheelchair-base (K0009)	32	0	32
Manual Adult- includes TIS (E1161)	158	0	158
Pediatric Manual TIS (e1232)	8	0	8
Pediatric, Manual folding w seating system (E1236)	4	0	4
Group 1 power wheelchair : K0813 - K0816	0	8	8
Group 2 power wheelchair: K0820 - K0843	16	128	144
Group 3 power wheelchair: K0848 - K0864	194	0	194
Group 4 power wheelchair: K0868 - K0886	10	0	10
Power wheelchair, group 5 pediatric (K0891)	2	0	2
Scooter	0	50	50
No Value	1	2	3
All	608	256	864

Seating system classification across device complexity

	CRT	DME	Total
C1	142	183	325
C1 with supports	110	0	110
C2	78	0	78
C2 with supports	145	0	145
C3	16	0	16
C3 with supports	8	0	8
C4	25	0	25
C4 with supports	27	0	27
No Value	57	73	130
Total	608	256	864

CRT Activity Time (hrs)

Activity (hrs)	N	Mean	StDev	Minimum	Median	Maximum
Visit preparation	16	0.3	0.14	0.25	0.25	0.75
Pre-delivery	303	0.6	0.45	0	0.5	2.5
Delivery	105	0.5	0.38	0	0.25	1.75
Follow-up	184	0.5	0.45	0	0.25	2.25

DME Activity Time (hrs)

	N	Mean	StDev	Minimum	Median	Maximum
Visit preparation	10	0.2	0.12	0	0.25	0.5
Pre-delivery	161	0.4	0.28	0	0.25	2.25
Delivery	55	0.4	0.44	0	0.25	2
Follow-up	30	0.4	0.24	0	0.25	1

Daily Episode time: Activity time was aggregated to reflect the total amount of time that employees focused on a particular client in a given day (defined as 'episodes'). Daily episodes could consist of one or more activities.

Daily Episode times without *travel* Device Complexity and Mobility Device Type

		N	Mean	StDev	Minimum	Median	Maximum
Manual WC	CRT	256	0.6	0.57	0	0.5	4.5
	DME	41	0.4	0.18	0	0.25	0.75
Power WC	CRT	161	0.6	0.45	0	0.5	2.25
	DME	80	0.5	0.27	0	0.5	1.25
Scooter	DME	26	0.4	0.3	0	0.25	1.5

Daily Episode times including *travel* across Device Complexity and Mobility Device Type

		N	Mean	StDev	Minimum	Median	Maximum
Manual WC	CRT	256	0.8	0.7	0	0.5	4.5
	DME	41	0.6	0.49	0.25	0.5	2.75
Power WC	CRT	161	0.7	0.58	0	0.5	3.25
	DME	80	0.8	0.58	0	0.5	2.5
Scooter	DME	26	0.7	0.43	0.25	0.5	2

IC 39: Postural Support for SCI: Theory, Products, and Opinions

Cynthia Smith, PT, ATP
Diane Thomson OTR/l, ATP
Jessica Presperin Pedersen OTR/L, ATP

This course is a collection of theoretical concepts, evidence, and experience relating to seating intervention for the trunk. The focus is on individuals with spinal cord injury who use manual wheelchairs.

The three of us discussed our experiences in this area during last year's International Seating Symposium and decided to provide a forum for sharing ideas and experiences in the hope of encouraging discussion. We have attached several articles related to the topic of intervention at the trunk. The reader will note that there is scarce evidence to support our hypotheses and experiences.

Firstly, we agreed that the standard upholstery provided with most ultralite wheelchairs does not provide adequate support. We discussed the pros and cons of adjustable back upholstery and will share these opinions.

Products such as back supports, abdominal binders, Lumbar-sacral Orthosis, LSOs, or Thoraco-lumbar-sacral orthosis , TLSOs, have been medically justified as providing the following benefits:

- Increase spinal extension
- Decrease lateral trunk leaning
- Enhance cardiopulmonary functioning
- Provide support to decrease the reliance on the arms to hold the body upright
- Increase functional reach
- Provide a base for neck and head control
- Support/stabilization
- Point of relaxation
- Substitution of weak or absent muscles
- Maintain natural curves of spine
- Decrease postural deformities
- Accommodate pelvic and spinal rotation and curves (deformities)

Specific areas of presentation and discussion include seat to back angle, back height, lateral support, and circumferential intervention.
Back angle is critical when specifying the mobility base and back support. The individual's ability to maintain an upright posture and function can be affected by seat to back angle A back angle greater or lesser than optimal can significantly decrease a person's physiological, functional and participatory abilities. A more reclined back will assist in maintaining a more posterior center of gravity for the upper body and provide encouragement of trunk extension, but may decrease functional reach. A back angle that is too far open can encourage the upper body to lean forward for a better visual field. Considerations in determination of appropriate back angle include: amount of hip flexion, range of motion, trunk and neck flexibility which allow for appropriate visual field, significant flexor or asymmetrical spasticity, the"Burrito test" (for ability to perform bilateral tasks), usage of other methods of trunk stability, and need for upper extremity mobility or functional tasks such as hooking on the back posts for reaching. It is imperative to evaluate the person in an upright, unsupported posture to adequately assess their needs. The back angle can be modified through the mobility base, through the aftermarket back, or both. For example, if the wheelchair back posts are interfering with freedom of movement for propulsion, then consider opening the wheelchair back and compensating with the aftermarket. Aftermarket backs tend to have smaller possible ranges with infinite adjustability for fine-tuning of the back whereas the wheelchair back posts tend to be larger possible ranges accomplished in limited degree options.

We encountered the most opinions about back height with both clinicians and consumers. Some individuals prefer a very low back barely supporting the pelvis, while others recommend a back just below the scapulae, and still others come to the shoulder. A back support that is too high may impair freedom of movement for propulsion. However, if a person does not have active trunk control, then a low back may not provide sufficient support and safety and the person may tend to flex the trunk to feel secure. The back must also be of sufficient height to provide adequate lateral stability, if it is needed. Again, in order to adequately assess needed height, it is necessary to assess posture in a seated, unsupported mode. How far up the trunk do you need to go to achieve stable trunk extension? It may be beneficial to consider a back support that provides higher support centrally and contours downward on the sides to achieve both mobility and stability adequately. In the absence of any trunk or scapular control, back height may need to extend to just below the spine of the scapulae to support adequately in a tilted position.Once posterior trunk needs are determined, lateral trunk intervention is considered. Lateral trunk supports can maintain postural alignment by centering the individual in the wheelchair. They can decrease the risk of scoliosis and the use of the upper extremities for balance and support, thus increasing the functional use of the upper extremities for bimanual tasks. They provide lateral stability to decrease lateral leaning. Consequently, lateral trunk supports can also limit functional lateral leaning and reaching and may also interfere in the ease of performing lateral transfers. If lateral trunk supports are not placed properly they can be a source of skin breakdown. When considering if and what type of lateral trunk support, is needed the therapist should assess what trunk muscles are available for support, how the upper extremities are used functionally, the chest width, the individual's balance and perception of balance with and without upper extremity support, the flexibility of any postural deformities, and the type of transfers performed.

Options for lateral support include mild to deep supports built into the back shell, lateral supports attached to the shell, swing-away laterals, and molded supports. If function does not tolerate the use of more controlling trunk supports, consideration may be given to creatively modifying the back contour to at least provide some amount of centering to the trunk.

Circumferential Intervention is an option not always considered but has demonstrated some positive physiological, structural, and functional benefits. Abdominal binders, padded corsets, and soft TLSOs have been used successfully. Circumferential supports provide external compression and an anchoring of the rib cage to pelvis relationship in order to provide trunk control and therefore they provide excellent anterior and lateral stability both in and out of the wheelchair. Unfortunately, increased stability usually comes with decreased mobility and a potential need to adapt some functional activities such as transfers. Those with long flexible trunks and decreased upper extremity function, such as persons with C5-7 SCI, benefit particularly from the stability provided, but the marginal functioning at these levels of injury is the most difficult to adapt.

The takeaway message from this session is that there are many ways to intervene at the trunk for those who are using wheelchairs as a primary mode of mobility. A full mat assessment and evaluation of the client's functional skills is essential to success when determining the most appropriate variables.

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IC 40: Understanding and Teaching Advanced Wheelchair Skills (lab session)

Darrell Musick

Learning Objectives

At the conclusion of this session, participants will be able to:

- understand advanced WC progression and how to apply skills in a logical approach based on client skill level.
- describe important wheelchair variables that affect high level WC skills.
- safely spot and a wheelchair user and give appropriate verbal cueing to improve their current skill level.

Abstract

Every person using a manual wheelchair is forced to manage community elements in order to have an active lifestyle. Advanced wheelchair skills are a required set of life skills to manage these elements. Many clinicians are limited in teaching these skills by time, knowledge or their own fear of falling. This course is designed to help clinicians understand a logical progression of wheelchair skills, be aware of critical elements related to wheelchair setup, and further develop their own skills in order to assist their teaching skills. Attendees arriving with at least basic wheelie skills (understanding the balance point) will have a chance to improve their overall skills during this active lab session.

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IC 41: The Changing Perception Towards Disability and Wheelchair Users And Its Impact on Seating Interventions and AT Provision

Bart Van Der Heyden, PT

Learning Objectives

At the conclusion of this session, participants will be able to:

- Understand the impact of how we view disability on the service delivery and AT provision. Understand to importance of respecting the individual's wishes even when there are medical concerns that need to be addressed.
- Assess the relevance of different seating assessments, seating techniques and seating interventions on several case studies in multiple care settings.

Abstract: Is the Glass Half Full or Half Empty ?

The Changing Perception Towards Disability and Wheelchair Users And Its Impact on Seating Interventions and AT Provision.

Our perception towards disability has shifted from a 'medical model' to a 'social model'. The 'medical model' tends to focus on the disabled and their physical problems. Individuals with disability need to be adapted (rehabilitated or cured) in order to fit in the world as we know it. Often, the focus lays on the impairment, rather than on the individual's needs. This view on disability has led to a segregation of rehab services and the imposition of a different lifestyle away from families and communities. The patient who's in need is subject to expert assessment and AT prescription.

Our views on disability shifted towards the 'social model' which distinguishes between impairment and disability. Impairment is being defined as the physical factors which cause immobility. Disability is defined as the limitations for the individual with disability caused by society and its tendency to accommodate to the needs of the majority of people who are not disabled. This way of thinking has led to the creation of new infrastructure which enables inclusion and a stronger focus on the individual's physical and intellectual abilities.

Recent publications points out the criticism that these models tend to oversee the specific needs of the individual by classifying them as a homogenous group without considering the levels of mobility and the individual's preferences. In other words, disability sometimes has to do with a human being, sometimes with an environment and sometimes with an identity 1 & 2.

This presentation will show how these different views on disability have led to differences in seating assessments on clients with similar disabilities in multiple care settings (Traumatic Brain Injury Rehabilitation and Cerebral Palsy Medical Pedagogical Institutes in several European countries). I will also show how these different findings have led to different seating interventions and AT provision.

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IC 42: Special Considerations for Transporting Clients with Special Needs

Delia Freney, OTR/L, ATP
Susan Johnson, CPST,

Terminology

NHTSA'S 4 STEPS for Typically Developing Kids
Convertible Car Seats
A convertible is a car seat which "converts" from a rear facing car seat to a forward facing car seat. Typically, a convertible car seat goes to 30 lbs. rear facing and is reclined. After it is turned around forward facing, it cannot be reclined. Typically convertible car seats go to 45 lbs.

Combination Car Seats

A combination car seat is a forward-facing-only car seat that has a 5-point internal harness and can also be used later as a belt-positioning booster car seat.
The belt-positioning booster seat does not intend to do anything except to provide better positioning of the vehicle lap shoulder belt.

Belt Positioning Boosters

Are upright so don't provide positioning to help with upper body weakness
Don't have a harness to provide additional support
Recent controversy over testing which indicated that some BPBs provide LESS safety than a regular seat belt because it routes the belt away from body leaving a gap.

Conventional Child Restraints for Children with Special Needs

Conventional restraints may be used in some cases; especially for smaller children
May be used provided that:
the child is within the weight specifications of the CR (high weight harness usually only to 65 lbs. but now up to 85 lbs.)

- the child has adequate hip flexion to sit upright in the seat
- the child can breathe satisfactorily in the seat
- the child can maintain head control in sitting

Regulation Overview: What are the Rules?

Federal Laws
State Laws
Best Practices
Reality of ticketing and fines

Fmvss 208- The Vehicle Restraints

Regulates seat belts and frontal air bags
Beginning with 1996 all seat belts must lock to secure child restraints (Remember ALRs, ELRs, and switchable retractors?)

Fmvss 225- The Vehicle

LATCH in vehicles. (lower anchors and tethers for children)
Location and strength of top tether anchorage points(req'd in 3 seating positions)
Lower anchorages in or near seat bight (2 seating positions)
Scope: light duty passenger vehicles mfg. after Sept. 2002
Standard includes:
Crashworthiness –
30 MPH frontal crash with CR on bench seat
Use of age/weight specific crash test dummies

Fmvss 213- The Car Seat

CR performance standards for children to 65 lbs.
(many special needs car seats go well beyond that weight- higher weight crash tests are voluntary for mfr.)
Standards include:

- Crashworthiness (how CR holds up in a 30 MPH frontal crash)
- Labeling and instructions (very explicit language and disclosure)
- Flammability
- Buckle release pressure

Lower Anchorages and Tethers for Children

(LATCH) for CRs.
Lower anchors replace seat belts for installation
Top tether reduces forward movement (excursion)

FMVSS 213- Aircraft use

The FAA and NHTSA decided to unify their regulation for child restraints used in aircraft seats
Requires an "inversion test"
Mfr. must state whether the CR is "certified" for aircraft use on its label.
There is NO FAA "approval". It is self certification by the mfr.
LATCH- Lower Anchors
LATCH- Tethers
FMVSS TIES IT ALL TOGETHER!
FMVSS Tie Together Safety of the Vehicle Components With the Safety of the CRS:

The Seat Belts, the Latch Anchorages, and the Child Safety Restraints are all Regulated by Fmvss.

Guidelines for Transportation- children with special needs

In general:

- Minimize travel
- Make frequent stops
- Have enough power for portable medical equipment for at least twice the length of the trip
- Position the child in the back seat of the vehicle with an adult observing
- Deactivate the passenger-side airbag if positioning the child in the front passenger seat is the only option
- Travel with a medical care plan that addresses appropriate measures to follow in the event of an emergency
- For long trips, make sure to have a list of health care providers and durable medical equipment providers that can be contacted en-route.

Considerations for Restraint Selection-Special Needs

Child's weight and height
Child's age
Child's medical condition
Recommended seated position
Families or caregivers
Medical equipment
Vehicle
Amount of travel
Funding sources

Special Needs Car Seats
Carrie Seat
Roosevelt- Merritt Manufacturing
Velcro cap to keep head up
EZ Tether holds shoulder strap in place
Britax Traveller Plus- Snug Seat
Special Tomato MPS
Hippo (Spica)- Snug Seat

Columbia 2000/2500 IPS
Unmet Needs
Most adaptive car seats do not provide enough recline. Many clients need 30-45 degrees to achieve adequate upper body control to maintain open airway and/or fit occupant restraint.
Complex positioning requirements were not met by adaptive car seats
Car seat difficult for transfers of larger clients
Funding limitations in some states

Columbia Spirit APS
Benefits:
Optional adjustable swing away trunk and hip supports
Low profile sides for easier transfers
Provides more room for shoulder and seating leg widths
Multiple accessories for growth

Installation
Should be verified by a certified person (CPST)
Positioning options should be fitted by an RTS or a therapist.
Should be checked monthly by parent
Must be installed according to the manufacturers' instructions for the restraint AND the vehicle.

Get to know them...
- CPS Technicians- Excellent Local Resource!
- Listing available at www.safekids.org
- Look for Special Needs Training designation (Riley Hospital administers the program). www.preventinjury.org

Tips For Proper Positioning

Position child with back and bottom flat against seat
Do not place extra padding behind or under the child unless allowed by restraint manufacturer
Place rolled receiving blankets on either side for lateral support
If crotch strap too far forward, place rolled cloth between child's crotch and crotch strap to help prevent submarining
Harness straps should lie flat and without slack against the child's body

Lack of head control concern
Only recommended after market head support.....
Wheaton Soft Cervical Collar

Footrests- A Low Tech Solution
Costco Paper Towel Rolls

Tips for Proper Installation

The back seat is considered safest location
In most instances, use seat belts that stay pre-crash locked
Apply weight to the restraint to get a tight installation
Make sure the restraint doesn't move more than one inch side to side at the belt path or away from the back of the seat

More Tips for Proper Installation

Harness retainer clips should be positioned at armpit level
Harness straps should be positioned at or below the shoulders of a rear-facing child
Harness straps should be positioned at or above the shoulders of a forward facing child- over the reinforced part of the child safety seat
Attach specialized restraint tethers to appropriate hardware
Follow LATCH (Lower anchors and tethers for children) attachments weight maximums

Car Seats on School Buses
Compartmentalization
On the school bus...
In a school bus, the car seat must be installed on a reinforced "210" seat with a seatbelt
On the school bus seat depth is 15 inches... no room to recline
On the school bus...
Can't sit an unrestrained person behind a car seat

Meet Suzanna
Meet Maria
Lateral view

Meet Veronica
Veronica's Story
Veronica is 27
She had meningitis from an ear infection when she was 9 mos old. She had been cruising before that
Both hips are dislocated
Scoliosis
G-tube. Non-verbal
She never used a stander or gait trainer

Veronica's Current Wheelchair

Good News!
New folding wheelchair that family can transport in trunk
Columbia car seat with Shur-Shape positioning no longer available

Car Seat Quiz
How does a child safety seat protect a child in a crash?
What standard applies to the crashworthiness of child safety seats?
Why are car seats (and all vehicles) tested at 30 MPH?

Resources

- www.safekids.org
- LATCH manual
- Your local car seat tech

IC 43: Investigating Clinically Relevant Cushion Characteristics Via Laboratory Testing

J. David Mccausland, ROHO
Mark Greig, P.Eng

Over the last several years, demand for "evidence" as a basis for clinical practice, regulatory policy and third party reimbursement; in order to augment "expert opinion", "clinical judgment" and / or "history" is dramatically increasing. However, this demand for evidence is has been difficult to satisfy for non-invasive, durable medical equipment.

The challenge becomes even more difficult when dealing with clinical conditions such as "the prevention and treatment of wounds" and "seated positioning" where we are dealing with a host of primary diagnoses and the need for a holistic approach. For such categories of products, the historic "clinical study" basis for evidence becomes problematic, if not impossible. As such, the presenters have developed a series of laboratory methods to test, compare and contrast the characteristics and features of seat cushions.

In this session, we will focus on the testing results between adjustable and non-adjustable cushions, specifically:

- Skin Integrity - Measurements related immersion, envelopment and magnitude
- Positioning - Measurements related to lateral and forward stability

Further, we will discuss the impact to a cushion's performance from:

- Changes to the pelvic shape.
- Changes to the individual's weight.
- Time in the seated position.
- Normal wear and tear (aging) of the cushion.

The session will conclude with a review of the metrics and a discussion on how these measurements can be applied in a clinical setting.

Upon completing this course, Attendees will be able to…

1. Understand the test methodologies and their clinical relevance
2. Understand the differences between the Adjustable and Non-adjustable cushion against key metrics
3. Understand the impact that time, aging and changes to the individual have of the ability of the cushion to address an individual's needs
4. Understand how these metrics might be applied in the clinical setting

References: Science of Seating test methodology presented at ISS 2010

C 44: Diagnosis... More Than Just Words

Brenlee Mogul-Rotman, BSc (OT), OTR, ATP, OT (Reg. Ont.),

"What is your diagnosis?" A typical question asked at the beginning of any assessment. When we get the answer to the question however, do we really understand what the words mean? What are the implications of the diagnosis or condition on the rest of our assessment and the types of devices that we may end up prescribing for our client?

Details of the client's condition is important to understand. As clinicians we must focus on identifying issues that are pertinent to the current assessment and pending prescription but also to the long term potential needs of our clients.

The following provides basic and introductory information on a variety of common and not-so-common conditions. The information in this paper is taken from various internet sources that provide quick and up to date information, consistent with the type of information searching that many of us do on a daily basis. The information is not intended to assist with confirming a diagnosis, just some introductory items that may be used by the team member when assessing and meeting a new client. There are many sources for searching for information and it is up to the individual to check accuracy.

ALS

Amyotrophic lateral sclerosis (ALS), sometimes called Lou Gehrig's disease, is a rapidly progressive, invariably fatal neurological disease that attacks the nerve cells (neurons) responsible for controlling voluntary muscles. The disease belongs to a group of disorders known as motor neuron diseases, which are characterized by the gradual degeneration and death of motor neurons.

ALS causes weakness with a wide range of disabilities. Eventually, all muscles under voluntary control are affected, and patients lose their strength and the ability to move their arms, legs, and body. When muscles in the diaphragm and chest wall fail, patients lose the ability to breathe without ventilatory support. Most people with ALS die from respiratory failure, usually within 3 to 5 years from the onset of symptoms. However, about 10 percent of ALS patients survive for 10 or more years.

Ankylosing Spondylitis

Ankylosing spondylitis is a form of chronic inflammation of the spine and the sacroiliac joints. The sacroiliac joints are located in the low back where the sacrum (the bone directly above the tailbone) meets the iliac bones (bones on either side of the upper buttocks). Chronic inflammation in these areas causes pain and stiffness in and around the spine. Over time, chronic spinal inflammation (spondylitis) can lead to a complete cementing together (fusion) of the vertebrae, a process referred to as ankylosis. Ankylosis leads to loss of mobility of the spine.

Arthritis

The major complaint by individuals who have arthritis is pain. Pain is often a constant and daily feature of the disease. The pain may be localized to the back, neck, hip, knee or feet. The pain from arthritis occurs due to inflammation that occurs around the joint, damage to the joint from disease, daily wear and tear of joint, muscles strains caused by forceful movements against stiff, painful joints and fatigue. The most important factor in treatment is to understand the disorder and find ways to overcome the obstacles which prevent physical exercise.

Cerebral Palsy

Cerebral palsy (CP) is an abnormality of motor function (as opposed to mental function) and postural tone that is acquired at an early age, even before birth. Signs and symptoms of cerebral palsy usually show in the first year of life.

This abnormality in the motor system is the result of brain lesions that are non-progressive. The motor system of the body provides the ability to move and control movements. A brain lesion is any abnormality of brain structure or function. "Non-progressive" means that the lesion does not produce ongoing degeneration of the brain. It is also implies that the brain lesion is the result of a one-time brain injury, that will not occur again. Whatever the brain damage that occurred at the time of the injury is the extent of damage for the rest of the child's life.

Charcot-Marie Tooth Disease

Charcot-Marie-Tooth disease (CMT) is one of the most common inherited neurological disorders. CMT, also known as hereditary motor and sensory neuropathy (HMSN) or peroneal muscular atrophy, comprises a group of disorders that affect peripheral nerves. The peripheral nerves lie outside the brain and spinal cord and supply the muscles and sensory organs in the limbs. Disorders that affect the peripheral nerves are called peripheral neuropathies.

The neuropathy of CMT affects both motor and sensory nerves. A typical feature includes weakness of the foot and lower leg muscles, which may result in foot drop and a high-stepped gait with frequent tripping or falls. Foot deformities, such as high arches and hammertoes (a condition in which the middle joint of a toe bends upwards) are also characteristic due to weakness of the small muscles in the feet. In addition, the lower legs may take on an "inverted champagne bottle" appearance due to the loss of muscle bulk. Later in the disease, weakness and muscle atrophy may occur in the hands, resulting in difficulty with fine motor skills. Although sensory nerves are also involved, patients rarely notice significant numbness or pain.

Fibromyalgia

Fibromyalgia is a chronic condition causing pain, stiffness, and tenderness of the muscles, tendons, and joints. Fibromyalgia is also characterized by restless sleep, awakening feeling tired, fatigue, anxiety, depression, and disturbances in bowel function. Fibromyalgia was formerly known as fibrositis.

While fibromyalgia is one of the most common diseases affecting the muscles, its cause is currently unknown. The painful tissues involved are not accompanied by tissue inflammation. Therefore, despite potentially disabling body pain, patients with fibromyalgia do not develop body damage or deformity.

Lupus

Lupus is an autoimmune disease characterized by acute and chronic inflammation of various tissues of the body. Sometimes lupus can cause disease of the skin, heart, lungs, kidneys, joints, and/or nervous system. When only the skin is involved, the condition is called lupus dermatitis or cutaneous lupus erythematosus. A form of lupus dermatitis that can be isolated to the skin, without internal disease, is called discoid lupus. When internal organs are involved, the condition is referred to as systemic lupus erythematosus (SLE).

Multiple Sclerosis

Multiple sclerosis (MS) is a disease in which the nerves of the central nervous system (brain and spinal cord) degenerate. Myelin, which provides a covering or insulation for nerves, improves the conduction of impulses along the nerves and also is important for maintaining the health of the nerves.

In multiple sclerosis, inflammation causes the myelin to disappear. Consequently, the electrical impulses that travel along the nerves decelerate, that is, become slower. In addition, the nerves themselves are damaged. As more and more nerves are affected, a person experiences a progressive interference with functions that are controlled by the nervous system such as vision, speech, walking, writing, and memory

Multiple sclerosis symptoms may be single or multiple and may range from mile to severe intensity and short to long in duration. Some symptoms may include:

- visual disturbances,
- limb weakness,
- muscle spasms,
- loss of sensation, speech impediment, tremors, or dizziness,
- depression,
- manic depression,
- paranoia, or
- uncontrollable urge to laugh and weep

Muscular Dystrophy

Muscular dystrophies are a family of hereditary (genetic) diseases that cause progressive and steady muscle weakening and wasting.

Due to this diversity, the severity in symptoms of different muscular dystrophies may vary greatly, from very mild to deadly, with the most dangerous being the ones that affect cardiac muscle and the diaphragm (the main respiratory muscle). The age of onset can vary from childhood to adult age, and there are also several differences in the rate of progression and muscle distribution. Generally, symptoms include the inability, or reduced ability, to walk erect and perform muscle-intensive workouts (such as weight-lifting); other symptoms include frequent calf cramps, limited range of motion, scoliosis (curved back) and inability to keep one's eyelids open (eyelid ptosis). As the severity of the disease increases, other symptoms may include an inability to breathe and frequent heart problems, at which point medical assistance is absolutely essential for survival.

Osteogenesis Imperfecta

Osteogenesis Imperfecta (OI) is a genetic bone disorder characterized by fragile bones that break easily. It is also known as "brittle bone disease." The term literally means "bone that is imperfectly made from the beginning of life." A person is born with this disorder and is affected throughout his or her life time. In addition to fractures people with OI often have muscle weakness, hearing loss, fatigue, joint laxity, curved bones, scoliosis, blue sclerae, dentinogenesis imperfecta (brittle teeth), and short stature. Restrictive pulmonary disease occurs in more severely affected people.

Parkinson's Disease

Parkinson's disease belongs to a group of conditions called movement disorders. The four main symptoms are:
tremor, or trembling in hands, arms, legs, jaw, or head;
rigidity, or stiffness of the limbs and trunk;
bradykinesia, or slowness of movement; and
postural instability, or impaired balance.

These symptoms usually begin gradually and worsen with time. As they become more pronounced, patients may have difficulty walking, talking, or completing other simple tasks Parkinson's disease is both chronic, meaning it persists over a long period of time, and progressive, meaning its symptoms grow worse over time

Post Polio Syndrome

Post-polio syndrome (PPS) is a condition that affects polio survivor's years after recovery from an initial acute attack of the poliomyelitis virus. Post-polio syndrome is mainly characterized by new weakening in muscles that were previously affected by the polio infection and in muscles that seemingly were unaffected.

Symptoms include slowly progressive muscle weakness, unaccustomed fatigue (both generalized and muscular), and, at times, muscle atrophy. Pain from joint degeneration and increasing skeletal deformities such as scoliosis are common. Some patients

experience only minor symptoms. While less common, others may develop visible muscle atrophy, or wasting

Spinal Cord Injury

A spinal cord injury occurs when there is damage to the spinal cord either from trauma, loss of its normal blood supply, or compression from tumor or infection.
Spinal cord injuries are described as either complete or incomplete. In a complete spinal cord injury there is complete loss of sensation and muscle function in the body below the level of the injury. In an incomplete spinal cord injury there is some remaining function below the level of the injury. An injury to the upper portion of the spinal cord in the neck can cause quadriplegia-paralysis of both arms and both legs. If the injury to the spinal cord occurs lower in the back it can cause paraplegia-paralysis of both legs only

Traumatic Brain Injury

Traumatic brain injury (TBI, also called intracranial injury) occurs when an external force traumatically injures the brain. TBI can be classified based on severity, mechanism (closed or penetrating head injury), or other features (e.g. occurring in a specific location or over a widespread area). Head injury usually refers to TBI, but is a broader category because it can involve damage to structures other than the brain, such as the scalp and skull.

Brain trauma can be caused by a direct impact or by acceleration alone. In addition to the damage caused at the moment of injury, brain trauma causes secondary injury, a variety of events that take place in the minutes and days following the injury. These processes, which include alterations in cerebral blood flow and the pressure within the skull, contribute substantially to the damage from the initial injury.

TBI can cause a host of physical, cognitive, emotional, and behavioral effects, and outcome can range from complete recovery to permanent disability or death.

Stroke

A stroke (sometimes called a cerebrovascular accident (CVA)) is the rapidly developing loss of brain function(s) due to disturbance in the blood supply to the brain,

caused by a blocked or burst blood vessel. This can be due to ischemia (lack of glucose and oxygen supply) caused by thrombosis or embolism or due to a hemorrhage.[1] As a result, the affected area of the brain is unable to function, leading to inability to move one or more limbs on one side of the body, inability to understand or formulate speech, or inability to see one side of the visual field

Spina Bifida

Spina bifida is a developmental birth defect caused by the incomplete closure of the embryonic neural tube. Some vertebrae overlying the spinal cord are not fully formed and remain unfused and open. If the opening is large enough, this allows a portion of the spinal cord to protrude through the opening in the bones. There may or may not be a fluid-filled sac surrounding the spinal cord. Other neural tube defects include anencephaly, a condition in which the portion of the neural tube which will become the cerebrum does not close, and encephalocele, which results when other parts of the brain remain unfused.

Spina bifida can be surgically closed after birth, but this does not restore normal function to the affected part of the spinal cord.

References

- www.medicinet.com
- Wikipedia.org
- Various associations related to diagnoses, Google etc.

Speaker Bio

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IC 45: Clinical Standards in Specialized Services

Simon Hall

The Central Remedial Clinic Ireland operates within the increasingly difficult environment of the health sector in Ireland, new legislation; health services reform (reformation of the health boards into the HSE), budget cuts and changing demographics are forging changes across the health sector. At a political level, there have been a number of significant policy and legislative advances in recent times underpinning services for people with disabilities with direct effect on all organisations.
The focus of this research is the Central Remedial Clinic (CRC) and its response to this changing environment. This paper will provide a management overview of our specialised and unique services within the CRC with a view to highlighting tease services to our stakeholders for the purpose of proving the service is value for money and also difficult to copy,

I also have conducted an in-depth analysis of assistive Technology and specialised Seating and perform a clinical audit of the area, also I intend to Focus on one area of this service which is Tactile / Moulded seating and show how we used Outcome measures as part of our overall Clinical governance.

The aim is to prove clinical governance over all our service, I have taken a random sample of our main client group, clients with cerebral palsy will prove or disprove the hypothesis that the CRC has met the challenge and are meeting the needs of this client group. Again emphasizing value for money by proving proper management processes are intact

Background / Culture of the Organisation

The Central Remedial Clinic was established in the 50 to deal with a polio epidemic sweeping the country we have gone through many changes and have seen a mission creep, however imbedded in the organisations is our culture
Over the past twenty years, the Central Remedial Clinic has established a number of specialised and unique services including a
Clinical Gait Laboratory,

- Assistive Technology & Specialised Seating services,
- Feeding and swallowing clinic
- Muscle clinic
- Hand clinic
- Orthopaedic clinics
- Adult rehab clinics
- Spasticity clinics
- However, the clinic has never used these services as advantage with our stakeholders for additional funding or recognition
- As part of my thesis, I intend to apply my management strategies to carry out a clinical audit on one of these specialised services

In 2003, one of these services Assistive technologies established a new clinic for its complex clients; this clinic was Tactile/moulding clinic. This research proposes to evaluate the efficacy of this service, it proposes to look beyond traditional clinical domains and analyse the social, economic and environmental conditions that affect the client and the service when a specialised service is the preferred intervention.

It will apply measurement instruments based on the ICF (International Classification of Functioning, Disability and Health).

The ICF was utilised as a response to the problem of evaluating the effectiveness of health care processes, it is considered that traditional methods that narrowly focus on the diagnostic and clinical results are not useful when measuring outcomes of long-term disability. This research will go beyond diagnosis, prescription and look to monitor the consequences of intervention. It will provide a comprehensive picture of the CRC specialised facility from both a client and system perspective.
With changing demands on the health care system, and new models of care been introduced, most health-care systems are increasingly focusing on integrating care across all health-care providers, care settings and devising resource allocation mechanisms that can support this.

The paper will provide an overview of the CRC specialised services and in analysing one sector, will provide a clinical audit to determine its effectiveness and that the service is meeting the needs of our population.

A recent report (ESRI 2010) on the Resource Allocation, Financing and Sustainability in Health Care concluded, "Changes are required in the operation of the present health care system in Ireland if progress is to be made in meeting the aims of current health care policy. The report argues that as the system stands it is not capable of producing high quality, easily accessible and safe care that is delivered cost-effectively.

The report has determined that the issues are systemic and changes need to go right through the system and that that this process of decision making must become more transparent The Health Information and Quality Authority have determined that there is a need for an integrated, standards-driven, approach to quality in all healthcare provision. Traditionally the services received were considered as the standard for establishing social validity using client surveys, waiting lists as opposed to establishing the success of intervention for the client's needs etc Measuring Quality of life now is generally considered a more reliable measures to evaluate services, rather than merely questioning users as to their degree of satisfaction

Seating and postural management is a fundamental aspect to the care and rehabilitation of children with cerebral palsy and has significant influence on the quality of their lives. Surgical and medical interventions have an enormous impact on the seating requirements of this cohort and effect on the level of position support required. Successful prescription of postural supports involves careful assessment, measurement, considerations of the clients' quality of life, participation and environment. From a systems perspective, consideration must also be given to cost factors, value for money and quality service provision.

Methodology

A mixed method research design will be employed with the use of a validated measurement instruments to measure the efficacy of moulded seating systems, the impact on the quality of life and participation of the clients and their carers. To supplement quantitative data, user and expert interviews, activity monitoring and focus groups will provide rich qualitative data. To achieve the outlined objectives the study will be include

Clinical results

- Quality of life and Participation of clients and carers
- Wheelchair outcomes measurement
- User Analysis
- Activity Analysis
- Cost benefit analysis

How I intend to carry out a clinical audit?

How I choose my topic

What makes a good topic?

- I Agreed problem
- Important aspects of the situation
- Good evidence
- Measurable
- Amenable to change
- Achievable within your resources (IT, space, financial and human)

What is important topic for my Audit?

- High level of concern with an issue
- High impact on health of patients or resources
- Common procedures or conditions

What are my organisational priorities?

- National standards or guidelines
- HSE Board priorities
- Local audit programme
- Local problems and priorities
- User views or complaints

Define my Aims and Objectives Aims

- Why am I you doing this project?
- What am I hoping to achieve?
- What are my Objectives?
- How specifically will I achieve my aims?
- What will I improve and assess?

Set my Standards

- I need to identify evidence of good practice as
- As a basis for setting standards. More information on appraising and using evidence is
- Available

Where do I get my standards?

- National guidelines, standards & local priorities
- Other teams
- Establish baseline standards

Once I have established my standards

1. I will State my Criteria – elements of care or activity, which can be measured
2. I will Set my desired level of performance or target (usually a percentage)
3. Standard: Patients with a diagnosis of CP should be reviewed every 6
4. months ,should have an orthopaedic review every 6 month The Clinical audit will involve looking at information already collected about a patient or treatment.
5. However, issues of confidentiality and unsound practice have to be considered.
6. The clinic Board has an ethics committee that meets regularly to assess research and
7. Special interest projects. If I have any questions relating to ethical issues related to an
8. In the Clinic we collect many data but how much of it is used to make useful, informed
9. Decisions about improving patient care. Before I look at tools of design a data collection tool, I will check

What information is collect at the moment and consider

- Retrospective (trawl existing records) or prospective (collect data from now)
- Who is your target population?
- What data will you collect? (Only what is necessary)
- Who will I collect the data?
- Where will I get the data from?
- What time period will I use? (I.e. start date and finish date)
- How will I select your sample? (How many subjects do you need?)

Data collection – Key points

- Develop a simple data collection form based on the information I want to collect.
- Check it out with colleagues to make sure that it is giving me the data in useful.

Sources of data

- Clinical records
- Disease or activity data sets
- Survey/questionnaire
- Interview.

Analyse my data

- I need to make sure you leave time to analysis your data
- will I need statistical help? With some of the out come measures I am using I can get this data
- I intend to Use spreadsheets to make the information clear
- Understandable and visually appealing

What changes in our practice will need to be made?

To achieve this and implement changes, I will need to develop an action plan
- Or something in more detail?
- When it is clear what changes need to be made? (If not, I may need to look in more detail

At a specific part of treatment ect
- How am I going to implement changes?
- Who will need to be involved?
- What new resources will I require?

Make the changes.
- Set new targets
- Tell people what I have done

Inform my colleagues and manager

- I may consider an Audit newsletter
- Present or display findings at national events and conferences
- Re audit
- Our practice with the changes, check standards.
- Clinical audit is about improvement.

IC 46: Water Sports: Seating in an Unstable Environment

Leif Nelson, DPT, ATP, CSCS
Chad Kincaid, CP, PT

Abstract

In a world that is 70 percent water, a majority of professionals working in the seating and mobility industry are not fully aware of the available activities and adaptive technologies available to keep their clients afloat. There are a sea of options available in the world of "adaptive sports" that are readily available in the buoyant world of water. A plethora of options are available for those seeking high velocity thrills, the exercise high from aerobic paddling, or just sailing through the weekend looking for some sun and fun. Skill levels range from novice participation to elite competition, and supprt may already be in place in your area.

Aquatic options for sports and recreation highlighting adaptive technologies will be featured during this session with a focus on, kayaking, sailing, swimming, water skiing among other water based activities. An overview of water sports available to those with physical, cognitive and/or visual impairment will be provided with a review of necessary functional skills for successful participation. Seating interventions for sports equipment to optimize support, skin protection and optimal performance will be highlighted. Adaptive technologies for each activity highlighted in this session will be reviewed in a format to allow the audience to understand similarities and differences of the many adaptive equipment options available. Photos, video and case examples will be utilized to demonstrate activities and interventions. Resources for pursuing and promoting aquatic recreation participation will be shared as well. By the conclusion of the session, the audience will be informed and excited to support client exploration of aquatic adaptive sports and recreation.

Brief Description

This lecture is designed to be a PFD (personal floatation device) to keep clinicians above water in the world of aquatic sports and recreation. Adaptive options and technologies for water sports activities will be highlighted with a focus on, kayaking, sailing, swimming, water skiing and some other water front activities. Seating interventions for sports equipment will be demonstrated. Adaptive technologies utilized will be reviewed as well as emphasis of important clinical skills. By the conclusion of the session, the audience will be informed and excited to support client exploration of hydrophilic adaptive sports and recreation opportunities.

Objectives

Upon completion of this session, participants will be able to:

- Describe five options for water sports and recreation participation for individuals with physical, sensory and/or cognitive impairments.
- Determine most appropriate sport-specific seating interventions in adaptive water activities based on client needs and available materials.
- List three resources for adaptive aquatic sports and recreation participation.

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IC 47: I Know the Best Product for My Client, But Will it Be Funded

Claudia Amortegui, MBA,

A therapist's role has become a key in allowing their patients to receive the best product to meet their needs, but also be covered by their funding source. As insurance companies continue to tighten the rules, the question of "what is the funding source(s)" should be one of your initial questions during or prior to a seating evaluation.

Once you know the funding source, the next question is do you know what that means in regards to what can be ordered for your patient? If you are unsure, your provider is going to be your ally in the process. They, as much as you, want to be certain that the insurance claim is paid. In many cases, the provider will first have to deliver the product before any monies are paid to them. Exceptions to this are most Medicaid programs, specifically for the under 21 population and some of the commercial insurances. When the therapist is aware of what type of products will be funded for their patient, the process can begin. This information will avoid headaches and delays in delivery of the equipment.

Whether you work with the pediatric, adult or geriatric market, a good rule of thumb tends to be if an order would meet the Medicare coverage criteria, it will likely be paid by all other funding sources. Medicaid coverage has tightened-up in most states for all beneficiaries.

As you look to evaluate if you are providing the appropriate documentation, it is suggested that you look at your specific area of expertise and/or your client population. This will allow you to assess your current evaluation forms/letters. Another key in your assessment is whether your providers are continuously asking for additional information.

Some basics that always should be provided, but at times seemed to be missed are: Full patient name, date of birth, height and weight, primary diagnosis, secondary diagnosis/conditions, date of the evaluation, and if this equipment is for a first time user or replacement of other equipment (even if going from a manual wheelchair to power).

Then it comes down to the details. Most funding sources are looking for clinical documentation for all the different options/accessories that are being ordered and billed. This does not necessarily have to line by line for each item, but the information needs to be within your notes. In most cases, this is not something that the provider can complete and just have you sign. If they do, the funding sources may ask for "proof" within any clinical notes (from the therapist or the physician).

Something else to keep in mind is the fact that the majority of funding sources will look at a patient's current medical need, not necessarily what they will "likely" need in the future. This does not mean that they will not pay for medically necessary modifications down the road (or possibly even new equipment). When providing documentation for patients with progressive conditions, it is strongly suggested that you state the specific individuals situation, not a general statement about any person with the listed diagnosis (i.e. ALS). If a patient is progressing, discuss how fast, how slow, and what it is affecting. Remember, you know your patient but the funding source only knows them by a number and the paper provided to them. It is your job to tell the story and draw the picture of your patient with your words.

Some funding sources also require an ATP, who is employed by the provider, to be involved with the order. Keep in mind, this does not mean they just sign-off on documents and never are part of the equipment selection process. This requirement was created to protect the patient, to help ensure that they are working with a person knowledgeable in seating and positioning.

If you are provided with information that does not appear to make sense, always verify the data. Providers are given a lot of information and at times, without meaning to, the information is not interpreted correctly. The rumors of certain products not being funded tend to start by those providers that are having difficulties in being reimbursed for the specific item; therefore the immediate conclusion is the item is not covered. Ask questions and ask others. You do not need to know all the funding codes; you just need to be involved in the process. Many funding sources will have time limitations on when documentation must be received and how quickly product needs to be delivered. Without a therapists support, these timelines will be missed and the whole process will have to start over again.

IC 48: Understanding and Teaching Advanced Wheelchair Skills (Session 2)

Darrell Musick, PT

IC 49: Seating and Positioning Fairy Godmothers: Real Live Cases in an Interactive Game-Show Format

Ginny Paleg, DScPT

It takes a team (stand and do the wave, like at a baseball game). This session will be a demonstration of how practitioners in the field can access master clinicians, loaner equipment, help with funding, and so much more. Every case is different, so this session will use 4 cases to highlight how one practitioner (Ginny Paleg, PT) contacted manufacturers, peers and researchers to design and deliver the best possible solutions for seating and positioning so her students could increase their activities and participation.

The first case is a child (from age 1-8 years) with dyskinetic (aka dystonia/athetosis) tetraplegic (all 4 extremities) cerebral palsy (CP). When Hunter was only one year old, he could not tolerate sitting at 90/90. I tried and tried, and he cried and cried. I needed help, so I waved my wand (or lifted my cell phone) and called my seating and positioning fairy godmother, Sharon Pratt. She performed a thorough evaluation and found that his right hip was subluxed and painful. This was why he could not sit. Sharon showed me how to combine an open seat angle with an anterior tilt. She used immersion in a gel and foam cushion to help stop him from sliding out and chastised me for my use of abductors. Sharon also showed me how to use split seating to accommodate asymmetrical postures and tendencies.

When seating infants and children with bones that are still growing and whose spinal curves have not yet developed, we need to be extra careful of where we load and direct the forces of gravity. When I needed help finding the right pelvic support, biangular back and split seating, I clicked my heels three times (got on Skype) and turned to Clare Wright. She will share her thoughts on Hunter.

Hunter has a movement disorder (dyskinesia) as well as spasticity (use the HAT (hypertonia assessment tool) to determine this). Cimolin (2009) suggested that children like Hunter could experience reduced dystonia of the upper extremities with the use of dynamic seating systems. Expert Eli _____ will share his thoughts.

Lastly, I was frustrated by Hunter's insistence on staring at the floor. Nothing I did could entice him to hold up his head, although I knew he could. So I waved my wand and wished for Leslie Fitzsimmons to help me out. She helped ensure that my seating system was not encouraging extreme postures (she calls them reflexes) and provided a special headrest which she will discuss.

This case is intended to show how experts are accessible and clinicians should feel comfortable in using these folks (or fairies) as resources.

The second case story is about a 2 ½ - 6 year old with arthrogryposis. At 2 1/2 , he could sit, but not roll, scoot or talk. His early intervention therapist wanted some help to teach him to move. We begin by conjuring up Canadian Fairy Godmother, Maureen Story and from Chicago, Fairy Princess (she insisted on being a princess), Susan Johnson Taylor and asking them what they would have done.

Lois Brown and Stephanie Tauguay then share with us what they each did to make Kaspar functional at school and better able to participate in activities. He had no funding so we will discuss how to appeal and find grants. Nancy Perlich will tell us how she has assisted countless families go thru appeal processes and win! We will also hear from Kaspar's mom how mobility motivated her son to talk and learn.

The third case story is a 3 year old with SMA type I. Her family's goal was to get out of house with all of their equipment and with Aleena fully reclined (almost flat). They also wanted her to be able to drive the chair in the house. The father traveled to ISS 2 years ago with Ginny to meet as many Fairy Godpeople as possible, and come up with solutions. Michelle Lange will share the journey to find the perfect switch access point, I will share how Mary Massery's lecture at ISS last year led me to order a soft body jacket. Stephaney Tanguay will share her experience with the family. Weezie Walker will discuss her frustration, and in the end success, in serving a family that did not follow the rules. While this case is very unusual, the solutions are magnificent and should be the beginning point not the end point, for all children similar to Aleena.

The last case story is a 6 month – 4 year old with hypoxic ischemic encephalopathy (CP). Despite early aggressive positioning and therapy, Wyatt developed a moderate flexible scoliosis by age 1. A soft TLSO was used, but the family and child care providers found it cumbersome. Fairy Godfather Jim Noland assessed Wyatt with me and recommended a custom system that placed Wyatt in an active seated position. For the very first time, he could hold his head up for 15 minutes at a time! He showed me the magic of an expert caster. Ken Vanstarlen helped provide Wyatt with a relaxed, recreational seated system. We will discuss the need for different systems and how we can get these funded.

Throughoutthe entire sessions, audience response units will be used so that each participant can be heard and share their "magic". We all have expertise, and we all need help. It takes a team (do the wave)! We hope we have grown each and every participant a new connection and the ability to reach out and build their team!

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IC 50: Assessment Issues for Individuals with Spinal Cord Injuries

Faith Saftler Savage, PT, ATP

People with spinal cord injuries have unique needs. In most cases, the level of injury specifies the types of problems that will be encountered with movement and sensation. The injury itself tends to be stable after fusions and further loss of function doesn't tend to be an issue. Seating and wheeled mobility should be easy but this isn't the case. Injuries, pressure sores, aging, prolonged poor positioning and changes in function continue to challenge our decision making process.

A series of case studies will be presented in this course with people that were injured from 3 years to 30 years ago. Each case study is unique in discussing different types of problems encountered by various individuals. Case studies will discuss the effects of old injuries on seating, positioning issues affect on breathing, self esteem, appearance, function, pressure sores and the difficulty of switching from one type of wheelchair to another due to changes in technology.

A thorough assessment is needed to determine optimal positioning and functional needs. This includes the mat assessment, seating simulation, manual wheelchair testing and/or power wheelchair testing. Depending on the person' level of injury, observation and discussion of transfers, driving (from wheelchair or car seat) and performance of other ADL's is also critical to ensure the person is satisfied with all components of prescribed equipment. Balancing the physical needs of the person with the desires of the person can be very difficult when determining the optimal wheelchair system.

There are no perfect solutions with this population. Group discussion will be encouraged to assist with solutions and provide examples of other possibilities to satisfy the end user.

IC 51: Wheelchair Basics and Reimbursement for Wheelchair Therapy Services

"Jodie" Stogner, PT, ATP/SMS

Objectives

1. The participants will be able to demonstrate techniques of measuring an individual for an appropriate sized wheelchair.
2. The participants will be able to identify and record the appropriate information as it relates to basic wheelchair documentation for insurance coverage.
3. The participants will be able to identify key elements of Medicare's local coverage determination for powered mobility devices.
4. The participants will learn how to effectively incorporate Medicare's Mobility Assisted Equipment Algorithm into their daily business activities.
5. Identify CPT codes that are appropriate for use with therapy wheelchair services
6. Identify documentation requirements that support the use of CPT codes billed for therapy wheelchair services
7. Identify obstacles to outpatient Medicare Part B access for Medicare beneficiaries when referred for specialty wheelchair evaluations
8. Understand and identify modifiers to CPT codes when billing for therapy wheelchair services for reimbursement of services performed
9. Identify coding challenges to CPT codes used for the billing of therapy wheelchair services
10. Define the necessary provider numbers needed for Medicare billing of independent practitioner services

CPT Code Summary Table
Physical Medicine and Rehabilitation 97000 Series CPT Codes ©AMA

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The below allowables reflect values as of January 2008

Code	Description	NC Allowables (estimated fee schedule for NC in 2008; varies by location, geography)	Recommendations	Not allowed on same day as 97__:	Requires Modifier -59, if provided on same day as 97___:
97001	**PT Evaluation** No time attached	$ 66.18	Use for first visit. May bill with 1-2 units of 97112, 97535, or 97542	002, 750, 755, 762	NA
97003	**OT Evaluation** No time attached	$ 70.64	Same as above	004, 750, 755, 762	NA
97002	**PT Re-Evaluation** No time attached	$ 35.43	May be used for subsequent visit every 30 days, but documentation must reflect changes in exam findings, goals and plan of care	001, 750, 755, 762	112, 530, 535, 537, 542, 760
97004	**OT Re-Evaluation** No time attached	$ 41.76	Same as above	003, 750, 755, 762	112, 530, 535, 537, 542, 760
97112	**Therapeutic procedure, neuromuscular reeducation** of movement, balance, coordination kinesthetic sense, posture, and/or proprioception for sitting and/or standing activities; Direct one-on-one patient contact, each 15 minutes	$ 27.08	Assessing and training for postural stability, control and balance for access	NA	002, 004, 760, 761
Code	**Description**	**NC Allowables**	**Recommendations**	**Not allowed**	**Requires Modifier -59**
97530	**Therapeutics activities**, direct (one-on-one) patient contact by the provider (use of dynamic activities to improve functional performance), each 15 minutes	$ 27.40	Primarily used for throwing, squatting, lifting. Can be used for w/c transfer training	NA	002, 004, 535, 537, 542, 750, 755
97535	**Self-care/home management training** (eg activities of daily living (ADL) and compensatory training, meal preparation, safety procedures, and instructions in use of assistive technology devices/ adaptive equipment) direct one-on-one contact by provider, each 15 minutes	$ 27.78	Safety issues in the home. Parent/caregiver training	NA	002, 004, 530, 755
97537	**Community/work reintegration training** (eg, shopping, transportation, money management, avocational activities and/or work environment/ modification analyses, work task analysis, use of assistive technology device/adaptive equipment), direct one-on-one contact by provider, each 15 minutes (For wheelchair management/ propulsion training, use 97542)	$ 24.97	For access and/or control training involving AT for transportation as well as worksite training. Not covered by Medicare.	NA	002, 004, 530, 755
97542	**Wheelchair management** (eg, assessment, fitting, training), each 15 minutes	$ 25.32	Utilize for assessment, fitting and instruction in the use of mobility devices and seating systems; incl. skin integrity, transfers, balance, propulsion skills, measuring, etc	NA	002, 004, 530, 755

Code	Description	NC Allowables	Recommendations	Not allowed	Requires Modifier -59
97750	**Physical performance test or measurement** (eg, musculoskeletal, functional capacity), with written report, each 15 minutes Requires direct one-on-one patient contact.	$ 26.97	For functional performance testing to assess needs and identify problems. May include pressure mapping. Decisions and plan of care made based on results.	001, 002, 003, 004, 755	530, 581 (ROMT)
97755	**Assistive technology assessment** (eg, to restore, augment or compensate for existing function, optimize functional tasks and /or maximize environmental accessibility), direct one-on-one contact by provider, with written report, each 15 minutes	$ 31.27	Assess the technology interface with the patient. Utilize after PT or OT Eval leads to referral for AT assessment	001, 002, 003, 004, 750, 762	530, 535, 537, 542, 760
97760	**Orthotic(s) management and training** (including assessment and fitting when not otherwise reported), upper extremity (s), lower extremity(s) and/or trunk, each 15 minutes	$ 29.32	Molding and fitting for custom molded seating systems	NA	002, 004, 112, 755, 761(Pros Train), 762
97762	**Checkout for orthotic/prosthetic use,** established patient, each 15 minutes	$ 28.90	Assess response to orthotic incl. redness and/or pressure areas; make adjustments	001, 002, 003, 004, 755	760, 761

Overview of Acronyms:

MAE=Mobility Assisted Equipment
MRADLs=Mobility Related Activities of Daily Living
LCMP=Licensed, Certified Medical Professional
POV=Power Operated Vehicle
LCD=Local Coverage Determination
PMD=Powered Mobility Device

Mobility Assistive Equipment (MAE) Policy:

Effective December 2005
Eliminated the Certificate of Medical Necessary for Powered Mobility
Implemented a Face to Face requirement between beneficiary and their referring Physician
Implemented an Algorithmic approach to MAE prescription

IC 52: The power of choice- Talking, computing, controlling the environment with the power wheelchair

Nicole Wilkins BScOT
Roslyn Livingstone MSc(RS), OT(C)

In the past few years all the major power wheelchair manufacturers have changed and expanded their electronics. This has made it easier (and sometimes more complex!) to integrate other kinds of assistive technology such as speech generating devices (SGD's), computers and other environmental controls such as TV, DVD, lights, door openers etc.

There are a number of advantages to integrating controls:

- The client can use one access device e.g. the joystick or head array to operate the wheelchair and also to control their SGD, computer and other electronics in their environment.
- Fewer boxes and contraptions attached to the chair - particularly helpful if the person has reduced motor control and strength and has difficulty moving from one access device to another.
- May be less expensive – less need to purchase additional components
- Able to use the same controls in different environments since it is with the person on the chair
- May increase independence

However, there are also some disadvantages to be considered:

- The wheelchair access device may not be the most efficient access method for the client to use for other technologies
- If the wheelchair breaks down, the client may not be able to communicate or to access their other technologies.
- The client may want to use the computer, SGD or computer outside of their power wheelchair (e.g. bed, walker)
- The integrated controls may be more expensive than using separate more mainstream market devices
- The method required to access the other technologies through the wheelchair may be confusing or complex for clients with motor control, visual or perceptual difficulties

There is no one perfect system or set up that will suit everyone. There are considerations and pros and cons to each of the manufacturer's electronics depending on the client's abilities, needs, and choices. Sometimes integrated controls will be the best option for a particular client and sometimes non-integrated controls are more appropriate.

Some manufacturer's use built in Bluetooth to communicate with the computer or SGD and others use radio frequency (RF). The advantage of Bluetooth is reported to be that the wheelchair can pair with a number of different Bluetooth devices. However in practice, we have found difficulties with Bluetooth 'dropping the pairing' during use and difficulties using third party Bluetooth adapters with some SGD's. RF works reliably and consistently but the wheelchair can only pair with its matching dongle. In order to use multiple devices, the dongle has to be manually transferred.

Mouse emulation through the wheelchair works differently with the various manufacturers electronics. Some have built in mouse acceleration (not speed) that cannot be adjusted. To perform mouse clicks, some manufacturers have the option to use external switches for left or right mouse clicks. However, other electronics require the client to use mouse click software, or require the person to be able to make small or repeated movements with the wheelchair controller (e.g. joystick, head array etc) to perform mouse clicks. This is often difficult for clients with fatigue issues, abnormal tone or movement disorders.

All manufacturers use infrared for environmental controls. Some of the more complex home entertainment systems have mixed inputs with combinations of RF and infrared signals. It can be difficult to set these up through the wheelchair as the electronics don't allow for the mixed RF and infrared inputs or for more complex remote control commands. The wheelchair visual displays all require either reading ability or the ability to recognize small symbols. It can be fatiguing for users to step down through all the items on a complex visual display to access the many functions of the media equipment.

With the client, we need to select the best method of access for driving and operation of the power wheelchair, SGD use, computer use and environmental control use and then look at the different electronics to see which the best match is. Having in-depth knowledge of the various power wheelchair electronics and other non-integrated options for controlling the power wheelchair, computers, ECU's and SGD's can give clients the best possible set-up and "power of choice" over their assistive technology.

Several video case studies will be used to illustrate the advantages and disadvantages of integrating SGD's, computers and environmental controls with various power wheelchair electronics. The principles apply to both children and adults.

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IC 53: Bike on! A Guide to Matching Your Client with the Right Handcycle

Jacqueline Wolz, MSPT
Randy Potter, ATP, CRTS
Jim Black

Objectives

- Describe three choices of handcycle frames and respective seating systems
- Discuss how an arm crank configuration affects the propulsion of a handcycle
- Apply principles of wheelchair seating to handcycle seating selection

Handcycling is a popular choice for adaptive sports and recreation, and it also provides an opportunity for an extremely accessible sport at many different levels of ability and fitness. The process of selecting and configuring a handcycle is similar to that of selecting a manual wheelchair. Upper extremity preservation is essential and must be considered with prescribing and fitting a client in the device.

This session will provide a 75 minute lecture with numerous photographs and videos to exemplify concepts of handcycle design and function of the rider. The lecture will be followed by a 45 minute interactive session where participants will have the opportunity to trial and adjust a variety of handcycles.

The lecture will focus on the process of selecting a handcycle frame, seating system, components and options. Essential client information needed prior to a handcycle trial and prescription will be discussed first. The VAMC requires such information prior to consideration of prescription of recreation and sports equipment, and this form provides an excellent example of essential background information. Handcycle frames are described in detail, including potential applications for each frame design. Two steering mechanisms, pivot steering and lean-to-steer, are discussed in conjunction with frame choice. Arm crank choice and dimensions are the next important components of a handcycle configuration. The crank style options, as well as the width and length of the cranks, are discussed in relation to its effects on biomechanics and propulsion of the device. Seating system selection (right, semi-reclined, reclined, and kneeling) is also essential to an appropriate match of equipment to client, and the seating system is often partially determined by the handcycle frame. Arm crank position in relation to each seating system is discussed. Photos and videos will be utilized to facilitate understanding of handcycle propulsion with a variety of frames, seating systems, and crank choices. Additional opportunities for seating interventions are also considered, from low-tech options to custom seating modifications.

Just as education, training and reassessments are essential to the success of new manual wheelchair riders, they are also key to the success of a safe and efficient handcyclist. Safe transfers into and out of the handcycle will be discussed and demonstrated. Key adjustments needed for a successful trial will be outlined and again reviewed during the interactive portion of this session. An understanding of gears and proper shifting is essential to the success and riding enjoyment of any cyclist. Multi-speed gears allow the cyclist to climb hills comfortably and go faster downhill. Every cyclist also has an ideal "cadence" and an ideal amount of resistance from the pedals. When pedaling at the ideal cadence, the cyclist puts out the greatest amount of power that he/ she is able to sustain efficiently. You select this cadence by shifting gears. As mentioned earlier, the cyclists understanding and appropriate use of the chainwheel(s) are essential to an efficient and enjoyable ride. Because of this, it is advisable that the rider have a solid understanding of the appropriate maintenance and care of the chainwheels and how the derailers work, as well as a means to identify and complete repairs, as needed. Aerobic implications with respect to slow and rapid cadences will be discussed, with examples of training programs with for various goals.

Additional handcycle options will be summarized with specific examples of applications. A proposed model for handcycle education, training, and reassessment will be summarized. An organized planning program outline will be provided and may be useful to those interested in coordinating a local handcycling clinic. US Handcycling Federation rules and regulations will be discussed briefly with references for additional information. Recumbent cycles and adaptations to standard cycles will be briefly presented, but the majority of this presentation's focus is on handcycling.

Finally, three case studies will be used to outline the process of client evaluation, selection of the handcycle frame, and the fitting, training, and reassessment of the client in the new device. The first client is a beginner with the diagnosis of L-1 SCI. The second client is an intermediate rider with the dual-diagnosis of paraplegia and hemipelvectomy. The third client is an intermediate-advanced rider with the diagnosis of triple amputations (L below-elbow, R above knee, and L below knee).

The final portion of this session will consist of an interactive session where participants will have the opportunity to trial the cycles, as well as adjust various cycles to provide an optimal client fit.

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PS 1.1: A Retrospective Look at Seating and Mobility Options for People with Lower Extremity Amputations

Jennith Bernstein, MSPT, ATP
Robin Skolsky, MSPT, ATP

The specific seating and mobility needs of people with lower extremity amputations will be addressed, including description of levels of amputations, presence of wounds, additional neurologic conditions, upper extremity amputations, as well as considerations for people who wear a prosthesis for function, cosmetics, or not at all. Shepherd Center is a private, not-for-profit hospital specializing in medical treatment, research, and rehabilitation for people with spinal cord injury and brain injury. The Seating and Mobility Clinic provides services for a variety of inpatient and outpatient populations. In fiscal year 2009, the seating clinic provided over 2400 hours of patient care to over 1000 patients.

A person with lower extremity amputation(s) may encounter challenges in obtaining the appropriate seating and mobility system. Many people with lower extremity amputations will require a manual or power wheelchair at some point in their lifetime, even if ambulation with prosthesis is their primary means of mobility. Factors contributing to non-use of prosthetic devices include age, severity of amputation, bilateral amputations, coronary artery disease and place of residence, such as a skilled nursing facility (1). It is crucial to provide the appropriate mobility device to maximize function. This is especially compounded when catastrophic events such as brain injury, spinal cord injury, or other systemic impairments occur concurrently with a lower extremity amputation.

Concerns when seating a person with lower extremity amputation are skin protection, pressure redistribution, maintaining joint range of motion, pain reduction, energy efficiency, and accommodating seated posture with prosthesis and without, all while maximizing functional mobility and stability(3). Options that have been used to provide skin protection and improving pressure distribution can come from both the seating system and the presence of a prosthetic device. A certified prosthetist/orthotist can be utilized to fabricate a custom, "bucket-type" prosthesis to distribute pressure (Picture 1) for a person with a hemicorporectomy, bilateral hemipelvectomy, or bilateral hip disarticulation (2).

Through the use of case studies we will explore the seating and mobility options for people with lower extremity amputations.

Picture 1: An example of a "bucket-type" prosthesis for a patient with hemicorporectomy. This example has the addition of custom cushion insert to assist with pressure distribution, reduction in friction, and moisture management (2). Reprinted with permission from Wilson, JD.

Pictures 2 and 3: Patient s/p motorcycle accident, with resultant acquired brain injury with left hemiplegia. His right hemipelvectomy amputation was as a result of pelvic fracture with arterial damage. Pictures 2 and 3 represent the initial custom molded seating system taken one month into rehab stay, with plans to be recaptured two months following discharge.

Pictures 4 and 5: Patient has a diagnosis of long-standing history of peripheral vascular disease, which resulted in multiple vascular surgeries including bilateral below elbow amputations, right above knee and left below knee amputations. Patient has a complex medical history: quadruple by-pass, fem-pop grafts, kidney disease, CHF, CAD, DM, HTN. Patient receives dialysis at home. Seating with midline, swing-away joystick mount, four-way toggle with elongated lever, swing-away footplate interchanged with residual limb support depending on if his prosthesis was donned. Power tilt and elevate for functional independence. Cushion selected with the leatherette surface to allow for maximum independence with transfer activities.

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PS 1.2: Do Standing Programs Make a Difference?

Megan Damcott, MS
Sheila Blochlinger, PT, ATP
Dr. Bruno Mantilla, PhD, MD
Dr. Richard Foulds, PhD

“Not a medical necessity.” As denials continue to flood the medical fields in the United States, this is one phrase that insurance companies incessantly quote and clinicians and therapists persistently cringe upon hearing. Individuals in durable medical equipment and assistive technology certainly are no stranger to this phrase and one application they can readily relate the phrase: the funding of standers. While research does exist supporting the benefits of standing, the subject populations are small and the results are varied, supplying insurance companies with enough doubt to deny funding standers.

One of the driving forces behind standing interventions is bone mineral density (BMD). Studies in astronauts and immobilized individuals (children and adults alike) have shown prolonged periods of non-weight bearing leads to decreased BMD. As bone mineral density correlates to the overall strength of the bone, it has been determined that individuals with lower BMD are at a higher risk of non-traumatic fractures than age-matched individuals with normal BMD. Therefore, it has ideally become standard protocol to place immobilized individuals in standers in order to provide weight bearing and subsequently increase their BMD. In reality, insurance denials and funding obstacles are making it increasingly difficult to incorporate standing in therapeutic protocols.

Another driving force behind standing interventions is the Bone Mechanostat, a model explaining bone growth and resorption (1,2). This model has deepened the understanding of how bone responds to mechanical loading. Most importantly, the Mechanostat suggests that the stresses and strains produced by reciprocal loading play a crucial role in the signaling associated with bone formation. Based upon this model, the last three decades have brought numerous studies into the prevention of osteoporosis via mechanical loading, specifically those standing interventions which provide a degree of ‘dynamic’ weight-bearing.

Low-magnitude, high frequency whole body vibration has been extensively studied in women and children. In young women with low BMD, whole body vibration increased the BMD in the lumbar spine and femoral midshaft with a 12 month intervention for two minutes per day (3). Vibration used for 20 minutes per day over 12 months demonstrated a decreased progression of osteoporosis in the spine and trochanter in postmenopausal women (4). Whole body vibration, coupled with static and dynamic knee-extensor exercises, showed increased BMD in the hip (5).

In children, Ward et al determined that 6 months of whole body vibration in ambulant children with disabling conditions increased the bone mineral density in the proximal tibia and the spine (6). While Ward et al found promising increases in ambulant children, a 9 month whole body vibration study in non-ambulant children with cerebral palsy increased the vertebral BMD, but did not increase the BMD in the proximal tibia (7). The results of these studies suggest that a high magnitude, low frequency mechanical loading intervention could play a critical role in increasing BMD in the lower extremities. Work by Chad et al further supports this hypothesis as they found an 8 month weight-bearing physical exercise program in children with cerebral palsy led to an increase in proximal femoral and femoral neck BMD independent of the child’s ambulation status (8).

Preliminary research aimed specifically at a more ‘dynamic’ standing intervention yielded promising results as well. Two children stood in a dynamic stander designed by Gudjonsdottir and Mercer for eight weeks, five times per week for 30 minutes a day. An additional two children stood in a passive stander. BMD increased in the distal femur of all four children. Although the dynamic stander yielded promising results, the authors noted that modifications to the design, including decreasing the noise emitted by the electrical motors and a higher voltage battery, were needed prior to its implementation in the clinical setting (9).

Methodology

To investigate the impact of dynamic and passive standing on bone mineral density, a 15-month study was conducted. The standers used were the dynamic stander designed by Damcott et al and passive standers currently available on the market (10). A pilot study with two children completed prior to the 15-month study confirmed the feasibility of using the dynamic stander in the clinical and classroom settings. The 15 month study consisted of eight children standing dynamically and six children standing passively for six months. All children then stood passively for three months. After the three month intermission, the children were returned to their prior standing intervention with six children continuing their dynamic standing and four continuing to stand passively. Four children were not continued after the three month intermission due to health and logistical reasons. Coupled with the larger population size, the study aids in filling two gaps noted in previous research studies.

All children were between the ages of two and nine years old and were standing passively prior to their inclusion in the study. Children were excluded if they were receiving medication specifically treating bone density (seizure medications were not included as exclusion criteria but researchers did make note of children on seizure medications). All children’s physicians were consulted prior to their inclusion and prescriptions for dynamic and passive standing and dual energy x-ray absorptiometry scans were obtained. Nutritional analyses were conducted during the first six months to confirm no significant changes in diet occurred. Institutional review board (IRB) approval was obtained through New Jersey Institute of Technology.

The standing sessions were conducted daily in each child’s classroom. In an attempt to create minimal disruption within the classroom, the established therapeutic protocols were followed with the children standing for thirty minutes per day, five days a week. Although 100% compliance was not observed, due to illnesses, personal conflicts and school closings, the total number of minutes and days each child stood was recorded.

Lateral distal femoral DXA scans were obtained at three month intervals throughout the study (0-, 3-, 6-, 9-, 12- and 15-months), following the currently accepted procedure described by Henderson et al (11). The GE Pediatric Lunar DXA and EnCore Software were used to obtain all scans. The same technician, therapist and research staff were present for all scans.

Results

As the study progressed over the fifteen months, preliminary analyses of the DXA scans revealed that the intracession reliability of the scans was questionable. Before any credible determination of the impact of each standing intervention can be made, the unreliability of the scans must be addressed. Two factors could explain this unreliability: 1.) the precision of the edge detection algorithms in the software and 2.) the impact of rotation of the limb during positioning.

While a pediatric DXA machine was used, the algorithms used by the GE software could result in an "inability to detect the bone edge in individuals with low bone density (12)." As immobilized children often have lower bone density than their peers, the precision of the edge detection algorithms provided may not be adequate for this study. The first step in analyzing the results is to test other edge detection algorithms to determine which algorithm is most appropriate for this application. Using MATLAB, researchers have found that the Pearson and Robinson and the Canny edge detection algorithms are more appropriate to detect the edges of bone in children with low bone mineral density (13).

To investigate the impact rotation of the limb has on the bone mineral density, a swine leg was scanned between 0 and 90 degrees at known five degree increments of rotation. It was determined that rotation below 20 degrees has negligible impact on the reliability of the bone mineral density. As the rotation of the child's leg between scans and between sessions remains below 20 degrees, it was determined that rotation does not play a critical role in the reliability of the scans. This finding, coupled with more accurate edge detection algorithms, has recently allowed researchers to better understand the complexity and process by which the DXA scans must be analyzed in this population.

Researchers are currently in the process of analyzing the bone mineral densities of the children in the study. One other factor that must be considered in this study is impact growth of the femur has on the BMD measurements. Unlike similar studies that have a shorter duration, it was determined that during the 15-month duration of this study, the children grew up to four inches. As 70% of the growth that occurred in the femur during this time was located at the distal end, the impact of growth on the placement of the regions of interest (ROIs) during analysis of the BMD is crucial.

Currently there is no database of normalized lateral distal femoral BMDs. Therefore, analysis of lateral distal femoral scans in six age-matched normal children and three immobilized children with no standing interventions will allow researchers to compare the relative BMDs of the children with standing interventions and gain a better understanding of where they fall in the spectrum and the relative improvement.

Discussion

While the direct impact dynamic and passive standing interventions have on the bone mineral densities of the children in this study must still be determined, preliminary analyses of the DXA scans have uncovered a number of factors that are critical to consider in this population. With a greater understanding of how to analyze and interpret the results of the DXA scans in this population, this study could potentially aid in the ability to reliably study and compare lateral distal femoral BMDs across multiple sites.

As preliminary analyses remain promising to date for dynamic standing, the future directions will include modifying the dynamic stander design to utilize electrical actuators instead of pneumatic actuators and to include outcome measures such as muscle tone, heart rate variability, bowel and bladder function and behavior.

*Authors note: Quantitative BMD measurements should be available by the date of the conference and will be included in the oral presentation.

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PS 1.3: The Transfer Assessment Instrument for Measuring Transfer Performance

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Objective

Participants will learn about a new outcome measure for documenting transfer performance (Transfer Assessment Instrument – TAI)
Participants will understand how TAI can be used to identify aspects of the transfer process in need of intervention
Participants will understand the various stages of psychometric evaluation of a new outcome measure

With advances in medicine, individuals with spinal cord injuries are living longer, thus placing them at greater risk for repetitive strain injuries. Transfers have been identified as one of the most strenuous upper limb activities potentially leading to the development of shoulder pain and injury (2). It is important that individuals are taught the correct way to transfer, in a manner consistent with the clinical practice guidelines for preservation of upper limb function. Currently, a clinician's judgment is the standard way of quality assessment. While clinical judgment is important, a validated outcome measure can significantly help with decision making and treatment plan development. Once a transfer has been taught, it is important a clinician can objectively determine if the transfer was performed correctly. Because there is no universal definition of what the proper transfer is the development of an outcome measure is necessary. The Transfer Assessment Instrument (TAI) is a 27-item criterion-referenced construct comprised of three domains 1) preparing for a transfer, 2) use of conservation techniques, and 3) quality of the transfer and was designed to determine a patient's adherence with 'best' transfer techniques. The TAI includes items that address the ergonomics of transferring independently and dependently for patients who need assistance either from a caregiver or with transfer equipment.

TAI Item Development

The initial items on TAI were derived from extensive review of current transfer literature, the clinical practice guidelines on preservation of upper limb function following spinal cord injury (SCI) (1), and techniques that have been successfully used in the clinic. The major items that TAI assesses are: 1) if the individual is employing the 'head-hips relationship' as appropriate during transfers, 2) proper positioning of the glenohumeral joint, 3) hand and limb position, 4)'smoothness' and control over the transfer, 5) if a caregiver is assisting, they are properly supporting the upper extremity and 6) hand positioning. In addition, TAI checks that compensatory strategies are appropriate and employed correctly for the long-term maintenance of independence and reduced upper limb joint loading.

TAI Validity

Content Validity:
After initial item and scale development, content validity of the tool was evaluated via multiple focus group meetings with the core team to reach consensus on item and scale structure. A second level of validation was performed by external review with clinicians and researchers not involved with item development who had several years of experience in the area of transfers and SCI rehabilitation. Their feedback was used to revise the tool resulting in Version II.

Face Validity:
Extensive psychometric testing of Version II was performed with three
clinician raters and 40 individuals performing sitting and standing pivot transfers at the 2009 National Veterans Wheelchair Games in Spokane, Washington (Table 1). Raters took 2-3 minutes to complete the measure and no special equipment was required. The clinicians reported that the tool could be easily integrated into a clinical setting. Study participants reported that the assessment was not difficult and they did not feel uncomfortable with any of the transfers the evaluators asked them to do.

Table 1: Subject Characteristics (N=40)

Mean Age (years)
51.7 (SD = 11.3)

Body mass index
27.12 (SD = 5.92)

Type of transfer performed
82.5 % -- Independent
17.5% -- Need assistance

Type of wheelchair used
71.8% Manual
28.2% Power

Level of injury
Tetraplegia – 27%
Paraplegia – 46%

Construct Validity:
Construct validity of the scale was tested by correlating each rater's total score on TAI to a global rating of transfer quality on a visual analog scale anchored by 'poor' at one end to 'excellent' at the other end. This scale was completed by a physical therapist with 10 years of experience who was not involved in TAI's development but was knowledgeable on best transfer practices. The global rating scale was used to assess how well the construct correlates with expert clinical assessment. Similar scales have been devised by others to assess validity of new instruments for clinical use (3). Establishing validity in this manner permits widespread use of the instrument because an expert clinician need not be present when it is used. On the subset of the sample above (n=33), correlation coefficients ranged from 0.192 to 0.690 indicating on the higher end the potential for TAI to achieve an acceptable level of validity (5).

Another level of construct validity based on known-groups theory was tested in a single (TAI rater)-blinded randomized clinical trial involving two groups of patients with acute SCI, a control group who received the standard of care therapy (n=37) and a group who received therapy by a clinician who was educated on the best transfer practices making up the TAI (n=34). The experimental group had a trend for higher scores on TAI compared to the control group at discharge and at the 6 month follow-up visit (p=0.082) indicating TAI's ability to detect expected differences in transfer quality (4). A sub-group analysis on the manual wheelchair users in the intervention group were found to perform significantly better (p = 0.03) at six months post discharge compared to manual wheelchair users in the standard of care group.

TAI Reliability

Reliability testing on same group of subjects described above revealed acceptable inter-rater reliability (ICC = 0.64) and excellent intra-rater reliability for two of the three raters (ICC = 0.74 and 0.89) with the third rater having fair intra- reliability (ICC = 0.35) (5). The wide variability in rater reliability and the validity results is significant and underscores the need for structured education to improve consistency among raters. All three raters had similar backgrounds and level of clinical experience and were educated in the same manner on the TAI beforehand with handouts containing an explanation of each item, a description of different scoring scenerios, and a face to face practice session. Feedback from the clinicians indicated that more in depth training on item scoring and seeing how the tool was used to evaluate actual patients would have increased their confidence and made the scale easier to use. It follows that like similar outcome measures developed in rehabilitation (e.g. Wheelchair Skills Test, FIM) a comprehensive instruction program that integrates examples of how the tool is used with patients and tests the clinician's knowledge on the application of tool will lead to a greater understanding of how to apply the measure and will further strengthen TAI's measurement properties.

Current Status

Using the feedback solicited from raters and detailed psychometric assessment of Version II, TAI Version III was created. We are currently developing a more formalized and comprehensive training program and plan to re-evaluate the tool's psychometric properties. This instrument will serve as an important clinical tool to improve a clinician's ability to objectively assess transfer skills and develop treatment plans. Improved clinician education and patient assessment concerning transfer technique has a high potential to improve transfer ergonomics and reduce the incidence of upper limb pain in SCI.

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PS 1.4: Interface Pressure Mapping: New Evidence for the International Protocol

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OT, Michael Stacey
Rosemary Mason

Learning Objectives

At the conclusion of this session, participants will be able to: Examine the sonographic methods used to determine settlement of the soft tissues under the ischial tuberosities during sitting.

Deconstruct the components of settlement during interface pressure mapping (i.e. soft tissues and cushion material). Debate whether the minimum time to sit before recording interface pressures can be decreased in the international protocol.

Background

One of the applications of interface pressure mapping (IPM) in seating assessments is to assist in matching the best wheelchair cushion to the person. There are a variety of IPM clinical protocols; however, there is a consensus IPM protocol that has been developed by an ISO working group of experts [1]. One component of the protocol is how long the individual must sit on a wheelchair cushion before an IPM can be recorded. The minimum sitting time on a wheelchair cushion before interface pressure mapping is recorded has been up to 4 minutes for able bodied and 8 minutes for individuals with multiple sclerosis who use a wheelchair for mobility ([2-3]. This time delay accommodates what is has thought to be creep in the soft tissues of the buttocks and cushion [1, 3]. The creep function is defined as “increasing strain with a constant force” [4]. The purpose of this study was to determine if soft tissue thickness in the buttocks changed over ten minutes of loaded sitting in able-bodied individuals.

Methods

Twelve (n=12) able bodied individuals (6 males; 6 females) were assessed on a study chair that was fitted with a water cushion (Photo 1). A previous study confirmed the reliability of this ultrasound protocol for measuring soft tissue thickness (in press). A senior medical sonographer measured the total thickness of the soft tissues and the skin/fat layer under the right ischial tuberosity at its lowest point in the loaded sitting position. The sonographer began measuring at the time of initial loading on the water cushion and every minute for a total of ten minutes. Initial measurements were performed within 30 seconds of loading. At each time point, three repeat measures of the tissue thicknesses were obtained. The mean of these measurements were calculated for each time point and were used in the data analysis.

A **B**

Photo: 1 The ultrasound device, sonographer and the assessment chair fitted with the water cushion are depicted on the left (A) and a close up of the ultrasound probe on the underside of the water cushion (B).

Results

Preliminary data analysis indicates that the mean height was 1.69m ± 0.11, mean weight was 66.18kg ± 13.06 and the mean BMI was 23.0kg/m2 ±2.5.

A repeated measures analysis of variance was undertaken using PASW 18.0. Preliminary analysis show that the total thickness was significantly affected by the elapsed time, F (3.83, 42.11), 5.991, p=0.001. The total thickness increased over the ten minutes of loaded sitting on the water cushion. The total thickness at time zero was a mean of 3.00cm ± 0.83 and the total thickness at 10 minutes was a mean of 3.18cm ± 0.77.

Future data analysis will include performing repeated measures ANOVA using the thicknesses for both the gluteus muscle and the skin/fat layers.

Discussion

In summary, the total soft tissue thickness under the lowest point of the ischial tuberosity increases over the 10 minutes of sitting. The possible explanations for this result include: (1) a biomechanical change within the tissue layers during loaded sitting; (2) movement of the participant on the water cushion that alters total thickness; and (3) measurement error.
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PS 1.5: Development and Usability of an On-line at Outcome Measurement Database

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For people with severe mobility impairments, mobility assistive equipment (MAE), (i.e. canes, crutches, walkers, manual wheelchairs, power wheelchairs, scooters and associated seating components) are viewed as one of the most important Assistive Technology (AT) devices in the field of rehabilitation. Unfortunately, due to outdated coverage policies and lack of oversight by the Centers for Medicare and Medicaid Services, there have been multiple instances of fraud and abuse in the provision of MAE interventions to Medicare beneficiaries as well as a lack of research and clinical evidence. It is also well documented that practitioners and suppliers of MAE interventions have limited resources to perform outcomes research related to this equipment including limited skills to perform research, time constraints, and relatively low disability-specific sample sizes they serve. The objective of this project is develop and refine an on-line AT outcomes measure management data system to enable the quantification of the functional benefits of MAE interventions and service delivery models used to provide the equipment. The AT outcomes measure management data system will specifically allow practitioners and suppliers of such devices to enter and share specific but non-identifiable information relative to people they serve, the equipment they provide, and patient reported outcomes as to the functional impact of the interventions using valid and reliable outcome measurement tools. Developing such an on-line AT outcomes measure management data system will assist with improving the quality of research and improving clinical care. Data provided will have vital applications by benchmarking outcomes of particular organizations with aggregated national result, identifying changing trends, establishing preferred practices patterns, and improving the quality of services.

PS 2.1: Introducing Fieldwork Students to Wheelchair Seating & Mobility

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Wheelchair seating and positioning in traditional therapy curriculums have been not much more than overviews of equipment and diagnosis with very little emphasis being placed on appropriate biomechanics and the implications for mobility enhancement. Across the country most curriculum have been shown to at best provide a single day of lab work in the area of seating and positioning with very little or no structured rationalization for the development of appropriate seating, positioning and mobility recommendations.

The fieldwork setting is an appropriate and vital component for this type of education. By providing students the opportunity to be exposed to a systematic client centered evaluation process that leads to increased functionality for the client. This will help them understand the perspective of the third-party payer and how to support the recommendations that will provide optimum seating, positioning and mobility for their clients.

On the initial day and second day students will be exposed to experienced therapist modeling appropriate evaluation techniques and procedures in clinical setting. Students will be encouraged to ask questions concerning rationale and decision-making process for final recommendations. The students will be given an opportunity to review the evaluation template and become familiar with navigating the computer model.

When the student expresses a level of comfort and confidence in their ability to process primary information in the evaluation template they will be asked to perform documentation of evaluation and recommendation under the guidance of a primary therapist. At this point the primary therapist will continue to be the lead therapist on the team asking all the questions of the patient and encouraging questions and taking teaching moments throughout the process. After this process is been completed for approximately 1 1/2 weeks the student is encouraged to try to engage the patient with the evaluation instrument and precede through the process.

Client will be specially screened at this point to assure a good match for skill level. By matching the patient with the student we can over a period of time increase the complexity of interventions that the student is facing and challenge the rationale. This will encourage the student to continue to ask questions and be engaged with a clinical instructor for feedback for thought processes.

Over the next four weeks the student will continue to receive evaluation screened to be at their skill level. With additional clients being added that require higher level skills. At this point the student in clinical instructor are acting as collegial team numbers asking for support as necessary and making recommendations based on their fundamental perspectives. This type of open-ended collaborative learning environment has a twofold effect it increases the students understanding of the rationale behind recommendations while at the same time providing service to a clinical instructor by requiring them to explain and support the decisions that are made.

Periodically clients will be screened that have the most complex physical needs for the student to evaluate and work as a team member with the clinical instructor. It is these clients that will provide the needed experience for recommendation of custom contoured seating surface and other components of complex rehab. It is during these periods that the students will get hands-on experience completing multiple types of custom systems.

The students are integrated into a program that allows for skill acquisition, good colleague support/mentor ship and a thorough understanding of the partnership that is necessary between rehab technology suppliers, third-party payers, and themselves as therapist. This understanding will help them be guided through a systematic evaluation and recommendation system that will be completed at delivery of the recommended seating solution. It is of vital importance for the treating therapist as well as the student to have a good understanding of the final outcome in disposition of the recommendations so that the learning process can continue and influence decision-making processes in a positive manner so that optimal recommendations can be made and solutions will fit the needs of our clients now and in the future.

PS 2.2: Collaboration in the Wheelchair Evaluation Process for the Pediatric User

Mary C. Bacci, PT, MS
Catherine T. Kushner, PTA, MS, ATP

At the 2009 RESNA conference, the authors presented a workshop entitled "Considerations for Wheelchair Evaluations of the Pediatric User in the Educational Environment". The presentation was initiated by discussions in several school districts on efforts to obtain seating and mobility equipment that maximized student function and participation in the educational environment. The evaluations from the RESNA workshop indicated a strong interest from therapists, engineers and wheelchair suppliers in attendance for documentation that could improve collaboration between school based therapists and outside agencies (private therapists, seating clinics and wheelchair suppliers). In an age where funding sources apply rigorous standards for approval, it is critical that all of the features of the wheelchair and seating system provide optimal function for the pediatric user. As a follow-up to the RESNA presentation, the authors designed 2 surveys. One was disseminated to wheelchair suppliers, private clinicians and seating clinics to ascertain what information would be most valuable from the perspective of school based therapists prior to seating and mobility evaluations. The second survey was distributed to school based therapists through the Northern Illinois OT/PT Coordinators group to therapists in school districts and educational cooperatives. 18 representatives from outside agencies and 86 school therapists responded to the respective surveys. The relatively smaller number of respondents from outside agencies resulted from the fact that the number of suppliers is small and the territories they cover are large.

The survey results indicate strong agreement on the importance of the contribution of school based therapists to the wheelchair evaluation process. In their assessment of seating system components and mobility base requirements, the outside agencies and suppliers rated input from school therapists as moderately to highly significant in 87.2% of the categories as they related to function within the school environment. They were asked for additional information that would be beneficial to the evaluation process. The responses were consistent for specific functional information, transfers, balance, strengths and weaknesses, range of motion as pertains to seating, need for extrinsic supports, architectural barriers, orthoses, medical/surgical history, fine motor/ propulsion skills, AAC use/needs, transportation issues and equipment history. Attendance at and participation in the wheelchair evaluation process was considered highly significant to the respondents. Information deemed not beneficial included unrealistic expectations of the seating system or of funding realities, lack of follow-up by the school therapist, inexperience and confrontational attitudes.

School therapists were asked to identify aspects of the collaborative model that exists between the schools, families and private clinicians/seating clinics and wheelchair suppliers in their areas for evaluation, delivery, modification and adjustment of seating systems and mobility bases over time. They were asked to provide data on the number of students for whom AAC/computers or EADLs should be considered in the evaluation process and data on users of manual and powered mobility. Additionally, they were asked to identify reasons for which school therapists should be involved in the wheelchair evaluation process. Consistent with the survey results from the outside providers, the school therapists identified areas of functional use of equipment, access to educational programming and resources, academic and mobility goals, architectural and transportation issues as concerns unique to the school environment. Of primary concern to school therapists were the length of time that the child uses their equipment during a school day and the significance of how their seating and mobility base is to their educational Collaboration in the Wheelchair Evaluation Process for the Pediatric User Bacci, M., & Kushner, C. ~ ISS Conference - March 2011 Page 2

progress. School therapists reported low totals for collaboration sought by outside agencies when evaluations did not take place at school. Approximately 74% of the respondents stated that they were generally not asked to participate in evaluations that took place in seating clinics. It was noted that while school therapists are frequently able to attend seating/mobility evaluations at seating clinics, private therapists and seating clinic specialists are unable to attend evaluations that take place at school due to financial constraints for their time. This was noted despite the fact that the need for evaluation was noted primarily by the school therapist (>56%) and family. They noted that in greater than 70% of cases, modifications and adjustments became the responsibility of the school therapist and family to either make adjustments or notify the wheelchair supplier.

There was an apparent disconnect between the agreed upon need for school therapist involvement in the wheelchair evaluation process and the lack collaboration by outside agencies when evaluations do not take place at school. Literature supports the concept of including all stakeholders in the evaluation process. Reality frequently dictates that not all stakeholders can be present; however, these surveys indicate a need to improve collaboration in order to assure that the needs of pediatric wheelchair users are met for success in all environments. Therefore, the authors have taken the common concerns expressed by outside agencies and compiled a document that can be used to improve collaboration between agencies and school therapists. Given that many evaluations take place outside of the school environment, this document could be supplied to school therapists as a means of identifying the needs of the child within the schools. Additionally, it can be included in documentation (forms or letters of medical necessity) completed by outside agencies to assist funding sources in understanding the needs of the child in multiple environments. The document can be used as an educational tool to assist less experienced therapists in defining the needs of the child and as a framework for the letter of justification when evaluations are completed at school. Wheelchair suppliers, private therapists and seating clinics could use this format to guide the process of evaluation, gather information and support their documentation. The information selected for the document was obtained through the authors' collective experience, a review of formats for letters of justification on manufacturers' websites and from the Seating/Mobility Evaluation form used by the State of Illinois Department of Healthcare and Family Services.

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SEATING/MOBILITY EVALUATION
FOR SCHOOL AGED CHILDREN

DATE: ________ NAME/TITLE OF PERSON COMPLETING THIS FORM: ________
PHONE: ________ EMAIL ADDRESS: ________
CLIENT'S NAME: ________ DATE OF BIRTH: ________

PHYSICAL ASSESSMENT

PRIMARY DIAGNOSIS: ________ SECONDARY DIAGNOSIS: ________
RELEVANT PAST AND UPCOMING SURGERIES: ________
CARDIO-VASCULAR OR RESPIRATORY LIMITATIONS: ________
ORTHOTICS: ________
COMMUNICATION SKILLS/LIMITATIONS: ________
VISUAL SKILLS/LIMITATIONS: ________
REFLEXES: ________
MUSCLE TONE: ________
SKIN INTEGRITY/SENSATION/PAIN: ________
SITTING POSTURE IN WHEELCHAIR:

TRUNK CURVATURES (SCOLIOSIS, KYPHOSIS):

PELVIC POSITIONING (OBLIQUITY, ROTATION, TILT):

POSTURAL SUPPORTS REQUIRED FOR UPRIGHT SITTING:

BALANCE IN SITTING, STANDING, AMBULATION:

STRENGTH IN UE, LE, TRUNK:

RANGE OF MOTION (HIPS, KNEES, ANKLES, SHOULDERS, ELBOWS):

FUNCTIONAL SKILLS RELEVANT TO W/C USE

USE KEY: (I) = INDEPENDENT; (A) = ASSIST; (DE) = DEPENDENT WITH EQUIPMENT; (IE) = INDEPENDENT WITH EQUIPMENT (E.G. SLIDING BOARD TRANSFERS)

ADL'S (DRESSING, EATING, GROOMING, TOILETING):

WHEELCHAIR SKILLS (TRANSFER METHOD, PROPULSION METHOD):

EXISTING SEATING/MOBILITY EQUIPMENT: MANUFACTURER ________ MODEL ________
DESCRIBE EXISTING SEATING (INCLUDE POSTURAL SUPPORTS AND MOBILITY BASE):

REASON FOR REFERRAL/ISSUES WITH SEATING OR MOBILITY BASE:

WIDTH OF W/C FRAME (MEASURE ACROSS OUTSIDES OF SEAT RAILS): ________ CLIENT'S SEAT WIDTH: ________
TRUNK WIDTH: ________ W/C DEPTH (LENGTH OF SEAT RAIL) ________
CLIENT'S LEG LENGTH FROM POPLITEAL FOSSA TO BACK OF SEAT SURFACE: ________

ENVIRONMENTAL ISSUES IN SCHOOL:

DESCRIBE ISSUES WITH EXISTING W/C AND SEATING AS THEY AFFECT TRANSFERS (E.G. USE OF MECHANICAL LIFT OR TWO PERSON LIFT, HEIGHT OF W/C OR SEAT TO FLOOR) ACCESS WITHIN CLASSROOMS, (E.G. TABLE HEIGHTS – INCLUDE SCIENCE LABS, ART ROOMS, ETC.) AND ARCHITECTURAL BARRIERS. INCLUDE DIMENSIONS OF SPACES THAT ARE PROBLEMATIC (E.G. WIDTH AND LENGTH OF BATHROOM STALL, STOOL HEIGHT, CHANGING AREA)

GOALS FOR SEATING:

GOALS FOR MOBILITY BASE:

Seating /Mobility Evaluation for School Aged Children
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PS 2.3: Pressure Relief and Common ADL Activities

Keith Grewe, ATP
Linda Clark OTR

Purpose

This presentation will hopefully increase awareness of pressure relief and the general understanding of the pressure relief techniques for impaired clients
During my work in an acute rehab setting, pressure relief is a difficult concept for clients and caregivers to fully understand. It often appears of little value and little purpose until it is too late or damage is done. A very common pressure relief technique is done by performing a w/c push up. This w/c push up requires strength, balance and pain free structures. Often individuals are either too weak, painful, anxious or have lifting restrictions and precautions that prevent this technique. In our rehab center we have access to a pressure mapping system to assess cushion and w/c seating effectiveness. In addition to seating appropriateness we will often demonstrate to the clients different ways to perform pressure relief in a more meaningful or purposeful manner, such as adls. The visual feedback of the pressure mapping system often provides clients, caregivers and clinicians, effective strategies for prevention of pressure ulcers.

Objectives

1. Common activities of daily living may or may not be beneficial for pressure relief in paraplegia and tetrapegia.
2. Common activities of daily living may be alternative or supplement routine pressure relief maintenance
3. Pressure mapping can demonstrate the importance of pressure relief and the performance of ADL activities
4. Show some common ADL activities and provide general feedback with pressure mapping system with acute and non acute clients

Goals

1. Participants to have general knowledge of traditional and alternative ways to perform effective pressure relief
2. Participant will be able to instruct others in appropriate pressure relief in acute and non acute setting

PS 2.4: Improving Service Delivery Throughout the Rehab Continuum

David Kreutz, PT, ATP
Robin Skolsky, MSPT, ATP
Jennith Bernstein, MSPT, ATP
Chris Maurer MPT, ATP
Pat Daviou, OTR/L, ATP

Objectives

- The learner will identify different processes to improve service delivery, related to seating and mobility equipment.
- The participant will understand how education and perceived comfort can affect one's function and participation in therapeutic activities; ensure appropriate fit of equipment for efficient mobility.
- The learner will participate in an active discussion amongst those present to further enhance the service delivery process.
- Improve supplier involvement in the evaluation and delivery process when working with suppliers from other regions.

Continuum of care and early provision of equipment to address posture and positioning is paramount in the rehab setting. Reassessment throughout the client's initial rehabilitation process will help promote optimal support to maximize function in the wheelchair. Early intervention of these services may help to prevent secondary complications such as skin breakdown and development of postural impairments. This also allows for early initiation of patient and family education to enhance knowledge that will be beneficial for a lifetime.

We have initiated an inpatient rounding program in which patients are seen within 2 weeks of admission. Through the inpatient rounding program, we have been able to monitor pain levels/perceived comfort, postural changes, and efficient propulsion. This begins the patient's education of available wheelchair options, various seating components, and the impact that posture and positioning has on their function. The client is followed closely throughout their stay extending to one year post discharge.

Process map is listed below:

- A written order for hospital based wheelchair written within 24 hours of admission.
- Rehab Equipment, which is housed within the center, will build the seating system and wheelchair to specifications and deliver within 24 hours.
- Rounding is performed by therapist from seating clinic and rehab equipment technician within 1-2 weeks to ensure fit, postural support, cushion usage, and set up for mobility.
- Wheelchair Maintenance classes are taught to caregivers, family members and patients.
- Initial seating clinic appointment scheduled by primary treating therapist. Client, family, supplier, and seating therapist present. Out of state suppliers either subcontract with local supplier or utilize on-line video capabilities in order to include them in the evaluation process.
- Trial equipment is available to finalize product description.
- Loaner and/or custom equipment is provided and fitted in the clinic.
- Outcomes data is obtained through ATOM survey as well as personal phone call or visits by the Marcus Community Bridge Program, which offers post-discharge client education, guidance and referral information.

In our discussion we will review the multiple processes we have incorporated into the standard practice at Shepherd Center. These include a database for follow up on paperwork and delivery, a database for tracking loaner deliveries, patient and family education classes, inpatient rounding program for equipment, Bridge program (upon discharge), as well as case study and inservices within the department. We will encourage discussion to improve our processes and discuss those used effectively in other facilities.

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PS 2.5: Changing Lives Through Recovery: A Comprehensive Team Approach

Sheila Blochlinger, PT, ATP

Introduction

Children's Specialized Hospital is the largest free-standing pediatric rehabilitation hospital in the United States, treating infants through young adults, up to the age of 21, and serving over 17,500 children with special needs in the last year alone. It began its operations in 1891 and now has seven facilities in NJ offering a range of outpatient, inpatient, and long term care services. Children's Specialized provides a wide array of medical, developmental, educational, and rehabilitative services for infants, children, adolescents, and young adults. Our mission is to be the preeminent provider of specialized healthcare services for infants, children, and young adults. In addressing this mission, the hospital will achieve its vision of a world where all children can reach their fullest potential.

Family Faculty

We are very fortunate to have a wonderful Family Faculty that assists us with making our inpatient's stay as comfortable as possible. Our Family Faculty staff consist of 14 families that at one time or another have utilized services at our hospital and have a child with some type of special needs. When a new patient is admitted to our inpatient program, a member of the Family Faculty greets them within the first 24 hours with a "Welcome Bag" that consists of various items including a hand written note from another parent who has spent time in our hospital. Each day a member of this team rounds the inpatient units and answers any questions the families may have. The families are provided with a phone number to call if they need to talk to someone as well as email addresses of our family faculty members. The Family Faculty's role is providing the emotional support to our families that is so desperately needed at this time of crisis. Other programs they offer are a "Snack and Chat" or a "Walk and Talk" where families can meet with other families in our inpatient program and offer support to each other. Family Faculty members also participate in committees within the hospital that involve policy making for the inpatient programs. They partner closely with all departments from nursing to environmental services to make sure we are doing the best we can to meet the patient's needs. This level of compassion and commitment to our patients has led us to have one of the best pediatric inpatient programs in the United States.

Initial Admission

When a patient enters our inpatient rehabilitation program, they are initially greeted by our medical personnel who assess the child. The physician and medical staff complete an admission assessment and then the team of treating therapists begins their evaluation process. A staff member of the Rehabilitation Technology staff joins the evaluation process to gather information about the functional abilities of the child upon admission. (5) Preliminary seating measurements are taken. Rehabilitation technologists then discuss their recommendations with the team members after the assessment and put in a work order for the custom wheelchair to be built. The assembly of the chair takes place by our technician with the support of our clinical staff. The goal is to have the chair completed within the first 24 hours of admission. Many of our newly admitted children have spent a significant amount of time in their beds at the acute care facility and are very anxious to get out of bed and move around our facility. If they are admitted late in the day, an appropriate sling manual wheelchair or a stroller is placed outside their room to give their family some type of mobility device to take the child around the hospital upon admission. The custom wheelchair or supportive stroller is then fit with the treating team and adjustments are ongoing throughout their stay as the child progresses. Our most difficult chairs to build are the ones of our children with traumatic brain injuries that may be somewhat combative or impulsive upon admission. They tend to require an extensive amount of time and effort to ensure proper pressure distribution over their weight bearing areas. Many of the children come to us with multiple fractures and occasionally pressure sores. Rehab Tech staff are informed of ongoing changes needed to the child's mobility equipment by the treating team through "Tech Request Forms" throughout the length of their stay. Many children enter our facility and require a tilt in space wheelchair upon admission and progress to a lightweight manual chair or hopefully even walking proior to discharge.

The primary occupational therapist is responsible to fit the patient with bathroom equipment for toileting and/or showering within the first 12 hours after admission, depending upon their bathing status. We are very fortunate at Children's to have many different types of bath and toileting equipment available for inpatient use. These products range from Rifton and Manatee Bath chairs, Leckey, Activaid shower commode chairs, Rifton Blue wave toileting systems, Arjo Carendo, etc. The occupational therapist will coordinate with the rehabilitation technologist if they need assistance with the fitting of more custom equipment to meet the child's complex showering or toileting needs. The child's progress and level of function are closely monitored throughout the inpatient stay by the responsible occupational therapist. She will continue to make any necessary changes to the bath or toileting equipment as the child's functional level changes.

During their inpatient stay

Assistive technology and independence is vital for children to improve their functional skills by increasing their motivation and their self worth. (3) During the inpatient stay, not only is our goal to make the child as functional as possible, but also to help them accept their disability and improve their quality of life. Our technology ranges from simple switches possibly for the infant-toddler and brain injury team to activate a toy, up to an eye gaze system for the child who has a high level spinal cord injury and has no active movement. To address our patients Assistive Technology needs, we presently employ an Occupational Therapy (OT) Assistive Technology Task Force that includes assessment equipment and occupational therapists that have been specially trained in assistive technology and environmental controls. This training will expand to the Child Life and Recreational staff this year. At the hospital's inpatient facility, all patients, especially those diagnosed with a brain injury or a spinal cord injury can have their assistive technology needs met within the first week of their initial stay. Nurse call is set up upon admission and other needs, i.e. computer, internet, TV, electronic readers and video game access are done shortly after their initial evaluation. The hospital inpatient staff has found that internet, computer, and cell phone access are three of the most important EADL'S (Electronic Aids to Daily Living) for teenagers given the communication habits of their peers.

Environmental controls and AT are also used as a treatment modality by inpatient staff, including Mobile Arm supports such as the REX, computers with adaptive programs, and virtual reality systems such as the V-tree and Biometrics. When assistive technology (AT) is utilized as a treatment modality, it then becomes a learned modality for our patients. (4) If AT is learned and used during their initial inpatient stay, there is a higher chance that it will be utilized post discharge. Assistive technology should be used often as it creates a higher motivational level for learning and participation in therapy. The V-Tree virtual reality system is an example of a technology that can help make some of the most difficult tasks fun. The patients enjoy seeing themselves reach in the large virtual screen to hit a volley ball in a beach setting. Participating in the game helps a child forget the pain or discomfort they are feeling during this motion and makes working on improving range of motion even FUN! Outcomes are better if the child has a positive attitude during their inpatient stay and technology is helping us reach the goals we set together. (1, 2)

Time to go home

Prior to a child leaving our facility, discharge planning meetings are arranged. When necessary, we provide our families with a home evaluation form to complete. This is a form that provides us with information regarding home access, doorway widths, bedroom set up and bathroom measurements. From this information we are able to make educated recommendations in regards to what equipment will work best in their home upon discharge. Families are asked to bring in pictures of their home and they can either be on their cell phone, digital camera or we can provide them with a disposable camera when necessary. Due to the decreased length of stay, the entire discharge process as well as the equipment has become more complicated. Simple equipment can be obtained prior to discharge such as a standard commode, rental wheelchair, or sliding board. Complex equipment such a tilt in space shower/ commode chair or a custom wheelchair will not be approved by insurance or recommended prior to discharge. A clinic for the custom wheelchair is scheduled post discharge because many of the children are still going through the healing process when they are discharged and his or her equipment needs will most likely change. In the past we had problems where we ordered a tilt in space wheelchair and 4 months later when all was approved and ready for delivery, the child walked into our outpatient clinic. Exceptions may be made and a clinic may be held during their inpatient stay for bath equipment prior to discharge if necessary. Funding for durable medical equipment is becoming so limited, we need to make our recommendations very carefully to make sure the child will get the best equipment possible and it will last as long as possible. In some cases, we will set up a loaner chair from our stock if the child has significant postural support needs and cannot be properly supported in a rental wheelchair. When this is done, the family has to come to our outpatient clinic for the fitting of this loaner chair and then schedule an evaluation for their own equipment at a later date. This has helped to decrease the amount of chairs that are loaned out and never returned to Children's Specialized as the patient then has a follow up appointment scheduled in our outpatient clinic.

This year Children's Specialized Hospital has been fortunate

to obtain grant funding from the Disability Rights of New Jersey Organization to be able to provide a basic loaner program for simple environmental controls for our patients with a terminal illness. If funding had to be obtained for these children, it may not come through until they have passed away. This grant has helped many of our children be able to communicate and play once they have gone home. We also work closely with "Advanced Opportunities" in Trenton, NJ which is a non profit program that specializes in assistive technology evaluations and training. We work hand in hand with organizations to assist our patients with getting the appropriate assistive technology post discharge.

Due to the decreased length of stay, more families are having difficulty taking their child home post injury. Not only are they not emotionally ready, but they have not had adequate time to make the necessary home modifications to facilitate a safe discharge to home. In these instances, we have been able to offer them a bed in our long term care unit to give them the extra time needed to make the changes necessary.

In these chaotic times with all that is happening in health care from a decrease in the average length of stay, budget cuts, and competitive bidding, it is getting more and more difficult to best meet the child's and the families adaptive equipment needs. We continue to make changes to our processes to best meet this changing climate of health care. The challenges our children and families face can be very overwhelming and at Children's Specialized Hospital we work together as a team both within our hospital and with other agencies outside our hospital to achieve our vision of a world where all children can reach their fullest potential.

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PS 3.1: Using Telerehabilitation to Educate Remote Therapists in Prescribing Wheeled Mobility and Seating Devices

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Richard M. Schein, PhD
Mark R. Schmeler, PhD, OTR/L, ATP
David M. Brienza, PhD

In the U.S. alone, an estimated 2.2 million people use wheelchairs for their daily mobility (Kaye, Kang, & LaPlante, 2000). The wheelchair selection process is complex due to specific disability specific issues, varied personal preferences, different professional approaches for Wheeled Mobility and Seating (WMS) interventions, and abundant technology options to address users' needs, skills, and resources. As a result of inadequate professional training, the proper selection of WMS is constrained by limited availability of practitioners and suppliers with knowledge and skill in this specialty area as well as poor access to resources (Herman & Lange, 1999; Cooper, Trefler, & Hobson, 1996; Fifield & Fifield, 1997).

The objective of this study was to analyze the use of TR as an approach to assist with educating remote generalist practitioners in prescribing WMS devices. The specific hypotheses include:

1. There is no difference in the amount of feedback measured by complexity and duration provided by the expert practitioners to the remote generalist practitioner via TR from initial participant assessment to the last participant assessment
2. There is no difference in duration (i.e. total time) between the expert practitioner and remote generalist practitioner from initial participant assessment to the last participant assessment.

Methods

Individuals from wheelchair clinics in Western Pennsylvania were recruited. Inclusion criteria for participation in this research study were: adult patients 18 years of age or older who were using a WMS device (i.e. manual wheelchair, power wheelchair, or scooter), seeking a new WMS device, and were able to read and comprehend English.

This is a secondary analysis of a prospective multicenter study. The assessments were recorded and archived via Versatile and Integrated System for TR (VISYTER), a secure integrated system that combines high-quality videoconferencing with other key tools in TR (Parmanto et al., 2010). The EP provided the following to the GPs during the interactive TR consultation: advice on seating system frames, bases, and accessories; knowledge of policy implications; intake follow-up questions; funding mechanisms; and education on how physical impairments and medical necessities related to decisions about WMS options. To measure the use of TR as a mechanism to educate generalist practitioners, a total of 23 recorded assessments from October 2006 to March 2009 were observed for specific factors, including: duration (i.e. total time) of the assessment, number of follow-up questions asked by the EP, and the complexity of questions asked.

STATA (StataCorp, College Station, Texas) was used to perform the analysis. A non-parametric Kruskal-Wallis test was performed since the assumption of equal variances across the levels of complexity was not achieved.

Results

A sample of 23 videos were observed and analyzed during the 26-month duration of the study.
Null hypothesis 1 was rejected as there was a significant difference between the amount of feedback measured by complexity and duration of the assessment between the EP and GP ($p = 0.00$).
Null hypothesis 2 was accepted as there was no significant difference between the duration of time spent between the EP and GPs ($p=0.25$).

Discussion

The results of this study showed that the use of TR is an appropriate tool to educate GPs because duration and level of complexity of the assessments were significantly different. On the other hand, the data did not show any significant difference of the overall duration of the assessment (initial to last).

An important factor to note during the analysis of the recorded videos was the involvement of the rehabilitation technology supplier (RTS). The RTS is a key member of the interdisciplinary team involved in prescribing a WMS device. While the practitioners have to be able to understand the patients' functional limitations, needs, and goals; the RTS assists with how to address those functional limitations by having the expertise and knowledge about particular WMS products. In all of the videos, the RTS was helpful in bringing equipment to be tried and assisted with the general discussion regarding what type of WMS device is appropriate for the participants

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PS 3.2: Microclimate Measurements with Human Subjects on Custom Carved Cushions

Evan Call, MS NRCM
Justin Pedersen
Brian Bill

The use of custom cushions is typically reserved for the most involved seating cases complicating the "normal" Microclimate at the seating interface with physiological and anatomical conditions that are addressed with the physical construction or features of the custom cushion. These features generate a need for a thorough understanding of the Microclimate conditions that exist due to the features of a custom cushion and any of the interventions that might be implemented. Recent advancements in measurement techniques allow us to identify the thermal status of the occupant. This allows the determination of whether they are in thermal overload, Isothermal state, or thermal conservation state. Understanding these states allows us to properly characterize the impact of a custom cushion on thermal status and the role in microclimate management played by custom cushions. Custom modifications to temperature and humidity logging devices, allowing proper monitoring of the microclimate at the body cushion interface.

An approved IRB is in place for all human based testing reported in this study.

Learning Objectives:

The participant in this presentation will learn the role of thermal status of custom cushion occupants on the microclimate of the body interface with the cushion. Measurement and logging techniques to allow analysis of the role of cushion features in microclimate management.

Teaching Method:

Slide presentation, classroom discussion and data review will be employed in the presentation.

PS 3:3 Comparison Between 2 Points and 4 Points Seat Belt in Patients with CP

Martino Avellis, PT,
Andrea Cazzaniga,
Veronica Cimolin,
Luigi Piccinini,
Manuela Galli,
Anna Carla Turconi,
Fumagalli Srl,

Introduction

Seated posture is essential to the ability of a person using a wheelchair to stay seated comfortably in the chair. Positioning is often considered one of the prerequisites for the effective use of wheelchairs by individuals with disabilities. Seat belts can be used to stabilise the pelvis to enhance postural support. When the seat belt is properly placed and used in conjunction with a contoured seat cushion, the belt can assist in holding the pelvis in place. The resistance provided by the seat belt prevents the pelvis from sliding under the belt and thus makes it very difficult for the pelvis to slide forward [1]. Different kinds of seat belt are commonly use: 2-points, 4-points seat belt, rigid pelvic stabiliser and others. Empirical evidence regarding the more effective seat belt used in patients with disabilities and in particular in children with spasticity, such as Cerebral Palsy or after traumatic brain injury, is not clear. Some studies are present in literature on this argument, but the analyses conducted were observational or based on interview and questionnaire to patients, their parents or therapists [1-9]; no quantitative investigations have been conducted. From these considerations the main objective of this study is to make a quantitative comparison of 4-points vs. 2-points seat belt in patients with spasticity, using quantitative analysis of movement (3D kinematics), in order to evaluate if any differences between the two seat belt are present in terms of the pelvis stability during seating.

Materials and Methods

20 patients with spasticity (35%: spastic diplegia in CP, 50% spastic tetraparesis in CP, 15% tetraparesis after traumatic brain injury) (range: 4-12 years; GMFM: 35-86), in particular with spastic tetraparesis, were evaluated quantitatively during sitting on a wheelchair. The patients were evaluated using an optoelectronic system with passive markers (ELITE, BTS, Italy) for kinematic acquisition and a synchronic Video system (BTS, Italy). Passive markers were positioned at specific points of reference on the patient's body so to represent the trunk and lower limbs. The acquisitions were performed in three sessions: a) with a 4-points seat belt; b) with a 2-points seat belt; c) without seat belt. In each session the children were evaluated before and after performing a path inside and outside the laboratory with the wheelchair driven by an operator. All the acquisitions were performed with the subject resting in a sitting position quietly for about 15 seconds in the acquisition volume of the optoelectronic system. The wheelchair tilt in space was under controlled; in particular in 10 patients the acquisitions were performed in absence of tilt in space and in 10 patients with tilt in space. Some parameters from 3D kinematics (trajectories, Range of Motion, …) were identified and calculated in order to make the comparison between the three conditions (2-points vs. 4-points vs. no seat belt).

Results

Among the evaluated parameters, the most significant ones were the angle at the pelvis (calculated as the angle defined by the markers placed on the acromion, the asis and the knee) and the angle at the knee (calculated as the angle defined by the markers placed on the asis, the knee and the ankle). In particular we considered the % of variation in ROM of pelvis (%P-ROM index) angle and of knee angle (%K-ROM index) between PRE and POST session. From our data analysis we found that 14 patients (70%) revealed a very low stability without seat belt, evidencing a rolling down of the trunk and of the pelvis. In this group of patients, 3 sub-groups have been identified: GROUP A (better stability with 4-points seat belt), GROUP B (better stability with the 2-points seat belt) and GROUP C (no differences between 4-points and 2-points seat belt (%P-ROM and %K-ROM were lower than 5%).

The comparison between the two kinds of seat belt showed that most of the patients (8/14 patients) were included inside the GROUP A and they revealed a better stability with the 4-points seat belt if compared to the 2-points seat belt. In particular the %P-ROM and %K-ROM indices were statistically higher with the 2-points seat belt than the 4-points one, indicating the pelvis sliding under the belt during sitting maintenance (%P-ROM: 4 points seat belt: 4.8+3.8 % vs. 2-points seat belt: 12.4+4.6 %) (%K-ROM: 4 points seat belt: 6.8+7.6 % vs. 2 points seat belt: 14.6+8.1 %). The GROUP B and the GROUP C were both composed by 3 patients. The remaining 6 patients (3%) revealed a good stability without and with the seat belts; no changes occurred at the pelvis and the knee position in the three considered sessions. In addition we assessed the presence of differences among these sub-groups of patients in terms of GMFM: our data showed that patients of the GROUP A (better stability with the 4-points seat belt than the 2-points seat belt) were characterised by lower GMFM values; in addition these patients are the youngest and with the less body weight. The presence or the absence of wheelchair tilt in space has not effects on our results evidencing no changes in terms of pelvis and knee arrangement.

Conclusions

The results obtained in this study showed that the 4-points seat belts seems to be the more stable configuration than the 2-points seat belt in terms of pelvis and knee position; it seems from our data that the use of this seat belt prevent the pelvis from sliding under the belt. This can be an indicator of an increasing occupant comfort, better pelvis and postural balance and quality of life. In addition our data evidenced that the patients with the less physiological motor condition, according to GMFM, and the lower body weight are the less stable patients which need a robust seat belt (4-points than 2-points).

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PS 3:4 Comfort and Stability of Wheelchair Backrests

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Background

In the United States, approximately 25 million people currently have limitations in basic physical activities and an ambulatory disability. Among these, over 2.7 million people with physical disabilities use wheelchairs [1]. The need for wheelchairs is expected to increase 22 percent in the next 10 years [2-3] due, in part, to the aging population. Wheelchairs provide greater function, independence, and accessibility to the home and community for people with disabilities [4-5]. As an individual adapts to his or her disability, the wheelchair often becomes an extension of his or her body. The wheelchair is a critical component that should meet users' expectations, preferences, physical needs, and functional requirements [6]. As the need increases for wheelchairs as a primary means of mobility and to function more like a prosthesis as an extension of the body, the demand for making them safer, more effective, more comfortable and more readily available is necessary. Typically, manual wheelchairs use either a sling or rigid backrest. Most manual wheelchairs come standard with sling upholstery backrests which are made of fabric or synthetic leather. Most wheelchair manufacturers and wheelchair users utilize the standard flexible sling upholstery for the backrest. Additionally, some sling backrests have adjustable tension, so they can be fitted to the wheelchair user and can be periodically adjusted if necessary. However, because of their flexibility these backrests provide limited postural support while the user participates in dynamic activities [7]. Therefore, a rigid backrest is one of the commonly prescribed backrests for supporting user posture. In a cross-sectional study participants with recent spinal cord injuries (SCI) evaluated three different backrest designs while performing four functional tasks [8]. The three backrests tested included the standard sling upholstery, the Jay J2 back (rigid backrest), and the Pindot Pax-Bac (individualized molded backrest). The reaching activity of the functional performance was significantly greater when the J2 was used. Also, people were more satisfied with the J2 [8]. A study capturing the comfort level of long-term users of these backrests styles is necessary to confirm that rigid backrests provide improved comfort.

Methods

Recruitment

Athletes or instructors aged 18-80 with SCI who use MWCs as their primary means of mobility were recruited at the National Disabled Veterans Winter Sports Clinic (NDVWSC) and the National Veterans Wheelchair Games (NVWG). Subjects with open wounds were excluded.

Protocol

Prior to recruitment, the study protocol was approved by the Department of Veterans Affairs Institutional Review Board. Participants consented to participate in this study. The participants were asked to fill out a questionnaire, and we recorded the type of chair and backrests that each subjects used.

Questionnaire

The Tool for Assessing Wheelchair disComfort (TAWC) was used [9]. The questionnaire was designed to evaluate the participants' discomfort while seated in their wheelchairs. The tool is comprised of three parts: general information, general discomfort assessment, and discomfort intensity rating. In this study we analyzed data from the general discomfort assessment and the discomfort intensity rating. In the general discomfort assessment, subjects were asked to rate their level of agreement with a series of questions in two categories: comfort (8 to 56 total possible points) and discomfort (5 to 35 total possible points). The responses were provided on a 7 point Likert Scale (1 to 7): strongly agree, agree, partly agree, neither agree nor disagree, partly disagree, disagree, and strongly disagree. In the discomfort intensity rating, participants were asked to rate their discomfort level of each of 7 areas of the body on a scale of zero to ten (total possible range was 0-70). The discomfort intensity rating portion of TAWC asks participants to assign a number on a scale from 0 (no discomfort) to 10 (severe discomfort) to explain a discomfort level for each area of body. Regions of the body were the back, neck, buttocks, legs, arms, feet, and hands. The questionnaire also asked about overall discomfort level (general discomfort level). For the final scoring of general discomfort assessment, all scores for the items are summed (13 to 91 total possible points). For the discomfort intensity rating scoring, "one" is added to each score with except of final score if left blank. Thus, total possible score is 7 to 77.

Statistical analysis

All scores were mapped to the same scale, where lower scores indicate a better (more comfortable) response for consistency. The scores were analyzed using SPSS 16.00 (Chicago, IL). Frequency distributions were used to describe the data, and the Mann-Whitney U test was used to test if there were significant differences in comfort level, discomfort level, and discomfort intensity rating between the different backrest types. An alpha value of 0.05 was used.

Results

Participants

A total of 36 individuals participated in this study and completed the questionnaire. Table 1 presents the descriptive statistics for the demographic data for all participants. On average, the wheelchair user participants had been using a wheelchair as their primary means of mobility for 16.4 ± 11.5 years. A total of 77.8% of wheelchair users (n=28) were using a sling backrest, and 22.2% of them (n=8) were using a rigid backrest.

Table 1: Participants

Demographic measure		%(n) or mean (SD)
Age		49.3(11.7)
Race	African-American	5.6(2)
	Asian-American	2.8(1)
	Caucasian/White	83.3(30)
	Hispanic	5.6(2)
	Other	2.8(1)
Gender	Male	97.2(35)
	Female	2.8(1)

Tool for Assessing Wheelchair discomfort – General Discomfort Assessment

Overall, the results of a Mann-Whitney U test revealed no significant differences in the expected direction, z = -1.256, p = .209. Sling backrest users had an average rank of 19.68, while rigid backrest users had an average rank of 14.38. Table 2 displays general discomfort assessment results of Mann-Whitney test with the lower scores being better from the questionnaire ratings. For the general discomfort assessment, sling backrest users had a median score of 42.00 and a range of 13 to 91 and rigid backrest users had a median score of 34.00 and a range of 14 to 55.

Table 2: Mann-Whitney Results

Ratings	Median score (Range)		P-Value (2-tailed)	Total possible score
	Sling (N=28)	*Rigid (N=8)*		
General Discomfort Assessment	42 (13-91)	34 (14-55)	.209	13-91
Discomfort Intensity Rating	21 (8-62)	24 (13-45)	.237	7-77

Tool for Assessing Wheelchair discomfort – Discomfort Intensity Rating

The results of a Mann-Whitney U test revealed no significant differences in discomfort intensity rating scores between the two groups, z = 1.183, p = .237. Sling backrest users had an average rank of 17.39, while rigid backrest users had an average rank of 22.38. For the total score of discomfort intensity rating, sling backrest users had a median score of 21.00 and a range of 8 to 62 and rigid backrest users had a median score of 24.00 and a range of 13 to 45. Overall, the participants rated a median of 5 and 1.5 on discomfort level for the back and neck regions, respectively. Table 3 displays medians and ranges of discomfort level by areas of the body. "Back" had the highest median score.

Table 3: Median and range of Discomfort Level (0=no discomfort, 10=severe discomfort)

Body Area	Rating Median	Range
Back	4	1 - 10
Neck	0.5	0 - 9
Buttocks	0	0 - 10
Legs	0	0 - 10
Arms	0	0 - 5
Feet	0	0 - 10
Hands	0	0 - 7
Overall Discomfort	3	0 - 8

Discussion

There were no significant differences in the discomfort levels between the sling and rigid backrest user groups. Trends of the general discomfort assessments support the argument that rigid backrests are more comfortable. However, discomfort intensity rating suggests the opposite trend. There are several reasons why results may not have been significant. Since scores tended to fall on the more comfortable side of the spectrum, both types of backrests may have been fitted well by clinicians. Also, the sample size may have been too small to represent estimates of various properties of the population. According to our power analysis, 52 subjects in each group are necessary to demonstrate significance with 80% of power. We plan to continue recruiting subjects to enlarge this study. Rigid backrests have a trapezoid shape that more closely resembles the shape of the back. Even though there is a cushion on the backrest, the frame is firm. Therefore, the backrest is generally not adjustable and is sensitive to the user's body size. Commercially available rigid backrests are manufactured along with the width of wheelchair and not necessarily with individual users' backs. A rigid backrest may not promote comfort when it is not fitted properly to the individual even though the rigid backrest is ergonomically well-designed. When the rigid backrest is too big or small, wheelchair users might have a skin breakdown. Therefore, the results suggest that improved designs are necessary, and a secondary analysis comparing different backrest models would be valuable to test various designs. The clinicians play a critical role when ordering and fitting rigid backrests. They need to evaluate the long-term performance of backrests with wheelchair users. Users of both sling and rigid backrests reported the highest level on the back discomfort among other body regions (median score of 4), emphasizing the need to focus on improving backrest design specifically in the area of providing comfort.

Study Limitation

The main limitation of this study was that all subjects were from NDVWSC or NVWG. They are all active wheelchair users, and may not be entirely representative of the wheelchair user population in general. Also, a larger sample is needed. Another limitation may be the TAWC questionnaire, since it asks broad questions about overall discomfort, which may be caused by issues and components other than the backrest. Also, the assessment may not be representative of long-term seating discomfort because the assessment asked about discomfort within the previous 4 hours.

Conclusion

Although results were not significantly obvious, rigid backrests are more beneficial on comfort and stability. However, we assumed importance of design, fitting, and trained clinicians from this study for better comfort of seating. It is emphasizing the need to focus more attention on the design and fitting of these devices.

Acknowledgements

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PS 3.5: A Generic Backrest Shape Generated from 3D Anatomical Scans

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Background

Backrests are important for providing comfortable and functional postural support for wheelchair (WC) riders. Poorly designed or fitted backrests may lead to postural deformities, discomfort and/or pressure sores. All of these consequences are likely to reduce function, participation and quality of life of the WC rider, so every effort should be made to improve the design and fitting of backrests.

Two important characteristics of backrests are their ability to support the trunk, and their conformity to the shape of the users' back. Trunk support is critical for individuals who are unable to maintain good posture independently (e.g. due to muscle paralysis), or those who have existing postural deformities that need to be stabilized or accommodated. Conformity of the backrest to the shape of the body is critical to reduce high pressure regions which can compromise comfort and increase the likelihood of pressure sores.

The sling and rigid backrests are the most commonly used backrests, and each performs differently to achieve postural support and conformity. Sling backrests, which are comprised of a flexible band attached laterally to the WC frame, naturally conform to the user's body as they are loaded, and thus provide excellent conformity. Unfortunately, the flexibility of the band also limits the support sling backrests provide, and thus they are inappropriate for users with either poor intrinsic trunk support or an existing postural deformity. Rigid backrests are comprised of a stiff pre-shaped shell covered with a thin (approximately 1-2cm) cushion. The stiffness of the pre-shaped shell provides excellent trunk support, but the conformity of these backrests is dependent on how well the shape of the shell and cushion cover matches the shape of the users back. Although mismatching can be accommodated by compression of the cushion cover, this can occur to only a small degree before it results in high-pressure zones on the skin. Thicker or more contoured foam can be added over the rigid shell to prevent against these high pressure zones, but as the thickness of the cushion increases it begins to compromise the postural support provided by the rigid backrest. This problem is compounded in adaptive sports equipment such as Mono-skis, where optimal performance depends on high conformity and low-relative motion (i.e. little intermediate foam) between the seat and the athlete; unless the back-shape and seat have matching shapes, skin breakdown can occur rapidly.

Consequently, one of the most important design characteristics of a rigid backrest is the shape of the stiff pre-shaped shell. Ideally, this shell should have a three-dimensional shape very similar to the back of the users. Unfortunately, there have been no systematic studies to characterize the back shape of WC users and so rigid backrest shells have been designed heuristically or by assuming WC users have back shapes identical to the general population, which have been reported in the literature [1]. Because many WC riders have spinal fixators surgically implanted to stabilize the injured region of their spines, it may be a poor assumption that back shapes are consistent across the impaired and unimpaired population. Thus, it is likely that rigid backrest design is sub-optimal, which may lead to a higher complication rate when using these designs, despite the fact that they have substantial benefit for postural stability.

Our goal in this study was to address these design shortcomings by collecting the anatomical back shapes of WC riders, and developing a 'generic' shape which could be used as the basis for rigid backrest shell design. We hope that results of this study will help to understand differences of individual backs and improve the fit, comfort and performance of off-the-shelf rigid seating systems.

Methods

We recruited athletes or instructors aged 18-80 with who use manual WCs as their primary means of mobility at the National Disabled Veterans Winter Sports Clinic (NDVWSC) and the National Veterans WC Games (NVWG) under a protocol approved by the Department of Veterans Affairs Institutional Review Board. Subjects with open sores on their back or buttocks were excluded to ensure that transferring would not exacerbate their condition.

Figure 1. Postural Support Frame

Consented subjects were asked to transfer into a custom-built device (Figure 1) that provides a crutch-style support under each arm so their backs could be exposed while they were seated in stable posture. A clinician assisted in positioning each subject into an optimal posture based on their clinical expertise. Subjects were asked to maintain that posture while their backs were scanned with the Scorpion model of the laser Polhemus FastScan system. Subsequently, a clinician used the Polhemus wand to record the three dimensional (3D) location of the following bones and bony landmarks: scapula (right/left inferior scapula angle, right/left medial edge of the scapular spine), lowest rib (right/left lateral edge), femur (right/left greater trochanter), pelvis (right/left iliac crest, sacrum, right/left PSIS), vertebral spinal processes (T7, T12, C7), and Acromion (right/left).

All scan data, which is comprised of a list of 3D points for the bony landmark locations, and 3D points with triangular surfaces for the back scan data were imported into Matlab (Mathworks, Natick, MA) for data processing. The following operations were used to align, scaled, crop and scale each scan so a generic surface could be developed:

- Alignment: A local coordinate system was developed, with its origin at T12, the x axis oriented along a line between the right/left inferior scapular angle, the y axis oriented along a line between the T7 and T12 vertebral processes, and the z axis as the cross product of x and y (approximately in the anterior/posterior direction). All scans were aligned using this coordinate system.
- Scaling: All scans were scaled so the distance between the right/left inferior scapular angle (x axis) and the distance between the T7 and T12 (y axis) were 1.
- Cropping: all data above the scapula and below the trochanters were removed.
- Averaging: An averaging filter is applied so that each surface is mapped to a grid with 15mm x 15mm spacing.
- Fitting: All surfaces are averaged on this grid to develop a generic surface, and finally a polynomial was fit to the data.

In addition to the surface fitting, summary statistics were performed on the distances between scapulae and vertebral bodies to investigate the size variations of the scanned backs.

Results

A total of 15 individuals participated in this study (Table 1). On average, subjects had been using their WCs for 22.80 ± 12.89 years. Eleven subjects used manual WCs, one subject used a powered WC, and the remaining four failed to report their WC type. The participants were in five disability categories: SCI, amputation, multiple sclerosis, “other”, and combination of disabilities. Eleven subjects had an SCI, one had multiple sclerosis, two had a combination of disabilities, and one had ‘other’ marked as a disability.

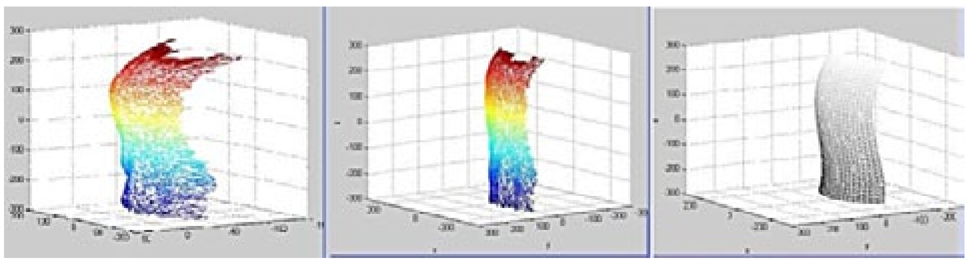
The mean (standard deviation) distance between scapulas, iliac crests and C7 and the sacrum were 254.1 (33.0) mm, 199.9 (56.2) mm, and 616.7 (30.1) mm respectively.

Table 1. Subject Demographics

Demographic measure		%(n) or mean (SD)
Age		54.67(12.89)
Race	African-American	6.7(1)
	Caucasian/White	80.0(12)
	Hispanic	13.3(2)
Gender	Male	86.7(13)
	Female	13.3(2)

A characteristic back scan before and after scaling, normalization and surface fitting is shown in Figure 2, and the final, generic surface which combines all 15 subject files is shown in Figure 3.

Figure 2. Examples of a single back scan before (left) and after (middle) normalization, and fitted with a polynomial (right).



Discussion

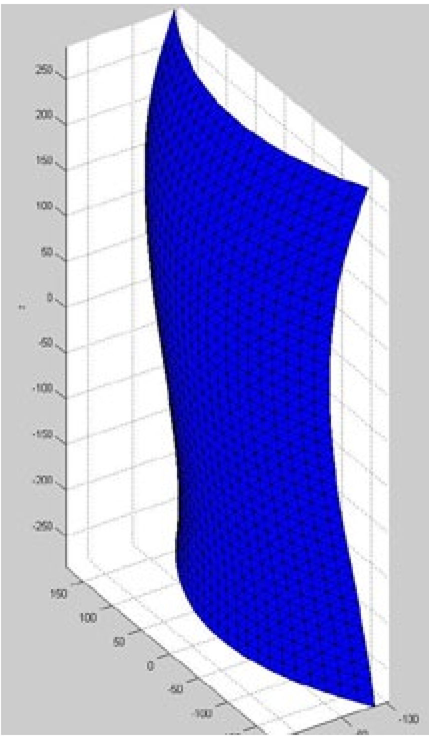
We successfully generated a generic back shape from a series of anatomical scans from WC riders, and also began to compile back size variations of WC riders backs. We expect this data to be useful for designers and manufacturers of rigid backrests as well as adaptive sports seating, such as those used in mono-skis and hand-cycles.

There are several additional avenues of data analysis which are currently being undertaken to help improve the usefulness of this data. For instance, it may be that a small set of generic backrest surfaces may be more appropriate than a single surface. We are investigating this using a cluster analysis approach and singular value decomposition, which has been used successfully to develop generic wheelchair cushion shapes [2].

Once either a set or a single generic back shape has been established, we will test their impact on comfort and functionality a clinical study (e.g. [3]) comparing existing rigid and sling backrests to our design

The main limitation of this study was that all subjects were from NDVWSC or NVWG. They are all active WC users, and may not be entirely representative of the WC user population in general. Also, data from only fifteen subjects were reported here, which is a small sample size given the goal of this study. We are in the process of collecting and analyzing more data with a final goal of at least 100 subjects.

Figure 3. Polynomial fit of average surface across all subjects.



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PS 4.1: Vibration Dampening Characteristics of Wheelchair Cushions

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Abstract

The vibration-dampening characteristics of wheelchair cushions are currently unknown despite the fact that vibration exposure is likely a main contributing factor to the high prevalence of back and neck pain among wheelchair users. This study was performed to characterize the dampening behavior of the most frequently prescribed wheelchair cushions. This was accomplished in two ways: First, dampening characteristics of cushions were found using a Material Testing System and mathematical models of the apparent mass of the human body. Second, dampening characteristics were evaluated while 14 unimpaired human subjects propelled a wheelchair through a Wheelchair Road Course (WRC). Results showed that 1) all cushions amplified vibrations at those frequencies most dangerous for the human body when measured in the WRC; and 2) that air-foam and air-based cushions transmit lower vibration than foam cushions when evaluate with standard methods. Mathematical models did not accurately reproduce values which were measured with human subjects over the wheelchair course.

Introduction

Prior research has convincingly demonstrated that wheelchair (WC) riders are exposed to levels of vibration that exceed the safety threshold indicated by International Standards [1-2]. Harmful vibration exposure may increase the risk of health problems such as vertebral disc degeneration and back pain which may thereby decrease the function and independence of WC users [3-4].

There is evidence that seat cushions and design characteristics of the WCs influence the transmissibility of vibration from the WC frame to the rider [5-7]. For instance, Cooper et al. found that although suspension elements added to WC can help reduce vibration exposure level, they still transmit peak accelerations in the frequency range harmful for humans [7]. DiGiovine [6] studied the effect of different WC cushions and back support configurations on the transmission of vibration during WC propulsion. Results suggest that the WC cushion/human systems may amplify rather than they attenuate vibration, which would increase the risk of vibration-related injury. Researchers also studied the effects of four different WC cushions on the transmission of vibration. They found that the WC cushion/human body systems reduce high impact vibration and amplify cyclic vibration [5].

Although the prior research provides compelling evidence that vibration exposure likely contributes to back and neck pain among WC users, the individual contribution of the cushion at modulating vibrations, is not well understood. This is because in previous studies, measurements were collected below the seat cushion and at the head [5-6], which lumps the user and the cushion together. To gather clinically relevant data about how well individual cushions attenuate vibration, they must be characterized independently, which was the goal for this research project.

Methods

Mathematical models approach
Seven WC cushions (Vector with VICAIR, Meridian Wave, Jay J2 Deep, Roho High Profile, Roho Low Profile, Invacare foam cushion, and a Zoombang® Protective Gear™ mat with the Invacare foam) were pre-loaded to six loads (300N, 400N, 500N, 600N, 700N,and 800N) and exposed to a random vibration (±4mm frequency range from 0.5 to 20Hz) using a SIT-BAR [8] attached to a Material Testing System (MTS) as the indenter. Reaction force below the cushion and acceleration at the SIT-BAR were measured using a force platform and an accelerometer (CXL10LP3 from Crossbow Technology), respectively. Collected measurements were used to calculate cushion's

vibration transmission behavior, S(w), described by (1) [9], where F(w) is the force below the cushion, and X(w) the displacement of the indenter: eq. (1)

Calculated dampening parameters were entered into a one-degree of freedom (ODF) and two-degree of freedom (TDF) models of the apparent mass of the human body described by Griffin in [10-11]. Maximum cushion vibration transmission (TMAX) and its corresponding frequency (FMAX) were then estimated.

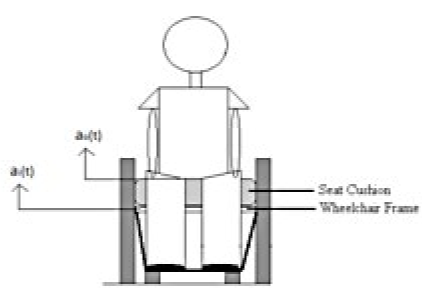

Figure 1. WC cushion/human body diagram showing the appropriate localization of the vibration measurements for WC cushion dampening characterization. Vibration measurement should be recorded below the WC cushion and between the cushion-human interface.

Wheelchair road course (WRC) approach
After informed consent was obtained, seat vibration transmission was measured below and above the cushion of 14 subjects who propelled a WC over a WRC. Subjects were seated on each of the seven seating systems. Input and output accelerations were measured at the cushion/body interface (with the SIT-BAR) and below the seat using two accelerometers. Figure 1 illustrates the location of the

force and acceleration measurements. We used this data to calculate seat transmissibility, T(w), which is defined by eq. (2), where a0(w) and ai(w) are the output and input accelerations respectively: eq. (2)

Amplification of vibration occurs if T>1. TMAX and FMAC were again estimated.

Vibration Dose Value (VDV) approach
Vibration transmission measured in the WRC was evaluated using the Vibration Dose Value (VDV), a evaluation method defined by ISO 2631-1 [12] that is sensitive and useful to evaluate transient vibrations with occasional shocks. Vibration transmission using VDV was defined as the radio of the input VDV (below the WC cushion) to the output VDV (in the cushion/human interface). Results were analyzed using a one-way ANOVA repeated measures to find statistical differences.

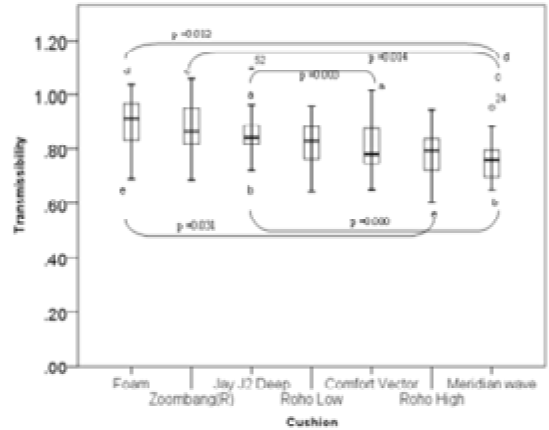

Figure 3. Distribution of the measured seat's vibration transmission values estimated with the VDV method. a, b, c, d, e identify cushions with significant difference. Air-based cushions transmit less vibration than foam-based cushions.

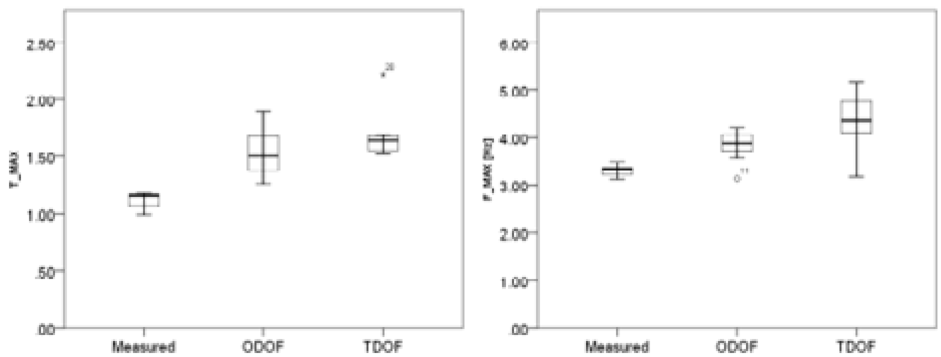

Figure 2. Comparison of the measured and predicted seat's maximum vibration transmission and their corresponding frequency value. Both measured and predicted vibration transmission values are greater than 1. Frequencies values of maximum vibration transmission are situated at low frequency range most harmful for humans (2-8Hz). Left: Seat maximum vibration transmission; right: corresponding frequency

Vibration Dose Value approach
Figure 3 illustrates seat's vibration transmission evaluated with the VDV method on the WRC. It can be seen from this figure that the Meridian Wave, Comfort Vector with VICAIR technology, and Roho High Profile cushions had the lowest vibration transmission, while the Jay J2 Deep, foam and foam with Zoombang® Protective GearTM had the highest. A repeated measures of ANOVA analysis also indicated that there is significant effect of cushions on the vibration transmission ($p<0.05$.) Significant differences are shown in Figure 3 with brackets. Air-foam and air-based cushions had the lowest vibration transmission, and foam-based cushion had the highest transmission.

Discussion and Conclusion

Figure 2 shows that mathematical models of WC cushion's vibration transmission to human body do not predict measured TMAX and FMAX obtained in the WRC. Differences in results may be attributable to differences in body posture when measuring vibration transmission, which has been shown to affect seat transmissibility measurements [8]. The mathematical models were based on vibration data obtained from 60 subjects who sat in an upright posture without a backrest [11]. In contrast, vibration data in this study was recorded while subjects propelled the WC at self-selected speed over the obstacle course. Subjects' hands contacted the push-rims and constantly leaned forward off the backrest during propulsion over obstacles. Measured TMAX and corresponding FMAX suggest that seat's dampening behavior was affected by this factor. Measured values shown in Figure 2 also suggest that vibration is amplified by WC cushions (i.e. T>1) at a low frequency range (2-5Hz), which could have harmful effects on health given that human body tends to absorb vibration in excess of the input at lower frequencies (2-12Hz) [7] thereby increasing the risk of back and neck pain [3].

Vibration transmission estimated via VDV method showed significant differences between WC cushions (Figure 3), which suggest that there is an effect of the cushion on the transmission of vibration probably due to differences in construction materials. The lowest vibration transmission was found in air-foam and air-based cushions, suggesting that they should be selected over gel or foam cushions when attempting to minimize vibration transmission. These results may have an important implication on wheelchair cushion recommendation and selection for active wheelchair users who are exposed to high levels of whole body vibration on a daily basis. VDV values are representative of the entire vibration exposure which occurred while traversing the WRC, while the Tmax shown in Fig. 2 represents the maximal transmissibility at any frequency which occurs while subjects navigated the WRC.

Acknowledges

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PS4.3: A Practice Guide for Wheelchair Assessments

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According to the U.S. Census Bureau's Survey of Income and Program Participation (SIPP) an estimated 2.8 million Americans residing outside of institutions utilize wheelchairs as an assistive technology device for mobility impairments (LaPlante & Kaye, 2010). While wheelchair users are some of the most visible members of the disability community; they have the highest level of activity and functional limitations, and the lowest levels of employment (Kaye, Kang, & LaPlante, 2002).

At present, there are a significant number of potential barriers to assessment and procurement for wheeled devices. These include public policies, funding, practitioner and end user knowledge or lack thereof, and advocacy for and by people with disabilities. Potential AT users also confront various levels of barriers in the procurement of devices. These issues range from appropriate referrals to funding for the recommended devices (Carey, DelSordo, & Goldman, 2004). Additionally, Carey et al. state that financing and accessing AT is a fundamental problem that is exacerbated by race, ethnicity, and cultural differences. Other findings conclude that health care professionals lack knowledge about AT; some do not know how to make appropriate recommendations for the specific device, how to document a patient's needs, how to advocate for AT, or how to initiate the funding and appeals processes for third party payer requirements (Scherer, 1993).

In summary, the wheelchair assessment and procurement process is complex and not well researched, but the need to consider client choice and values is well documented. There are also multiple levels of procedural, political, and funding issues that further contribute to the multiplicity of issues that affect the wheelchair assessment and procurement process. A need for a systematic and detailed review of the perspectives of all stakeholders involved may contribute to a greater understanding and perhaps an improved process of meeting the needs of wheeled mobility users.

Purpose of the Study

The purpose of this action research study was to examine the current state of practice in the wheelchair assessment and procurement process by garnering input from various stakeholders. Additionally, this study sought to obtain consensus on the essential elements that should be included in a wheelchair assessment based on stakeholder input. In this study, stakeholders include clients who use wheelchairs or end users, manufacturers of wheelchairs and related components, clinicians who evaluate end users, suppliers who assist in the procurement of wheelchairs, individuals who educate suppliers and clinicians, reimbursement reviewers, and other individuals such as government affairs officials who examine funding.

This study utilized Participatory Action Research (PAR) which focuses on the empowerment of individuals through participation in research (Dickens & Watkins, 1999). Stringer (2007) defines action research as collaborative, systematic, and rigorous inquiry that allows researchers to investigate issues in diverse contexts to define problems and discover solutions. Action research aims to provide opportunities for disparate groups of people to engage in a consensual approach to inquiry. PAR, by design, links groups of people who are potentially in conflict so they may attain a viable, sustainable and effective solution to the problems they identify (Stringer, 2007). Because the stakeholders involved in the wheelchair assessment and procurement process represent diversity and disparity in power (e.g., therapist and client, supplier and insurer) it is instructive to utilize a research approach aimed at consensus and anonymity, such as PAR.

Participants

Over one hundred and fifty people participated in the study over an 11 month period. Participants included 6 representatives from manufacturers of wheelchairs or components, 13 occupational therapists, 18 physical therapists, 14 suppliers, and 8 others represented 21 states, one general region of the United States, as well as Australia. Several focus groups of clinicians were conducted and accounted for over 100 individuals. Fourteen end users agreed to participate in the multiple rounds of data collection and 2 focus groups of end users were conducted. Five individuals represent the "other stakeholder group". This group was comprised of insurance reviewers, government affairs representatives and a Medical Director of a large Government owned research and rehabilitation center who participated either in an online electronic posting or a telephone interview.

Findings

Based on the input from all stakeholders regarding the strengths, limitations, and essential elements of the wheelchair assessment, a standardized assessment is necessary. To this end, this study offers an assessment checklist that incorporates the input from the participants, reflects a comprehensive review of the literature, and embraces a client-centered practice. Using the ICF as the taxonomy (WHO, 2001), client-centered and empowerment as the theoretical underpinning, the essential elements identified by the various groups in this study, and a review of the literature regarding wheelchair assessments, a checklist was developed to guide the wheelchair assessment.

A Wheelchair Assessment Checklist

Client and caregiver interview

- Client or caregiver needs
- Reason for referral (from their perspective)
- Presenting problems
- Desired outcomes
- Goals for mobility
- Hours per day in wheelchair
- Length of need for mobility device
- Chair use (indoor / outdoor)

Demographic Information
- Name
- Address
- Date of birth
- Living situation
- Diagnosis and ICD codes, Date of onset
- Referring MD
- Supplier
- Funding

Medical Status
- Medical information (disease or impairment)
- Medications
- Precautions
- Surgeries
- Hospitalizations
- Cardio-pulmonary status
- Skin integrity
- Risk of falls

Occupational roles: (school or vocation)
- Community activities and locations
- Leisure interest and ability to pursue

Other Team Members: (identify other professionals who interact with client on an on-going basis)
- Identify need for education of others

Environment
- Other AT devices used and/or needed
- Physical Environment
    - Home Assessment completed by?
    - Steps to enter, rooms accessible
    - School Assessment needed?
    - Work Assessment needed?
- Transportation
- Supports and Relationships
- Attitudes as reported by client
- Services utilized or needed

Current mobility device (describe in detail)
- Date obtained
- Who funded
- Presenting problems
- Aspects that are positive about current device

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PS4.4: Custom Molded Seating: Is Softer Better?

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Custom molded seating is designed to provide total contact and support for an individual with significant positioning needs. Upon delivery, a frequently heard comment from caregivers is "it's so hard." Initial responses to contact with custom molded seating components reveal that the surfaces tend to be rigid and therefore, assumed to be uncomfortable. What is often forgotten or misunderstood is that total contact provided as a result of accurate simulation would be comfortable made out of any material. From a trained clinician's standpoint, total contact offers total support and alignment. From a concerned parent or caregiver's standpoint, it is assume that hard equals uncomfortable and soft equals comfortable.

To determine if softer is better, a single subject study was completed with the assistance of Pindot, part of the Helix Group of Invacare. The focus of the study was to identify if improved pressure redistribution was observed in custom molded cushions made with softer foam. Pindot offers a variety of cushion options. These include standard foam with and without vinyl covering and soft foam, with and without vinyl covering. A subject was selected using specific criteria. Some of the factors included:

- Need for custom molded seating due to severe skeletal asymmetries and need for total support.
- Familiarity with custom molded seating (selecting an individual who had successfully used custom molded seating).
- The ability to tolerate trials with a variety of seating and cover options, utilizing pressure mapping to determine benefits.

Once the selection was made, simulation occurred to capture the desired shape. When sent to Pindot for manufacturing, four sets of cushions were created under consistent circumstances (temperature, humidity, foam batch). Two were created with vinyl coverings and two were created in Pindot's naked option (without the vinyl skin). Of these naked and vinyl cushions, one set was fabricated in soft foam and one set in standard (firmer) foam. Once received, trials were completed in the four sets of cushions. Cushions were installed, allowing their use during the course of a normal day with pressure mapping occurring late afternoon. Peak pressures and the number of active cells were recorded providing evidence of contact.

Findings:
The pressure mapping data revealed consistent contact and peak pressures among the vinyl cushions, both soft and standard. Consistency was also found among the naked cushions, both soft and standard. Inconsistency was found comparing the naked seats to the vinyl seats. Both naked seats displayed increased contact and lower peak pressures than the vinyl seats. As a result, it can be assumed from these findings that cushion covering plays a more significant role in custom molded seating than "softness".

An additional observation from the cushion trials revealed that the subject's overall posture was more compromised on the soft cushions compared to the standard. As she was positioned, the soft foam compressed. This, in turn, altered her orientation within the contour and support surfaces. As a result, optimal positioning was not maintained in the desired, upright manner.

From these very primitive study results, it has been determined that softer does not equate to increased comfort. The successful use of custom molded seating is more reliant on capturing an accurate shape while also maintaining a realistic and balanced posture. Foam coverings were found to play a vital role in the pressure distribution of custom molded seating components.

The author would like to thank Tom Mathes, ATP and Pindot for contributing the seating systems for this study. Without their effort, the study would not have been possible.

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PS4.5: Mobility Assistive Technology Device Use and Satisfaction among People with Multiple Sclerosis (MS)

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Abstract

The purpose of this study was to investigate whether there was an association between the types of mobility device used and device satisfaction among people with Multiple Sclerosis (MS).

Fifty five people with MS participated in our cross sectional study. An in person interview collected information on demographics, type of device used and satisfaction with their device. Outcome measures used to collect information were: Multiple Sclerosis Quality of Life Inventory (MSQLI) instrument and the Quebec user evaluation of satisfaction with assistive technology (QUEST, version 2.0). The relationship between use of mobility device and satisfaction with device used was evaluated by a chi-square test. Results showed no statistical significant difference between satisfaction with mobility device and type of mobility device used. However, participants reported to be quite satisfied with their mobility devices in both QUEST device subscale and QUEST total subscale scores.

Keywords: multiple sclerosis, QUEST, satisfaction, mobility devices

Introduction

Multiple sclerosis (MS) is a neurodegenerative disorder of the central nervous system, which currently affects approximately 400,000 U.S. residents, with 200 newly diagnosed individuals each week 1,2. It causes a wide variety of neurological deficits, with ambulatory impairment as the most obvious cause of disability 3, 4. Within 10 to 15 years of disease onset, 80% of persons with MS experience gait problems due to muscle weakness or spasticity, fatigue, and balance impairments 5, 6, 7. To facilitate mobility, persons with MS frequently employ mobility assistive technology (MAT), such as canes, crutches, walkers, wheelchairs, and scooters. Significantly decreased mobility and self-reported quality of life (QoL) in the MS population has been highlighted as an important need for intervention 6. Over time, people with MS experience reductions in health status and physical function 8. In addition, people with chronic progressive type of MS experience more activity limitations than relapsing-remitting and benign types of MS. Fatigue, weakness, balance impairments, spasticity, tremors, speech and swallowing problems are the most troublesome MS symptoms that impact activity performance of people with MS 8,9. Hence, the resulting impaired ambulation is an important contributor to disability and decreased quality of life in people with MS 10. Little research has actually looked into the real effect of MAT devices on people with disabilities quality of life 11. Therefore the purpose of our study was to investigate satisfaction of mobility assistive technology (MAT) device used among people with MS.

Methods

Subjects: University of Pittsburgh Institutional Review Board (IRB) approval was obtained prior to initiation of the study. Individuals from Western Pennsylvania with MS who use MAT devices as their primary means of mobility provided written informed consent prior to their study participation. A specialized multidisciplinary center was our recruitment site: the Center for Assistive Technology (CAT), located in Pittsburgh, PA. Participants were recruited via flyer or approached by their rehabilitation clinicians during their scheduled visit to the clinic. Potential participants were informed about the study purpose and if they showed interest in participating in the study they were introduced to a study researcher during their visit to the CAT.

Inclusion/Exclusion Criteria: Inclusion Criteria: Adults aged 18 or older who have a diagnosis of MS; participants had to use some type of mobility device to participate in the study. Exclusion Criteria: Participants who did not live in Western Pennsylvania around the Pittsburgh area, and/or were not capable of providing informed consent.

Protocol: The protocol consisted of an in-person interview used to collect participants' demographic information, MS diagnosis, data regarding MAT needs and mobility-related perceptions, preferences, and transportation. Participants included in the study were people with MS who used any type of MAT devices. Due to the length of the CAT assessment, participants were given the questionnaires to be taken home with a postage paid envelope.

Outcome measurement: Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST 2.0) The QUEST determines users' satisfaction with their mobility devices and also includes questions regarding service delivery program received for the device. The QUEST uses a five-point Likert scale (ranging from 1 to 5), where a score of 1 indicates "Not satisfied at all" and a score of 5 indicates being "Very satisfied."

Data Analysis: Descriptive statistics were used to analyze the demographic factors associated with the subjects including gender, age, type of MS, years since diagnosis, ethnic origin, veteran status, and type and model of mobility assistive technology device. All statistical analysis was completed using PASW v18.0b software (SPSS, Inc.). Based on the normalcy, either a Chi-square test or Mann-Whitney U test was used to investigate an association between mobility device used and satisfaction with their devices. Statistical significance was set at 0.05 a priori. The significance level was set at $p < 0.05$ a priori.

Results

Fifty five participants completed our study protocol. Preliminary demographic information of our study participants showed that the majority of them were female (66 %); in addition, the majority of participants were Caucasian (86%) with an average age of 52 years (Table 1). Most of participants (40%) reported having secondary progressive type of MS followed by relapse remitting (20%) and primary progressive (20%). On average participants reported to have MS for 19 years. Ninety five percent of participants reported to have balance problems, followed by fatigue (89%), weakness (87.5%), and decrease endurance (79%). The majority of participants used power wheelchairs (43%), followed by manual wheelchairs (20%), walkers (20%), cane (10%), and scooters (7%). Results from the QUEST device subscale was represented by a mean of 3.79 (+ 0.812), on service subscales we observed a mean of 3.74 (+ 1.069) (Table 2). A total score of the QUEST survey showed a mean of 3.68 (+ 0.971). No statistical significant difference was observed between mobility device used and the satisfaction with device used (p=0.30) as well as between device used and the QUEST total scores (p=0.635). Interestingly to note a statistical significant difference between device used and service subscale (p=0.0). This result could have been due to the fact that not everyone answered this question, leading to a mistaken result.

Table 1 Participants Demographics

	N	%
Gender		
Female	37	66
Male	18	44
Ethnicity		
Caucasian	48	86
Age		
Mean (± SD)	52 (7.6)	
Type of MS		
Secondary progressive	22	40
Relapse remitting	11	20
Primary progressive	11	20
Others	11	20
Years with MS		
Mean (±SD)	18.28(9.497)	
MAT device		
Power wheelchair	24	43
Manual wheelchair	11	20
Scooter	4	7
Walker	11	20
Cane	5	10
Reported mobility problems		
Balance	53	
Fatigue	50	
Weakness	49	
Decreased endurance	44	

Table 2 QUEST scores

		Device	Service	TOTAL
N	Valid	55	53	55
	Missing	0	2	0
Mean		3.79	3.74	3.68
Std. Deviation		.812	1.069	.971
Minimum		2	1	1
Maximum		5	5	5

Discussion

Mobility devices are known to facilitate and improve mobility among people with disabilities 7. If the device prescribed does not satisfied and the user and is inappropriate, there is a high risk of abandonment and consequently decrease in quality of life 5. There are not many literatures investigating satisfaction with mobility devices among people with MS, instead, most of the literature found is focused on use of mobility devices and its influence in quality of life 7.

Our study purpose was to investigate whether there was an association between the type of mobility device used and satisfaction with this device among people with MS. We found that participants did not show greater difference on satisfaction with their devices in both QUEST subscales; however we observed a slight higher score on device subscale scores. In spite that no statistical significance was found on satisfaction between participants, their report seemed to show satisfaction with their device (Mean scores very close to 4 in both subscales). These results could be due to the fact that the majority of our participants (70%) used wheeled devices (e.g. manual and power wheelchairs, scooters) and these devices are known to improve mobility especially in progressive diagnosis such as MS, consequently improve their quality of life 6.

With the variable and progressive nature of MS, the use of wheeled mobility devices might be more beneficial among people with MS. Verza et al., found that non-wheeled mobility devices (e.g. cane, crutches, walker) were the devices most frequently abandoned among people with MS. Most of their devices abandonment happened due to worsening in physical status in 36.4% of their study participants 6.

Our study had few limitations. We recruited a convenient sample from a specialized wheelchair seating and mobility clinic. Our study population may not represent the majority of mobility device used by people with MS. Another limitation was that our study was a cross sectional study design and participants were only interviewed once. Suggestions for future study will include a follow up phase where we can investigate participants 6 months and 12 months after their first interview and observe whether they got a new mobility device and what changes were observed with the satisfaction with the new devices.

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PS5.1: Creating Molded seating for Adults with Tone which support movement

Karen Kangas, OTR/L, ATP

Historically, custom molded seating systems were created to support skeletal anomalies. Consequently, the configuration of these systems support contiguous and full body contact. When utilized, however, on an individual with tone, these systems frequently are refused or fail. The assessment appears to have worked, but the individual cannot tolerate the new seating or is now compromised in independent control they once had.

Creating a molded system in an adult with sensation and tone, must be different. Today I will share specific case studies, and share how to alter the standard approach when using the simulator, and how this can provide a seating system which supports yet does not restrain or prevent movement and functional control.

Objectives

1. analyze the patient's postural control and movement to determine the alternations required while modling a seting system.
2. identify the key "points" of critical position within the seating, which are needed for support, but whihc will also allow for movememnt.
3. create a molded seating system, for an individual with tone, which does not prevent movement nor funcional cotnrol of the extremities.

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PS 5.2: Around We Go: Custom Anterior Supports in Conjunction with Molded Seating

Deborah L. Pucci, PT, MPT, ATP
Denise Harmon

Individuals who exhibit concurrent scoliosis and abnormal muscle tone are among the most challenging to provide with appropriate support and positioning within a wheelchair seating system. Circumferential orthotic devices such as the TLSO (thoracic-lumbar-sacral orthosis) are often prescribed to assist with posture and controlling trunk position both within and outside of a mobile seating system. The clients followed in the case studies presented have utilized both circumferential orthotic devices (TLSO) and custom molded seating systems. This presentation highlights the variables impacting limited success with these seating support systems, meanwhile exploring alternative approaches to use of anterior supports:

- Limitations of using custom molded seating system:
  - Caregiver limitations/transfer techniques
  - Diminished use of seating system while at home vs. school, or vice versa.
  - Countering effects of gravity sans firm anterior support
- Limitations of using circumferential orthosis in conjunction with seating system:
  - Caregiver Compliance
  - School vs Home 'wearing' schedule
  - Provision of fit of seating system with and without TLSO
  - Shear forces/Tolerance creating 'rejection' of TLSO
- Use of orthotic anterior support in conjunction with custom molded seating system:
  - Inter-disciplinary evaluation process
  - Application for funding
  - Molding process
  - Fitting and follow-up
- Use of 'soft' anterior support in conjunction with custom molded seating system:
  - Evaluation process
  - Application for funding
  - Molding process
  - Fitting and follow up

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PS5.3: Design, Re-design, Repeat: A Holistic Approach to Seating a Veteran Client

Deanna Baldassari

1. Introduction: Seating persons with spinal cord injuries requires looking at various aspects of the client's life and utilizing a holistic approach to foster success. Each individual seating system must be customized to the client to maintain function while optimizing proper seating postures. Customization of seating systems and individualizing the treatment intervention to the client is critical for prevention and management of secondary medical complications such as pressure ulcers and contractures. Despite education and pressure reducing equipment provided to clients, the incidence of pressure sores in community dwelling persons with spinal cord injuries has been reported as high as 23-30% annually. Additionally, contractures are common in the spinal cord injury population, cited in some studies at 84.7% of the population surveyed. This paper session will take an in-depth look at the progression and challenges of a seating intervention for a veteran client with tetraplegia, skin integrity issues, and contractures.

2. Client Background: Franklin S. is a 67 year old Caucasian male with C2 sensory, C7 motor complete tetraplegia, AIS A. Franklin was initially injured aboard a Navy boat in July of 1961, and was later diagnosed with a syringomyelia in 1964, which has caused progression to the current level. Franklin S. has battled with intermittent skin integrity issues over right ischial tuberosity and bilateral greater trochanters, with chronic skin integrity issues over left ischial tuberosity for over 10 years. Franklin also has atelectasis, a reactive airway disease, and COPD rendering him oxygen dependent. Franklin has a colostomy and silastic foley for management of his bowel and bladder care. Additionally Franklin is an insulin dependent diabetic and has MRSA. Franklin is an artist who enjoys working in his personal studio on the property where he and his wife reside in North Carolina.

3. Chief Complaints: 1) inability to tolerate prolonged sitting without re-current breakdown; 2) inability to engage in professional and personal pursuits secondary to skin integrity issues; 3) no viable options at time of consult for increasing sitting time with little success to previous seating solution attempts; 4) loss of confidence in prescribed seating configurations.

4. Seating and Positioning Presentation: Franklin S. presents with a pelvic obliquity, rotation and tilt compromising his seated position resultant of bilateral hip and knee contractures. Additionally, Franklin's fit into his current power wheelchair is questionable secondary to rotation of cushions in his attempts to control skin integrity and prevent further skin breakdown.

5. Intervention: A comprehensive evaluation in the clinic setting, extensive chart reviews from multiple facilities, and the collection of historical data from the client and his wife lead to the decision to utilize custom seating. Franklin S. was measured for a new seating system, including new cushion, backrest, and power wheelchair base. A mold for a custom backrest and a custom cushion were completed and the shapes captured were sent for fabrication. The rationale for specific configuration of seating system, backrest and cushion, was to allow for off-loading of bilateral greater trochanters and bilateral ischial tuberosities. Target weight distribution points for newly configured seating system were posterior proximal thighs, posterior-anterior aspect of sitting surface, and lower back.

6. Outcomes: On fitting of the custom seating system, it was determined that the client was unable to utilize the cushion secondary to a disjoint in the user-cushion interface. Franklin S. was scheduled to return to the clinic for follow-up and continued seating interventions. Franklin was issued custom power wheelchair with custom molded backrest for utilization with previous cushion configuration at conclusion of fitting. Prior to return for follow-up, the client and his wife verbalized inability to adapt current lifestyle and tolerate new power wheelchair base and custom backrest. Franklin S. abandoned the seating system and returned to utilization of his previous power wheelchair. At follow-up, Franklin was provided with a newer power wheelchair base identical in model to his preferred base, with planar backrest, and a new shape was captured for custom cushion. Presently, Franklin S. is tolerating the re-issued power wheelchair base, however, the attempts to fit the second custom molded cushion are still in process. The client continues to have intermittent periods of sitting time with prolonged periods of bedrest in attempts to manage skin breakdown over left ischial tuberosity.

7. Conclusion: When creating a seating system for a client with extensive skin integrity issues and failed prior seating interventions, it is crucial to utilize all clinical resources and multiple interventions to achieve success. Location of the client in relation to the medical center can play a role in the service delivery process, effecting efficiency of treatment and re-evaluation procedures. Abandonment of prescribed adaptive equipment, including seating systems, is common in our practice as healthcare providers today. To reduce this and improve the quality of life of our clients, therapists and providers alike, must be willing to address all factors of the client's lifestyle, not solely focusing on the medical needs.

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PS5.4: Supporting, not Stressing the Autonomic Nervous System: 2 Case Studies

Jean Anne Zollars, MA, PT

The autonomic nervous system (ANS) is the quiet, deep aspect of our nervous system that allows us to: breathe without difficulty, rest when we need to, become more active to learn, our gut to digest, our bowels to eliminate, and our urine to flow.1 It allows our heart to beat at a calm pace, to speed up when we need to do a demanding physical activity, and to slow down.

It is the big modulator, the rheostat.

Many people that are in seating/mobility systems struggle with the regulation of their ANS. We see this in breathing difficulties, constipation, abdominal pain, low appetite, reflux, difficulty tolerating transitions between activities, and difficulty tolerating different positions in space. Because of disregulation and/or pain, the person may push and move, express discomfort, “space-out”, or fall asleep.

Comfort Before Function: Use Hand Simlulation

Stress, pain, and discomfort add to an already imbalanced ANS. Seating systems can either help alleviate that stress, or add to it, if improperly fit.2,3
If the seating system is not fit well to the child, function will be impaired, whether that be breathing, eating, using her arms to function, or being awake enough to participate in school. The key is finding what is the person’s neutral posture, not what we think it should be.4 The key to finding the person’s neutral posture is by hand simulation. This means getting the child out of the seating system, accommodating for her ROM limitations, then assessing what supports she needs in the upright seated posture.

Case Study: Joint Pain & Position of Head Causing Breathing Issues

This young girl with cerebral palsy and visual impairment audibly strains with each breath. Her teachers said her day was spent either complaining with discomfort or asleep. (Figure 1)

Figure 1

Upon evaluation, this girl had significant limitations in her hip flexion and adduction/internal rotation and spinal motion. (Figure 2). During “hand simulation”, allowing for her limitations in hip mobility, and allowing her head and neck to flex forward, her breathing relaxed and improved. (Figure 3) This posture is her neutral posture.

Figure 2: Hip mobility limitations

Figure 3: Hand simulation

Seating Solution: The seat-to-back support angle was opened to 120° to allow for hip limitations, and upper thoracic kyphosis. Left hip was allowed to externally rotate. When her head and neck were supported over her pelvis, her breathing and body relaxed, and she was more comfortable. (Figure 4)

Figure 4

Case Study: Constipation and Seat Belt

Constipation is a common problem in children with cerebral palsy.5,6 This boy with spastic-athetoid cerebral palsy tends to thrusts into extension. He was sitting on a flat seat, flat back support with a 45°angle positioning belt (Figure 5). The continuous pressure of the belt against his lower abdomen was causing pain, not only of his abdominal muscles, but the intestines underneath. The spasm of the intestines contributed to his constipation. During hand simulation, we found that he required a lot of contact proximally, especially around pelvis, thighs, and trunk, and he also needed to be free to move his arms, legs and head. Additionally, his trunk needed to round forward slightly.

Seating Solution

Remaking anti-thrust seat cushion, so it properly fit (Figures 6,7), and adding a four-point positioning belt (Figure 6,8) provided greater support to his pelvis and prevented some of the sliding out of the seat with extension. Wider, wrap-around lateral trunk supports gave him more postural support. His digestion improved, with less constipation, less internal agitation, and less thrusting.

Figure 5: Initial seating system

Figure 6: Final seating system

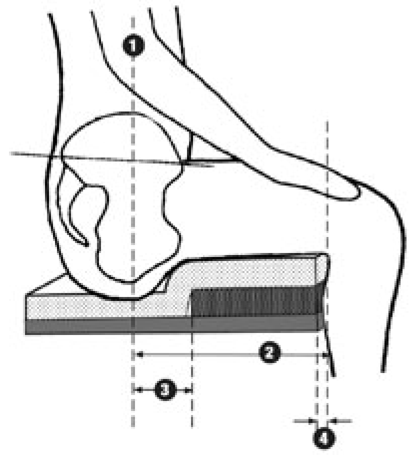

Figure 7: Measuring for antithrust seat

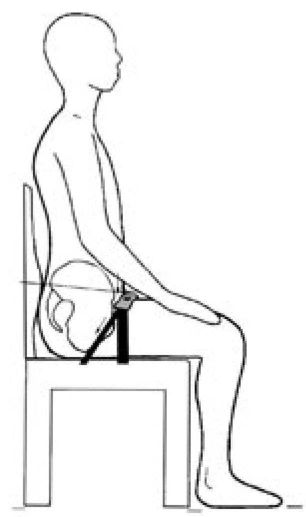

Figure 8: 4-point positioning belt

1. Check that the pelvis is upright.
2. Measure from the front of the ischial tuberosity to the back of the knee.
3. Subtract for the softer foam and relax room.
4. Subtract for space behind the knee.

Conclusion

When looking at the Autonomic Nervous System, we know that the seating system is successful for the child if the child is:

- Happy, not crying or complaining.
- Interacting and not spaced out or sleeping.
- Breathing without distress or strange noises.
- Having regular bowel movements.
- Not extending out of the seat in discomfort.

In the assessment process, it is critical to:

- Fully assess joint mobility and judge what is the practical flexibility.
- Assess the child in the upright seated posture using hand simulation. Utilize your hands and body to assess what postural support and alignment allows the child to relax, ease in breathing.
- Ask the caregivers, teachers, therapists what improves the child's comfort, how the child eats, digests, and has bowel movements. What have they found that helps the child with comfort and function?

In the design/intervention process:

- Translate the results of hand simulation into simulation with materials.
- Remember the intestines are under a 45° positioning belt. Use alternatives to help support the pelvis, like an anti-thrust seat with a posterior pelvic/sacral support, 4-point positioning belt.
- Remember the lungs are under the chest supports. For relaxed respiration, the thorax needs to be supported, and allowed to expand. This might require trying different angles of tilt-in-space. Sometimes when there is tension in the neck and upper thorax, the head and neck might need to come forward for comfortable air exchange. Conversely, a collapsed trunk will require more support and a tilted back seating system.
- Allow for the practical flexibility of the joints, particularly the hips, knees, ankles, feet and spine.
- Consider alternative therapies such as visceral and nerve manipulation.7

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PS 5.5: Neuromuscular Spinal Deformities In Children: Challenges of Custom Molding

Michele Audet, MMSc, PT, ATP

Introduction

Providing the appropriate supportive seating system to neurologically impaired patients is always a challenge. The challenge is intensified when the patient is a growing child, has developing orthopedic complications, or a progressive neurological disease. When a planar seating system is inadequate to provide the needed postural control, or there is an existing spinal deformity, custom molded systems are considered. A review of cases where custom molded seating is utilized at Children's Healthcare of Atlanta, reveals that 3 major diagnostic groups are the primary recipients. A review of the literature reveals the following information about these diagnostic groups and why the potential for scoliosis is of particular concern.

Cerebral Palsy

Evidence shows the incidence of scoliosis with curvatures >40 degrees at skeletal maturity, is approximately 30%. Most of these curves start before age 10 and patients with spastic quadriplegia are at greatest risk. Furthermore, progression of scoliosis does not stop at skeletal maturity. Studies of institutionalized adults show that curves >50 degrees continued to increase at a rate of 2.4 degrees per year in bedridden adults. There is also evidence in the medical literature showing an association between intrathecal baclofen pump placement and increased scoliosis, in one study, an 11 degree increase per year.

Spinal Muscular Atrophy

Almost all Type 1 and Type 2 SMA children develop scoliosis. Type 1 develop scoliosis at 2 years of age or younger. Type 2 develop scoliosis between 1 and 7 years. Most curves are single C shape curves toward the right side. The flexibility of the curves are greater than the flexibility seen in idiopathic scoliosis but progress more rapidly.

Duchenne Muscular Dystrophy

Scoliosis rarely occurs in the ambulatory child. Once ambulation stops, scoliosis occurs in 75 to 90% of children and progression can be rapid.

Early Onset Scoliosis

Throughout the literature, authors note improved outcomes, less influence of secondary effects of deformity and less surgical complications when surgery is done when the degree of curvature is less than 40 or 50 degrees. But, arthrodesis performed before skeletal maturity raises its own problems including prevention of growth of the vertebral column and influences thoracic cavity growth. Particularly problematic populations are those with congenital scoliosis and SMA where scoliosis presents as early as 2 years of age or younger. Two popular "fusionless" surgical procedures are done successfully with these populations and are being utilized increasingly in our population.

Vertical Extension Prosthetic Titanium Rods (VEPTR)

Initially devised as a treatment for congenital scoliosis, in particular, when there is risk for Thoracic Insufficiency Syndrome (TIS). TIS is associated with fused ribs and a thoracic cavity which is unable to support normal respiration and lung growth. An expansion thoracostomy is performed and a VEPTR device is attached between 2 ribs, to keep the constricted chest wall expanded. Additional VEPTR devices are attached from rib to spine, to correct the spinal deformity. Lengthenings are done every 6 months and eventually surgical spinal fusion is done.

Growth Rods

Usually, 2 rods are placed subcutaneously, or below the fascia, next to the area of the spine needing lengthening or correction. They are attached to the vertebrae at the ends of the curve region, with bone hooks or screws. Serial lengthening or replacement of the rods is done every 4 to 6 months, until eventual surgical spinal fusion close to the end of growth.

Clinic Experience

Children's Healthcare of Atlanta has been using custom molded seating systems with the pediatric and young adult population for many years, with generally good results. Significant limitations have been identified through clinical experience with our population. As follows:

1. Patients with severe rotational deformities are difficult to accommodate, as the custom mold is attached into a flat planar pan or base.
2. Patients with pronounced anterior inclination of their trunks and/or anterior pelvic tilt are difficult to position, as they are far forward of the back canes.
3. There is minimal flexibility of the systems for growth or change in status.
4. Bulk and weight of the systems is not appropriate for children with potential for self propulsion.
5. Custom Ride Seating System

The custom Ride seating system was introduced as an alternative to the traditional custom molded systems at Children's, to address the problems stated above. Benefits of the system were considered to be:

1. Attachment of the custom back to the wheelchair frame by multi-axial attachment hardware, allows positioning and rotating the back in multiple planes, to support or accommodate the deformity.
2. System has the ability to be angled or adjusted with change in status such as growth rod or VEPTR rod lengthening. Also has ability to grow in height and some width.
3. ts small size and low profile make it a feasible possibility for providing support and/or accommodate deformity, while allowing manual wheelchair self propulsion.

Results

As of December 1,2010, Children's Healthcare of Atlanta has evaluated 31 patients for Ride custom seating. 20 patients have been molded and 12 have received their systems.

Age Range: 4 years 10 months to 20 years 10 months.

- 16 patients age 15 to 20
- 9 patients age 10 to 15
- 6 patients under age 10

Diagnoses:

- 19 cerebral palsy
- 5 muscular dystrophy or SMA
- 4 spina bifida
- 3 other neuro

Posterior Spinal Fusions: 9 patients have had fusions.

VEPTR or Growth Rods: 4 patients. 1 had spinal fusion after 3 lengthenings. 1 had spinal fusion after 8 to 10 lengthenings.

Previous Custom Molded Systems: 13 patients

Full Body Molded Systems: 2 patients receiving full body molded systems secondary to severe deformity, minimal hip mobility and need to be recumbent.

Discussion

At time of paper submission, 2 children with spina bifida have had their systems delivered. Both are able to self propel their manual wheelchairs. One is undergoing VEPTR rod surgery and has had a lengthening since delivery. The system was rotated to accommodate her change in shape with good results. This child had difficulty pushing her manual wheelchair before the Ride system and was being considered for power mobility. Her stability has improved to the point she is much more efficient with self propulsion and is now awaiting a power assist system rather than full power.

I

nitial report of patients and families has been very positive with the Ride system. 5 patients who already have their new systems have previously had other types of custom molded seating. All 5 have voiced initial satisfaction and 2 have stated preference for the Ride system over other custom molded systems they had in the past.

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n conclusion, the custom Ride seating system shows good potential for use with children and young adults with scoliosis and other spinal deformities, seen at the Seating and Mobility Clinic at Children's Healthcare of Atlanta. Strong points appear to be its multi-axial attachment hardware, ability to be modified and its smaller profile.

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PS 6.1: Single Switch Access: The Story of One Boys Independence

Jay Doherty, OTR, ATP, SMS

Abstract

As therapists and providers we have all had some very challenging and difficult clients throughout our careers. Some of our consumers seating needs are so difficult that trying to provide them with adequate stability can take significant time and equipment. Since these clients are so difficult to seat, it is very easy to lose sight of the fact that we may be able to provide independent mobility to these individuals through use of alternative controls. In order to provide the best service we can, we need to think of every option available that may improve the consumer's level of independence.

Background

A.B. was three years of age when the assistive technology team first evaluated him for a Augmentative communication device. The team was assembled to explore augmentative communication options for A.B. His medical diagnosis is Cerebral Palsy: Double Hemiparesis. He presented with very low tone at his pelvis, trunk, neck and head. His tone in his arms fluctuated with activity.

After Evaluation of communication we found that he could access a single switch with right hip flexion. We also discovered that A.B. is a very smart creative little boy.

We approached the subject of power mobility with his parents. They had no idea that A.B. could possibly independently control a power wheelchair with use of only one switch. His mother stated "I thought we had to wait to see if he gained better control with his arms so he could drive with a joystick". We educated A.B. and his parents on what types of alternative drive controls were available.

The Evaluation Process

Since we had evaluated A.B. previously for communication we thought single switch access would be the best option. Since months had passed since the evaluation, the team decided to see if he could control the power base with a joystick. We quickly ruled out joystick access as an option. We then tried the joystick mounted down at his foot and then at his knee. These two locations also proved to not be accessible to Andrew.

We then placed a switch mounted about 1" above his right knee. A.B. utilized hip flexion of his right leg to access and hold down the switch. He was very accurate driving with this access method. The team started A.B. out with 4-way scanning. Since the Q-Logic electronics have 4-way and 8-way scanning built into the programming of the Enhanced Display we used the built-in scanning features. A.B. was able within 1 hour to drive the power base in all directions accurately. We next moved A.B. to 8-way scanning feature. A.B. practiced for about 15 to 20 minutes and picked up driving with 8-way scanning and figured out quickly how to utilize the veering directional controls.
We knew since A.B. was 3 years old that it was important to include all team members, so we setup a two week trial to be sure the pre-school team was on board. After the two weeks the entire team was ready to recommend a system for A.B.

Recommendations

The team recommended a Q610 power base with a manual tilt-in-space feature for positioning purposes throughout the day. He was provided with a pelvic belt positioned at a 45° angle to stabilize his pelvis along with a pair of lateral thigh supports and a posterior sacral pad. Lateral trunk supports provided the lateral stability his trunk required. An I2I head support with swing away temporal pad and an occipital pad provided the anterior trunk support and head control he required to be stable in the seating system. For his lower extremities he had an ankle hugger on his left ankle and a medial thigh support prevented his lower extremities from scissoring while accessing his switch.

Follow up

A.B. drives with 8-way single switch scanning extremely affectively. His scan rate has been sped up to .8 seconds. He drives in a variety of environments with great ease. Since receiving his wheelchair he has developed better control with his left lower extremity (hip flexion). A.B. now controls a switch mounted above his left knee to access his Vantage for communication and the switch over his right knee controls the power wheelchair electronics.

Since gaining better access to two switches, A.B. tried two switch driving (available in the programming of the Q-Logic electronics). To drive the wheelchair with two switches requires the following movements: Forward (hit the right switch twice and hold on second hit), right (hit and hold the right switch), Reverse (hit the left switch twice and hold on the second hit), and left (hit and hold the left switch). He was successful driving with two switches but decided he prefers single switch scanning.

A.B. accesses his computer with the Bluetooth mouse emulator (built into the Q-logic electronics). He controls the television with his Vantage via infrared control (although his enhanced display offers the same access as well). His parents want him to be like other children so A.B. brings his laundry down to the laundry room, and brings out the recycling with his power wheelchair. At school they have integrated his wheelchair into different activities. They play tag on the playground with the other children running around with hula hoops and A.B. hooking his foot on the hula hoop to tag them, and they hook a rope to his wheelchair and everyone follows him when he is the leader.

Conclusion

Remember a switch can truly be mounted anywhere. We need to remain creative with options when looking at mounting any switch. The mounting location will probably be as unique as the individual we are working with.

We always need to remember, we owe our consumers the greatest level of independence they can achieve. If it is an access method which seems labor intensive to us, we still need to allow the consumer to determine if it is to slow an access method for them or does the independence that the access method provides out weight the time factor for them. Give them the chance to live part of their life independently and they may just surprise you with the level of independence they can achieve.

PS 6.2: Twenty-Four Hour Postural Management for Adults

Linda Norton, OT Reg.(ONT), MScCH

Twenty-four hour positioning for children, especially for those with neuromuscular diseases has received attention in the literature, however this approach to adult positioning has received less attention. Positioning literature regarding adults has focused on positioning after acute injury, for the prevention of pneumonia in ventilated patients and for the prevention of pressure ulcers. The idea of balancing positioning to prevent deformity, positioning for stability and function and positioning to prevent pressure ulcers is explored

Twenty-four hour positioning

In children, the goals of night time positioning are to “support the child in an optimum position to promote the symmetrical growth of muscles and joints and to promote comfort and decrease deformity throughout the night.”1 The hip joint is often a focus for positioning for children with cerebral palsy as this joint is anatomically normal at birth, but does not develop normally in many children because of the imbalance in muscle pull and decreased weight bearing.1 In adults the focus is not on development but rather the prevention of deformity including contractures.

Thirty nine percent of adult patients (n=61) discharged from the intensive care unit (ICU) had at least 1 joint contracture, 34% of those not lost to follow up (n=50) had at least one functionally significant joint contracture at discharge from the hospital approximately 6.6 weeks later.2 Increased length of time in the ICU was correlated with increased risk of contracture development. In this study it was found that receiving steroids was associated with lower odds of developing any contracture. Although contractures of normal joints subjected to immobility are theoretically preventable, in this study the authors suggest that despite Occupational Therapy and Physical Therapy monitoring and preventative activities, these measures were insufficient to prevent the joint contractures.2

Elevating the head of the bed to greater than 30 degrees reduces the risk of Ventilator Acquired Pneumonia, in ventilator dependent patients.3,4 This same position however increases the risk of pressure ulcer formation.3 The best position therefore will vary depending on the needs of that patient.

Every 12 minutes, healthy individuals change their position even when asleep.3 For clients who are unable to reposition themselves in bed, best practice recommendations suggest turning every 2 hours, and then adjusting that time frame based on the needs of the individual patient.5 There is evidence to suggest that this practice standard is not consistently met.3 Currently the impact of extending the time between repositioning to every 3 to 4 hours is being investigated.

Clearly positioning to prevent and manage pressure ulcers should be a high priority as approximately 26% of patients in the Canadian Health Care System have a pressure ulcer, 70% of which could have been prevented.6 As discussed positioning for the prevention and management of pressure ulcers addresses the frequency of repositioning and keeping the head of the bed below 30 degrees where medically possible. The actual body positions recommended focus on prevention of sustained pressure on bony prominences or other risk areas, rather than positions to preserve range of motion.

Barriers to Twenty-Four Hour Positioning with Adults

Specialty equipment such as a therapeutic support surface, wedges or other positioning systems may be required to meet the client’s positioning and pressure management goals. This equipment may not eligible for funding. For clients struggling to access funding for other equipment and services, this additional cost may be unrealistic.
In some communities, access to care providers in the home may be limited. As the child grows into adulthood, the physical size of the client may make care and positioning more difficult. In hospitals and other facilities, ceiling lifts, repositioning equipment and additional staffing may be available to help with repositioning a client. In the community the safety and security of the formal (e.g. health care provider) and informal (e.g. spouse) caregivers may be more at risk due to the lack of support from a second individual during repositioning activities, and a lack of available equipment. Roles of individuals in the family change as a result of the impact of chronic disease. For example rates of marital separation and divorce are higher among the people with Multiple Sclerosis related to: changing the balance of the relationship, assuming a care giving role, sexual dysfunction, cognitive impairment and financial strain.7 Equipment and approaches to bed positioning (such as specialty mattresses, positioning devices etc), could conceivably be an additional stressor on the spousal relationship.

Positioning for Adults with Neuromuscular Disease

An optimal position for clients with neuromuscular disease has not been clearly defined but must be based on a thorough assessment of the client and identification of their specific needs and goals. Although there is indication that therapeutic positioning may not prevent all contractures, it should still be considered as a component of the care plan of the individual patient. Positioning for the prevention of pressure ulcers should always be a consideration in the adult population considering the prevalence of pressure ulcers in our health care system. Once the postural care plan has been developed and implemented, regular re-evaluation to determine effectiveness and sustainability.
Ultimately there needs to be a balance between positioning for the prevention of contractures and deformity, stability and pressure management which is sustainable within that client’s environment and social context.

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PS 6.4: I Deserve Filet Mignon: Best Practice vs. Compromise in Equipment Prescriptions

Douglas Whitman, OTR, ATP
Amy Bjornson, OT

The purpose in writing this paper was to explore / assist my own practice in equipment provision when what the team (consumer, vendor, therapist, and MD) considers the 'optimal' wheelchair for a given consumer cannot be provided. At times, the wheelchair that we think will best suit ALL of our client's needs isn't possible for a variety of reasons that I will attempt to explore here. When that optimal equipment solution is not possible, compromise occurs. I wanted to explore for my own practice the question: "is that ok?"

When we evaluate someone for a piece of mobility equipment we come up with various findings- objective measurements, strengths, limitations, consumer or caregivers wishes/ wants desires, … these shape our recommendations and eventually the outcome prescription and what is delivered. Often we must compromise what is ideal and make it real.

Compromise is defined as:

- 1a : settlement of differences by arbitration or by consent reached by mutual concessions
- b : something intermediate between or blending qualities of two different things (1)

A compromise may also be thought of as a "concession". This can have a negative connotation, as if we are "giving in" or accepting a less than optimal outcome.

Various factors seem to force the compromise.

1. Too often financial constraints come into play (2). Coded items are too expensive for a supplier to provide under the allowable. ("consumer needs a certain type of chair or accessory, but it's not covered by/ too expensive for the insurance coverage").
2. Environmental barriers/ space restrictions sometimes interfere (manual tilt in space is recommended but the family has a small car and wheelchair needs to fold for car trips or consumer needs power but there are 3 steps and mom can't lift a portable ramp, can't leave it in the apartment bldg lobby).
3. Attitudes, perceptions, and desire to 'fit in' influence equipment choices (3)
4. Limited tech tolerance – family afraid of complicated equipment. Fear of change (4)
5. Functional considerations can force compromise in equipment prescription (patient cannot perform necessary ADL task in wheelchair with optimal seating system, so must give on the seating/ posture)
6. Postural/ Positioning limitations: consumer requires a certain posture/ position for skin protection so wheelchair is big for the home or not set up correctly for some other functional activity- (needs tilt on power chair, now sits higher than previous so doesn't fit under desk to run his computer)

Sometimes compromises work out and sometimes they don't. I wish I could say that every time I worked out a compromise we (consumer, vendor, and myself) were happy or at least satisfied with the outcome, but that's not the case. An unhappy "blending" of optimal and possible can lead to equipment abandonment, set-backs in productivity, loss of time spent learning to use new equipment, or health impairments such as skin breakdown, physical injury or even death (4).

Following are case examples of six categories of limitations consumers may encounter:

Financial limitations:

Jayden A: Jayden is an 8 year old boy with CP diplegia, fluctuating muscle tone, developmental delays and hearing impairment. The "ideal" wheelchair was determined because of a key feature that was not available on other brands of wheelchairs. This brand not normally distributed in our geographic area. When investigated, the vendor could not afford to provide under the insurance allowable since it was a manufacturer they did not do business with (the vendor did not get the pricing they needed to provide the chair under this insurance plan). The compromise was a different brand of pediatric manual without a key feature only found in the "ideal" chair. The outcome was equipment abandonment/ refusal.

Christina D- Christina is a 22 year old girl with muscular dystrophy. She is vent dependent. She lives with her family and has 24 hours nursing. She attends a local college. Since she is currently in a manual wheelchair, she must be pushed by her caregiver. We requested a power wheelchair with full power seating and custom molded seating system. Additionally we requested accessible computer controls thru drive control however this feature was not covered by her HMO. If she wants to control her computer independently she will have to pay privately for accessible computer control and require assistance to set-up, increasing her dependence on her caregiver.

Gloria D- DM, s/p bilateral BKA secondary to advanced DM, obese. Requires power wheelchair for independent mobility. The "ideal" power chair was classified as group 3. It was the ideal choice for this consumer as it could be ordered in the seat-to-floor-height that was ideal for her environment (able to go under her sink in her accessible bathroom. However, only a group 2 power chair was covered under Medicare as she doesn't have a neurological diagnosis.

Environmental limits:

Luis S- 40 years old, spastic diplegia CP, moderate MR. Lives at home with his sister. He has better propulsion in rigid frame, but sister wants to fold wheelchair to put in car- her primary concern/ need/ goal, so compromised to folding K0005. While some rigid frames can be folded down or disassembled to allow car transport, the client's insurance would not cover a "higher end" rigid frame wheelchair. The only financially feasible option for a rigid frame had a "box" frame and was too large and unmanageable for the family car. Sharon T- 48 years old, obese, history of multiple LE fractures resulting from falls and she has subsequently ceased ambulation. She attends a day program, but power chair was too heavy for the van lift. She had to compromise and use a heavy duty manual wheelchair for her home mobility and use when traveling although she was independent only with indoor mobility on smooth surfaces. Her power chair can only be used in and around her day program environment. Henry M: 45 year old male CP diplegia, severe MR, often incontinent, lives in accessible group home environment. Uses a rigid K5 manual wheelchair independently. He would sit well on a lightweight foam cushion. Compromised with sealed upholstery cushion because of history of cockroach infestation.

Attitudes/ Perceptions:

Elon V.- 8 year old girl with CP, spastic quadriplegia, developmental delays, severe asymmetrical posture including scoliosis, leg length discrepancies related to hip dislocations. Mom wants it to look like a stroller, but the child really needs a pediatric tilt in space with custom seating to accommodate asymmetries.

Charlie – Quad for 30+ years. Has been using folding frame because that's how he was taught to get a wheelchair into the car. Rigid would be much more functional and lighter to propel. He doesn't want to learn a new transfer/ transport method, so he chose to continue in a folding frame. Limited Technology Tolerance… too much tech for their environment to support, too many caregivers, school, group home, parents with multiple kids

Raymond C- 26 years old, CP with spastic quadriplegia, dysarthria, normal cognition. Raymond obtained a power chair to increase independence in community activities including wheelchair sports, but mom is afraid to take it home despite training from the prescribing therapist- compromise is letting it stay at program, limits his independence at home but allows independence at program where caregivers are more accustomed to power wheelchairs and more willing to allow him to take safe risks.

Margaret C: 51 year old lady with CP, spastic quadriplegia, MR, history of skin breakdown. Originally used a custom molded seating system, however began to develop skin breakdown and complaints of pain after prolonged sitting. An inflatable air cushion was considered however it was determined that the group home residence cannot maintain the inflation, so the compromise was a lower maintenance pressure relieving cushion. The compromise was successful as the consumer no longer complains of pain and the skin breakdown was resolved.

Chelsea – diagnosis rare form of spinal degeneration. Quick onset, 15 years old. Living in Singapore. Low tone - poor head control but prone to seizures and flexion spasticity. Seating had to be simple for care givers, school carers, The selected system needed to require minimal skill at getting her into the chair, needed to be maintenance free and durable. Mini joystick user – rather than more complicated seating, head support and shoulder keepers etc, went with neck collar or even neck "band" that provided safe head control when required

Functional limits:

Betty G- 26 year old girl, s/p meningitis, MR, obese, postural deformities including fixed kyphosis. Her mother requested a bath chair that would allow her to wash Betty's long hair. The ideal piece of equipment was an adaptive device ("Comfort Cape"), however, it was not covered by her insurance and was cost prohibitive for private purchase. Instead mom chose a chaise –type bath chair with a high back that was covered by insurance but didn't work for her.

Wilson G: 21 year old man with advanced muscular dystrophy, normal cognition, attends college. He needed an adaptive commode to allow him to sit independently after transfer. Currently his mother has to hold him on the commode due to his postural impairments. He received an adaptive toilet system that didn't work for him because couldn't tolerate the seat due to significant pelvic obliquity and sensitivity in sitting surface. A custom seat was proposed, however the consumer declined to pursue it, feeling that it wouldn't work.

Jose B- 23 year old male with CP, spastic quadriplegia, and multiple contractures. He had to compromise on self-propulsion vs positioning… needed tilt for pressure relief but cannot push the tilt in space chair due to UE contractures The tilt chair is too heavy and cannot set up for UE contractures, cannot operate a power secondary to cognitive limitations. The caregiver chose to go with primary need of pressure relief and positioning over his attempts at independent mobility

Kenny F- 52 year old man with spastic diplegic CP and normal cognition. His backrest needed to be at a specific height for transfers- The back height he needed for his unusual transfer technique was not possible on the new wheelchair frame. We mounted the backrest upside down and it worked. A successful compromise.

Amber – T10 Para – very active, full time propeller, caths in the chair (so has to pull her pants down by leaning over backrest), and has significant scoliosis. Had to compromise on the seating because she would not tolerate a taller backrest or laterals to complete this necessary ADL task in the wheelchair.

Posture and positioning limitations - have to compromise some functionality of the mobility system due to overriding postural or positioning need

Thomas L.– 53 years old, CP, Spastic quadriplegia, profound MR, severe kyphoscoliosis, severe hypertonia and multiple contractures throughout upper and lower extremities, and a history of severe gastroesophageal reflux. He lives in a state-run group home with 24 hour care in an urban area

He uses a prone cart which is extremely long and makes access to various environments challenging. He is not able to interact in his environment as much and cannot eat in supine, but cannot travel in prone. Compromise was two mobility systems: supine cart for travel, and prone for his home environment.

An interesting side note when writing this paper, that many consumers with compromises in their equipment order had limitations in more than one category, so it seemed like the compromise became more complicated.

How do we decide? We lay out the costs and benefits of each option and let the consumer/ caregivers decide. Kittel et al (5) listed consultation with the user as a strategy to improve the outcome of use of the wheelchair. Louise-Bender Pape et al (4) maintains that a sense of control vs "non-participation in device selection" is important to users when ascribing meaning to their experience of assistive technology. As experts, we can provide a context, answer questions, and offer suggestions based on our experience with similar cases if possible. Ultimately it is consumer/ caregiver right and responsibility to choose.

Conclusion

Filet is nice but ground chuck can be satisfactory when chosen with care.

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PS 6:5 Let's Roll! A Team Approach to Achieving Optimal Rolling Dynamics

Jacqueline Wolz, MSPT
Randy Potter, ATP,CRTS
Jim Black

Objectives

1. Understand the determining factors for frame length within a wheelchair configuration
2. Describe problems that may occur when frame length is too long and too short
3. Assess an individual propelling over three different obstacles in three different frame lengths

Manual wheelchair configuration may be considered routine after many years of practice. Yet, should it feel so routine for the clinician in today's world? Multiple options are available when going through the process of completing specifications on a custom manual wheelchair. Frame length is often an afterthought, as it is typically a result of wheelchair frame choice and seat depth. Seating specialists are familiar with optimal wheel access to promote optimal propulsion, but how do we determine the best wheel base for the end user? What defines the "best" wheel base for the individual? Balance, maneuverability, and static and dynamic function are key concepts when considering optimal wheel base. If optimal wheel base is considered after the final wheelchair configuration, the wheels may be moved back or forward to provide the optimal balance angle. This change completed after-the-fact may negatively affect the wheel access.

This presentation will examine the effects of frame length and wheel base and its relationship with function in everyday wheelchair use. Advantages and disadvantage of relatively short and long frame lengths will be discussed. A video will be presented that shows an end user negotiating three environmental obstacles with three different frame lengths. Participants will have the opportunity to analyze this movement and discuss optimal frame length in these three activities.

The seating specialist must consider and determine optimal wheel base and frame length prior to finalizing the wheelchair prescription.

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Saturday

March 5, 2011

IC 54: Out and About: Reducing Injury via Vehicle Wheelchair Lifters and Van Conversions

Joan Padgitt, PT, ATP
Ryan Crosby, ATP

During the initial rehabilitation phase, the new wheelchair user is educated on acquired or "secondary" injuries resulting from long-term wheelchair use. These secondary injuries include sitting acquired pressure ulcers (SAPU's), repetitive strain of the upper extremity resulting in muscle tears, impingement, and tendonitis, avulsion-type fractures from transfers and bone fractures related to falls.

Mechanisms of secondary injury from the wheelchair can be accumulative over time or a sudden onset. For example, a small (or large) movement of the wheelchair (w/c) during a transfer can cause shoulder injury to the stabilizing arm or result in a fall between transfer surfaces causing a fractured femur or wrist. A poor propulsion technique while negotiating up a ramp or down a curb can contribute to shoulder pain, carpal tunnel syndrome or biceps tendonitis. Additionally, physical or mental fatigue after a long day at work or less than ideal weather or parking conditions can result in non-participation choosing to forego an activity such as grocery shopping or attending a social event.

To avoid injury and maintain the ability to perform activities of daily living, it is recommended that the w/c user follow guidelines to optimize healthy shoulder joints and include:

1. Be active and engage in a formal physical activity or exercise program for 30 minutes at least 5 days/week. The exercise session should include a warm-up period of light activity, followed by a main activity consisting of cardiovascular, muscular strength or flexibility training and end with a short cool-down period of light activity (1).
2. Maintain an optimal weight for their height and age (1).
3. Optimize manual w/c configuration/ set-up (2).
4. Perform optimal manual w/c propulsion (minimize force on the push rim, decrease the frequency of pushes, improve the smoothness and increase the length of push on the rim) (3).
5. Be proficient in advanced w/c skills training (wheelies, negotiating curbs, uneven terrain, etc.) (4).
6. Decrease the # of transfers into/out of the wheelchair per day.
7. Eliminate/decrease lifting of heavy objects and over-head reaching/ pulling particularly when the UE is abducted and externally rotated (2).

Even with strict practice of the above recommendations, multiple transfers into a vehicle, as well as lifting and stowing the wheelchair into the vehicle is a frequent mechanism for injury and can lead to permanent loss of function.

The use of a wheelchair lifter for the vehicle or ramp van conversion can help reduce the likelihood of injury and increase access to community mobility. This type of equipment tends to be consumer purchased (except persons with worker's comp or VA benefits). It is, therefore, important that the wheelchair seating and mobility specialist (SMS) identify the person's current vehicle and lifter options at the initial w/c evaluation and future w/c transportation goals. A basic knowledge of vehicle lifter options, vehicle and w/c considerations, and the approximate cost of this equipment is needed in order for the SMS to educate the client and their family.

When considering vehicle lifters for a power wheelchair, the w/c features that need to be addressed include w/c weight

Table A – Power Wheelchairs (PWC):

Type of Lifter Power Wheelchair (PWC)	Vehicle Considerations	Wheelchair Considerations	Cost of Equipment* (*Approximate)
Hitch-mounted external platform (350 lb.weight capacity)	1. Tongue weight of vehicle. 2. Mid- or larger size SUV 3. Transit tie-down brackets	1. Weight of PWC 2. WC width* (outside to outside of armrests) *Can be an issue with bariatric seating.	1.Possible need to upgrade vehicle suspension (cost varies) 2. ~$2,300-3,000 includes installation 3. +Price of hitch ~ $250-400
Bed-mounted external boom-arm (pick-up truck) (400 lb.weight capacity)	1. Cannot have topper w/ less 36"vertical opening. 2. Turny seat	1. Weight of PWC 2. May need fold-down back w/ topper.	1. ~$3,800 for lift 2.~$8,000 for turny seat
Internal stowage platform lifter (lifter takes up 4-5"H space) (350 lb. standard and 450 heavy duty wt. capacity)	1. Minivan or larger SUV 2. 36" vertical height opening	1. Weight of PWC 2. Fold-down back 3. 34" overall w/c height 4. Transit tie-down brackets	1. ~$3,500-5,500 (need dock & lock for HD PWC = ~$1,500)
Internal stowage boom-arm lifter (lifter takes up 4-5"H space) (250 to 450 lb.wt. capacity)	1. Minivan or larger SUV 2. 36" vertical height opening	1. Weight of PWC 2. Fold-down back 3. 33" overall w/c height 4. Transit tie-down brackets	~$3,00-4,000
Ramp van conversion	1. Driver vs. passenger 2. Transit tie-down brackets vs. EZ-lock 3. Turny seat vs. drive from w/c 4. Headroom and door opening 53 to 56"H (Drop floor (10" to 14" drop floor). 5. Seat belt extensions	1.Turning radius of w/c (mid-wheel drive affords best mobility) 2. Lowest seat to floor height as possible (head & knee height low) 3. Stay as narrow as possible.	Brand new: $45,000-65,000 Previously owned 2-3 yrs. old: ~$25,000-42,000 4-5 yrs. old: ~$17,000-25,000

(e.g., battery size, power seating options, heavy duty frames), w/c width (particularly with bariatric sizes), turning radius (specifically front-, mid-, or rear-wheel configuration), fold-down back canes, and overall w/c height (w/ back folded down) (see table A).

When considering a vehicle lifter for a manual wheelchair, the features that need to be considered include w/c weight, ease of removal of w/c components (eg, seat cushion, back support, rear wheels, armrests/clothing guards), cantilever frame vs. box frame, locking fold-down back, rigid vs. folding frame, and length of frame (see table B).

Table B – Manual Wheelchairs (MWC):

Type of Lifter Manual Wheelchair (MWC)	**Vehicle Considerations**	**Wheelchair Considerations**	**Cost of vehicle equipment* (*Approximate)**
Self	1. 2-door sedan 2. Driver seat recline 3. Passenger seat fold forward and recline	1. Ease of removal of cushion, rear wheels, clothing guards, etc. 2. Weight of MWC 3. Cantilever frame	None needed.
External boom-arm lifter (pick-up truck)	1. Turny seat	MWC under 85 lbs. PWC under 350lbs.	1. Cab-forward pivot type lift (Bruno Outrider) ~ $4,000 2. ~$8,000 for Turny seat
Trunk lifter	1. Larger trunk – opening needs to big (Larger size sedan	Folding frame (narrow as possible)	~$1,800
External hitch-mounted lifter (eg, Tilt & Tote & Bruno power)	1. Tongue weight of vehicle	1. Folding frame	Non-power: $400 Power: ~$2,000 + the price of a hitch (250-450).
WC roof topper	1. Mid-size sedan or larger	1. Folding frame 2. Frame width/length restrictions 3. Ability to remove front riggings & cushion	~$4,000.

In summary, vehicle wheelchair lifters and van conversions tend to be a consumer product purchase. Although this type of equipment is often considered cost prohibitive, it is important for the wheelchair seating & mobility specialist to identify w/c transportation issues at the time of the initial evaluation and be able to advise the person in the type of vehicle that can support the transport of their w/c, know the different types of lifters, identify & eliminate w/c features that pose barriers to the successful use of a lifter, as well as the average costs of this equipment in order to educate their client.

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IC 55: Beyond Seating: Enhancing Function & Fun with Children through Adaptive Equipment

Jonathan Greenwood, PT, MS, NDT, PCS

Faculty Description

Jonathan Greenwood PT, MS, NDT, PCS received a B.S. degree and M.S. degree in physical therapy from Northeastern University. He is the Director of Pediatrics at Northeast Rehabilitation Hospital Network and is owner of Greenwood Therapy Services, L.L.C. where his roles involve program development, clinical consultation and direct service delivery in a variety of settings. Mr. Greenwood is a Board Certified Pediatric Clinical Specialist, a Pediatric Neurodevelopmental Trained therapist and holds certification as an Early Intervention Specialist. Having worked in a variety of treatment settings, he brings a working knowledge and hands on approach to pediatric care across all disciplines.

Description of Course

Therapists are often challenged by complex pediatric patients who present with multiple equipment needs all at one time. This course will guide clinicians through the process of managing equipment needs of complex pediatric patients and their families beyond that of seating. A Case study will be used to advance clinical problem solving skills needed to address the indications, complications and complexities when choosing equipment for complex kids. This course educates clinicians on current clinical assessment, equipment options, justification of equipment and Evidence Based Practice for the variety of equipment options "Beyond Seating" to enhance the function and fun of children with adaptive needs.

Objectives

- Participants will be able to identify the children who may benefit from adaptive equipment to enhance their lives
- Participants will be able to assess children for equipment needs beyond seating needs
- Participants will demonstrate evidence based clinical decision making within a family centered model of care

One Hour Course Outline:

- Identification of non seating equipment options for children with complex adaptive needs
- Standing Equipment
- Gait Trainers
- Alternative Seating Options (classroom chairs, feeding chairs, floor sitters)
- Bathroom Equipment
- Hospital Beds
- Adaptive Tricycles
- Combination Equipment Options

Bringing Clinicians through the process of Prescreening & Evaluation for Functional Equipment

Evaluation of the Evidence for Adaptive Equipment for Children with Special Needs

Building an Equipment Blueprint for each Child

Comprehensive Letter of Justification Review

- Outline Letter of Medical Necessity
- Justifying beyond the basics – itemized justification to ensure successful funding
- Funding options for equipment (traditional and out of the box)

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IC 56: Focusing on Breathing in Adults with Cerebral Palsy

Jessica Pedersen, MBA, OTR/L, ATP
Jill Sparacio, OTR/L, ATP, ABDA

Respiration is a vital function that impacts all areas of one's ability to function. Inability to properly oxygenate the body results in many adversities and can be life threatening. Individuals with cerebral palsy experience greater difficulties due to imbalanced tonal patterns, skeletal asymmetries and limited mobility. In order to understand the affect of seating and positioning on respiration, an understanding of the respiratory process is needed.

Respiration

Humans need to constantly move air in and out of the lungs because the body cannot store oxygen. Respiration is an autonomic nervous system function regulated in the brain stem. Respiration allows for an exchange of oxygen and carbon dioxide gases through diffusion. The process can be broken down into three stages which include: movement of air in and out of the lungs, the exchange of gases between the internal surface of the lungs and blood, and the exchange of gases between the blood and cells of the body.

Groups of muscles act together to expand the chest cavity, drawing air into the lungs. They are the dome-shaped diaphragm, the external intercostal muscles and the abdominal muscles. The diaphragm lowers and the rib cage expands. The atmospheric pressure (outside the body) is higher than the pressure in the lungs. Air flows from a higher pressure to a lower pressure and the lungs fill with air through a system of channels called the respiratory tract.

The respiratory tract starts at the nose and mouth. If air is inhaled through the nose, it passes through the nasal passages. The nasal passages warm, humidify, and filter the air. The air continues to filter as it passes through the respiratory tract. After passing through the oral cavity or the nasal passages, the air passes the pharynx which has an epiglottis. The epiglottis is a flap which performs the function of preventing food from entering the trachea (windpipe). At the top of the trachea is the larynx. Two bands of tissue that extend across the larynx make up the vocal cords. The trachea is in front of the esophagus, which is aligned with the spine. Spinal curvature can, therefore, negatively affect breathing, airway protection, and swallowing.

The trachea branches into the bronchi, which are large tubes that carry air in and out of each lung. From the bronchi, the air passes into branch-like bronchioles and finally into a clustering of balloon-like sacs call alveoli. The alveoli make up most of the lung tissue contributing to its soft spongy consistency. Each alveolus is lined with a fluid called surfactant, allowing the oxygen and carbon dioxide to dissolve so it can diffuse through the aveoli walls. The alveoli are covered with capillaries. Blood receives oxygen from the alveoli. The red blood cells then carry the oxygen to the body tissue cells. Carbon dioxide follows a reverse pathway and leaves the blood, entering the lungs. It is expired through exhalation out of the body.

In expiration, the ribcage and diaphragm relax and the lungs contract. The air pressure inside the lungs is greater than the atmospheric pressure causing the air to move out of the body. Some air always stays in the lungs which is called residual volume. The amount of air that moves in and out of the lungs is called tidal volume.

This pressure is the key to breathing and is the focus of the "soda pop can" theory developed by Mary Massery, PT. Massery demonstrates that a closed aluminum can maintains its structure due to the pressure on the inside (carbonated gases from the pop) being greater that the atmospheric pressure on the outside. Once the top is popped, the can weakens and can be crushed. The body structures that provide the support for optimal breathing include the diaphragm, thoracic cavity, abdominal cavity, pelvic floor muscles, and vocal apparatus.

Impairments in body function or structure have an affect on breathing. Hypertonicity can significantly impair a person's ability to have vital capacity of the lungs for proper oxygen exchange. It also negatively affects the ability to cough and control secretions. While medical intervention in the form of anti-spasticity drugs is often the protocol, passive positioning of the person's skeletal frame may also come into play.

Destructive postural tendencies tend to have a detrimental impact. A flexed posture including a protracted and depressed shoulder girdle, general trunk rounding and posterior pelvic tilt compromises the ability of the abdominals and diaphragm to contract, and impinges the rib cage which may decrease expansion of the rib cage and therefore the lungs, decreasing tidal volume. A more extended posture including retraction and extension in the shoulder girdle, spinal extension and an anterior pelvic tilt compromises the ability of the respiratory musculature to relax, allowing for effective expiration. The imbalance between inspiration and expiration results in inefficient exchange of gases, potentially leaving the individual in a state of low oxygenation. Other postural asymmetries can interfere with effective respiration. Lateral trunk curvatures can greatly limit expansion of one side of the lungs, again limiting the effective exchange of gases.

Seating interventions have the potential to enhance the symmetrical position of the person's body or support asymmetries in a better position against gravitational force. Postural supports such as lumbar sacral support, lateral support, head rests, and molded systems can effectively enhance breathing. Rearward, forward and lateral tilt have also been used to enhance breathing and assist with coughing and secretion control. Abdominal binders and various TLSO systems have also been used to promote alignment and capture the abdominal muscles to assist with breathing.

The seating therapist and supplier need to be aware of the effect the intervention has on breathing. In some cases, the use of ancillary support surfaces can limit respiration. Use of supports that lack contour but instead encourage leaning can place increased pressure against respiratory components. These can include lateral trunk supports, head rests and anterior chest/shoulder harnesses. In some instance limiting retraction and abduction of the arms may limit the individual's ability to inhale the necessary volume needed for oxygen exchange. The individual may have learned to exaggerate retraction and abduction into a high guard position in order to promote lung expansion. The seating team, in an effort to promote neutrality and protect the arms when going through a door, may have incorporated protraction and UE adduction into the seating system, not knowing they were compromising the individual's ability to breathe. Alternatively, an individual may need to flex in order to compress the diaphragm for exhalation. Shoulder straps and other intervention meant to hold the individual upright may interfere with this.

In summary, when completing a thorough seating evaluation, the respiratory patterns need to be fully assessed; making sure function is facilitated without indirectly limiting a consumer's ability.   As always, there is no cook book to seating and some goals may need to be compromised to enable other functions to occur. Therapists specializing in breathing can be called in to assess whether the seating system is enhancing or limiting the individual's ability to breathe optimally. Orthotic intervention such as abdominal binders, soft TLSOs or LSOs, and anterior shells with molded back support may be incorporated in to the seating systems.

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IC 57: Designing a Pediatric Power Wheelchair from a Therapeutic Perspective!

Penny Knudson, OT
Clare Wright

Summary

A Best Practice approach to product design and development was used in the development of 'KIT', a new adult and teenage seating system which bridges the gap between modular and moulded seats for users with complex postural needs. Following a user-centered assessment of clinical, technical and environmental needs, a series of prototypes were manufactured and subsequently evaluated in over 65 clinical trials with 40 wheelchair users. Mechanical and analytical investigations into the seats' strength and durability were performed concurrently to ensure the seat exceeded ISO standards. The result is an innovative modular seating system which easily adapts to accommodate and support changing need.

Introduction

Product development is often an iterative process with new designs slowly evolving from previous ones based on feedback from users and carers. Although Best Practice (BP) - the use of a trusted methodology to reliably produce a near-optimum result, has become a widely established practice in clinical medicine, its use in rehabilitation is still unfamiliar, if not unknown. In the design of Assistive Technology (AT) however, two broad principles dominate: firstly, the end product must be user-centred and secondly, 'good design' must appropriately meet defined needs. Using these principles as guidelines for BP, Leckey aimed to develop a new seating system for wheelchair users with complex postural needs.

While each group of users present their own set of issues, teenagers and adults often provide the most extreme challenge for any seat due to their size, strength and probability of postural deformities. Couple this with the far reaching list of functional requirements: the need for hoisting, to self transfer and operate powerchair controls, be transportable etc., and the prospect of conflicting requirements becomes evident. Recent advances in materials and manufacturing methods have not simplified the issue. While modular seats adapt to changing needs and are the equipment of choice for early years, their planar design means complex postures with associated pressure or breathing issues, cannot be accommodated. This results in a shift towards moulded seating during teenage years. The limitations of moulded seats are well known: static position which is inadaptable to changing needs. Clearly there is a need to bridge this gap between modular and moulded options.

Methodology

A Health Needs Assessment (1), based on UK National Institute of Clinical Excellence (NICE) guidelines, was undertaken to systematically review the target population – teenagers and adults with complex postural needs – for a new seating system. A multidisciplinary research team visited a range of schools, centres and homes and engaged with the main stakeholders; users, carers and clinicians, to identify factors which contributed to improving function and posture. Three key clinical requirements were identified:
To accommodate and support a range of back shapes, including the natural s-shape, a fixed kyphosis, spinal rotation and a kypho-scoliosis
To maintain the pelvis in a neutral stable position
To accommodate the lower limbs and feet without straining back, pelvic or lower limb musculature, such that the head and chest are kept midline and forward facing.

Technical/functional requirements included:
Strong, durable seat for extended periods of heavy use
Optimum interfacing with a range of bases: manual attendant, power, self-propelling
Straightforward set-up and adjustment for growth and changing need

These requirements were translated into design goals and resulted in a novel prototype which, like modular seats, fully adjusted to evolving needs, and yet like moulded seating, could contour to, and accommodate a variety of physical shapes. The prototype comprised of:
A multi-adjustable 3-part backrest, with each part connected to a central spine by a ball and socket joint allowing freedom to rotate around and translate along the spine.
A unique 'Pelvic Cradle' which firmly grips the pelvis to encourage neutral tilt, reduce forward sliding and promote dynamic upper body positions
Multi-positional femoral supports and footplates to securely accommodate a range of clinical issues, e.g. tight hip adductors, leg length discrepancy, ankle plantar flexion.

Consent for involvement in a clinical trial was obtained from 40 users (eight using moulded seats), ages 10-77; mean 27, who were judged by their therapist to have complex postural and functional needs. For each trial the prototype was adjusted to maximise function while suiting the individual needs and shape of the user. This user-focussed approach resulted in continual alteration and refinement of the initial prototype. Strength and durability were systematically analysed using a combination of Finite Element techniques and mechanical testing to ensure KIT exceeded standards laid down in16840-3 (2) for wheelchair seating. Crash testing was performed to ISO16840-4 (3). The seat was interfaced with a range of commercially available wheelbases, e.g. Otto Bock Discovery and Invacare Spectra Plus, and the optimum balance of manoeuvrability and stability determined for different configurations.

Using Principles for Best Practice in Clinical Audit (4), five long term trials were conducted to determine whether the KIT seat met the original objectives. From the original 40 users, a subset of five of the most challenging cases, (ages 14, 16, 17, 19, and 42), were chosen for an indefinite period of evaluation, see Table 1. Questionnaires were circulated to the user's therapists and five characteristics of the seat: posture, comfort, manoeuvrability, transfers (hoisting) and pelvic position, were rated from: excellent, good, satisfactory or poor over a 6 month period. These ratings were converted to a single mark out of 20. Scores from multiple assessors were averaged to give a mean rating for each KIT seat.

Results: An equivalent or improved functional position, as judged by the local therapist, was achieved in 38 of the 40 users who trialled the KIT seat. Two of the 40, both mould users, could not be accommodated due to the severity of their deformity. The feedback from the questionnaires from the five long term users is given in Table 1. An example of user Ti seated in mould and KIT seat is given in Picture 1.

Table 1: Results from five long term KIT users

User	Age	Key challenges for KIT seat	Rating	Feedback
Ky	14	Maintain shoulders/ head in midline. Stabilise pelvis, withstand extensor pattern.	16/20	"Head held in alignment for significant period of time"
Or	16	Accommodate severe kypho-scoliosis	17/20	"Maintained posture as well as previous mould. KIT seat better for feeding"
Ti	17	Accommodate windsweeping, ensure head and shoulders in midline	16/20	"The fact that it accommodates the windsweeping so well is a real bonus"
Tm	19	Maintain neutral pelvic position and encourage upright posture	15/20	"Client's new chair is a great improvement in every way...he looks taller, smiles and eats better"
To	42	Accommodate spine rotation. Allow self propelling	18/20	"Overall the chair is excellent"

Picture 1: User Ti seated in original mould (top), and modular KIT seat (bottom).

Discussion

There is currently a lack of peer-reviewed BP guidelines for the design and development of AT. As such a combination of related research methodologies including guidelines for Needs Assessment and BP in Clinical Audit, were employed to create a user-focussed approach to the design and development of a new seating system for users with complex postural needs. The research identified the requirement for a seating system, suitable for the changing needs of teenagers and adults, which pushed the boundary between modular and moulded seating.

KIT, a modular system with multiple adjustable components, capable of contouring to and supporting various body shapes was developed from the knowledge gained during the Needs Assessment, clinical trials and clinical audit. The increased modularity and adaptability of the KIT seat compared to contemporary seating systems enabled a wider range of the most challenging users to be supported. However, two of the most complex postural shapes, both of whom used moulds could not be accommodated. This indicates that although the modular/moulded boundary can indeed be moved, some users will always require a bespoke solution.

It became apparent during development, that innovative design solutions were required to meet the project objectives of accommodating more posturally challenging users. This led to the development of original features, such as hinged laterals and freely rotational footplates. Interestingly, raising the bar in terms of design goals directly resulted in improved design outcomes.

Initial findings indicate that a contourable yet adjustable seating system which facilitates and maintains an upright functional posture has been achieved through a user-centered approach to BP. Feedback revealed that the Pelvic Cradle (patent pending) was instrumental in encouraging function and maintaining the improved postures observed.

Future work should continue with the user-focussed methodology and concentrate on collecting more Case History data from a wide range of users. A quantifiable measurement of function for users with limited upper limb ability would allow a rigorous comparison between AT devices.

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IC 58: A Problem Solving Model For Seating Assessment

Kelly Waugh, PT, MAPT, ATP

Introduction
Achieving optimal outcomes for clients requiring complex wheelchair seating technology is based on a comprehensive assessment process which includes sound problem solving and good communication between client, therapist and supplier. The following problem solving model can provide a foundation for critical thinking, communication and specification of products during the assessment process.

This conceptual model was introduced to me by Eileen Cox, MS, RPT (Cox, 1987) and I have been using this model in my own clinical practice and teaching materials for over 20 years. It is based on the idea that any seating product can be described by its features, or properties. Properties are the specific characteristics which describe an object. Examples of seating properties are: surface shape, material stiffness, dimensions, angles, placement, and adjustability. Being able to delineate the properties required to address a client's unique problems and needs is paramount to optimal product selection. In order to delineate the appropriate features, you need to set objectives based on the client's unique physical characteristics, health and functional needs. This linear model can guide your problem solving during assessment:

CLIENT Problems & Potentials ↔ OBJECTIVES → PROPERTIES → PRODUCT

In this conceptual model, the primary purpose of the seating assessment is to determine the equipment properties which will be required to address the therapeutic and functional objectives of the individual. During the assessment process, active analysis and problem solving occurs as the client's problems and potentials in all areas are translated into specific seating objectives. These objectives then drive the formulation of a list of properties which the team has determined will address the objectives, and the list of properties will in aggregate describe the end product. The process is linear, in that each identified problem or potential is linked to a specific objective, and each objective is addressed by a specific property or a set of properties.

A problem solving grid can be used to jot down notes during an assessment, or to help guide critical thinking when determining solutions for clients with multiple complex problems. Here is an example of just one row in a problem solving grid:

Client Problems & Potentials	Objectives	Properties	Product Options
Limited hip flexion to 80 degrees bilaterally	Accommodate lack of hip flexion in order to maintain optimal pelvic tilt alignment	100 degree seat/back support angle	Angle adjustable back canes, or Back support hardware capable of 10 degree angle adjustment

Description Of The Component Steps

Client: Information gained from clinical assessment procedures generates a list of the person's unique characteristics, problems and potentials, such as:
- Specific abnormal movements or postures that are causing health/functional problems
- Range of motion limitations, deformities
- Health problems (such as skin breakdown)
- Environmental barriers, functional limitations
- Skills/function person has desire and potential to achieve
- Current functional abilities you want to preserve

Objectives: From each listed problem or potential, a specific objective is formulated. Seating objectives can be related to:
- Positioning and alignment of body
- Motor control, movement, tone or reflexes
- Health (skin integrity, physiological functions)
- Functional tasks and abilities
- Environmental issues
- Social/behavioral/emotional issues

To help generate seating objectives, ask yourself these questions:
- What is the primary postural problem in this area of the body, and what are the contributing factors?
- What is the desired resting posture?
- In what areas of body does client need stability, and where does he/she need mobility?
- What movements need to be prevented, or discouraged?
- What movements need to be allowed, or facilitated?
- What functional abilities need to be preserved, improved or acquired?

Properties: Properties of the body support system can be categorized into these feature areas:
- Surface shape (flat, contoured, custom contoured)
- Materials (stiffness, resilience, envelopment, etc)
- Dimensions (define the size and shape of surfaces)
- Placement (where surface is to contact the body; also orientation and angles)
- Attachment features (fixed or removable, adjustability, etc)

After articulating an objective, ask yourself - what kind of surface or feature will address this specific objective? This is your intervention strategy, much like a therapist's treatment strategy/plan. Resist the temptation to use product names at this stage, as it limits creativity and can make you miss the opportunity to determine what the client REALLY needs.

Suppliers – Encourage the therapist on your team to talk to you in the language of properties, as opposed to jumping to a product name too early in the process. Conversely, if someone on the team suggests a product, ask them what features of the product do they think are critical to addressing client's objective? It is the RTS job to make sure that the product being considered has the key features the team is looking for.

Product: Desired properties/features are reviewed with the supplier and matched to available products and/or product components. Is there a product that has these properties? Will customization be needed? It is the RTS' responsibility to be knowledgeable about available products and their features, and how different product components can be interfaced together.

Hints For Effectively Using Model

1. Objectives should address the source of the problem
   It is important to determine the source of a problem before setting specific objectives and delineating features needed address the objective. If equipment design addresses the source of a problem, it will be much more effective and therapeutic. If you skip steps (jump from problems to product), you are likely just addressing the symptoms, rather than the underlying cause.
2. Objectives need to be specific, not general.
   For example, it is too general to state as an objective "Inhibit ATNR posturing of the head" – this is too general to determine an effective seating feature. However, if you state "Prevent head turning to the left past 25 degrees" – then it is easier to generate a specific feature required within a head support.
3. An RTS can help a less experienced therapist formulate objectives and articulate desired properties by asking good questions.
   For example, if the therapist is saying that they need to inhibit the ATNR posturing of the head and arms, you can ask the therapist/client/caregiver: "How do you inhibit his ATNR?", "Show me with your hands", "Do we want to decrease the tone in the whole body, or do we need to block the resulting movements?", "What affects this person's tone and reflexes?", "Does his head need to be held in midline?" By asking specific questions, this forces the therapist and team to think about strategies that work with this client. These types of questions will prompt the team to experiment, think and refine objectives and properties.

Primary Benefits Of Using This Model During Assessment

1. Helps keep the process client centered rather than product driven
   Because of the linear analysis, you are building the prescription around the specific needs of the individual: matching equipment to the client, rather than trying to fit the client into predetermined categories of equipment according to a "recipe". Theoretically, every component of the final product solution has been chosen because its properties address a specific therapeutic or functional objective of the individual. Therefore, the final product solution reflects the specific, unique needs of the individual – no more, no less.
2. Forces you to think and problem-solve
   In order to articulate an effective strategy (e.g. delineate properties) you need to be specific in your objectives: "Do we want to encourage active midline control of the head or do we want to maintain a midline position of the head". These are two very different objectives with different features required.
3. Helps insure accuracy and appropriateness of final product choices
   Describing features rather than jumping to product solutions too soon helps insure an accurate product – client match. Additionally, speaking in the language of properties improves accuracy of communication between team members, allowing you to be more specific as to what exactly you are looking for in a product component. Lastly, this process fosters creativity in determining unique product solutions.

Additional Potential Benefits of this Model

1. Helps delineate roles and responsibilities of team members
2. Improves communication between team members and with colleagues
3. Helps document intervention strategy
4. Assists with writing letters of justification/reports
5. Helps to measure outcomes

How the model helps to define team member roles
Therapist (PT or OT): Performs clinical evaluation. Identifies and analyzes client's problems, formulates seating goals, and breaks down goals into specific seating objectives. With experience, communicates desired properties to supplier/ fabricator.

Therapist / Seating Specialist: In addition to the above, has special knowledge/skill in the application of seating technology to address clinical objectives, thus being able to formulate a seating strategy by identifying and communicating desired seating properties.

Rehab Technology Supplier: Helps therapist to refine objectives and properties, then offers product options which have desired properties. Has knowledge/skill in interfacing product components while maintaining integrity of desired properties.

Rehab Engineer/Custom designer - fabricator: Combines desired properties into a design for custom end product; fabricates or assembles final product according to desired properties.

In summary, use of this conceptual model can improve outcomes by insuring that products are selected based on an accurate delineation of the features required to address client specific objectives.

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IC 59: Keeping Up With the Changes in Medicare Reimbursement: The Year in Review

Elizabeth Cole, MSPT

By the time this paper is presented we will be 3 months into the year 2011, dealing with some of the many changes that occurred in Medicare policies and reimbursement in the previous year. What were these changes? How did these changes come about, and how are they affecting us as we attempt to provide the best equipment choices for our clients? This paper will provide background information as to these key issues. Any updates to these issues will be presented in the final session, as well as any additional issues that have arisen in the interim.

National Competitive Bidding

The competitive bidding (CB) program was actually mandated by Congress back in 2003 under the Medicare Prescription Drug, Improvement and Modernization Act. Under the program, in order for equipment suppliers to provide certain items of DME to Medicare beneficiaries they must be a "contract supplier" for a specific geographical area (a metropolitan statistical area or MSA). To do this, the suppliers submit bids as to what they would accept as payment for each of the items in a product category along with the percentage of the population in that geographical area that they could serve. All bids must be lower than the current fee schedule for that item. Medicare then takes all of the bids for a product category, orders them from lowest to highest and selects the median bid as the new payment amount for that item. They then start with the supplier who submitted the lowest bid and add this company as a contract supplier. They continue to add suppliers from the list (going up the list from lowest to highest bidders) until they have enough suppliers to service the whole MSA (based on the percentages which the suppliers claimed they could service). These become the contract "winners" and are now the only suppliers who can provide these items for Medicare beneficiaries. They must accept this median bid as the payment amount for these items.

The DME items included under CB are as follows (each category includes all of the relevant HCPCS codes within that category including base codes and all accessories):

- Standard power wheelchairs, scooters and accessories
- Complex rehab power chairs (Group 2 only) and accessories
- Walkers and accessories
- Hospital beds and accessories
- Oxygen supplies and equipment
- Respiratory assist devices, CPAPs and accessories
- Mail order diabetic supplies
- Enteral nutrition, equipment and supplies
- Group 2 support surfaces and accessories (Miami only)

There are several key points to consider. Suppliers are not required to bid on all product categories, but can pick and choose from the categories. However, if a supplier bids on a product category, it is required to submit bids for every HCPCS code within that category. A supplier might win in some categories but not others. For example, let's say a supplier submits bids for all the items in all of the categories. However, because of its specific bids, it only wins in 2 categories (i.e., walkers and oxygen supplies and equipment). This supplier can no longer provide any of the other items in the other categories to Medicare beneficiaries.

CB will be rolled out in several "rounds". Round 1 of the CB program actually began in July 2008 in 10 MSA's, but was halted by Congress after less than a month (under the Medicare Improvements for Patients and Providers Act of 2008) due to significant flaws in the program. The Centers for Medicare and Medicaid Services (CMS) was given 18 months to eliminate these flaws, however, little was actually changed between the initial Round 1 and the Round 1 "re-bid". The Round 1 re-bid, scheduled to begin January 1, 2011 includes 9 MSA's. The second round will include 100 additional MSA's and will most likely begin sometime in 2013. Round 3 will include all other MSA's across the U.S. that are not yet a part of the program.

The payment amounts and the "winning" bidders for Round 1 re-bid have been determined and some are 20 – 30% lower than the current fee schedule. This will have a significant effect on the beneficiaries. With the absurdly low payment amounts, contract "winners" will only be able to supply the lowest cost (and often lowest quality) products as opposed to the variety of products that they currently offer. Beneficiaries will have little to no choice as to which product they receive and will not have access to higher quality, and often more medically-appropriate products, resulting in medical complications that require additional treatment, increased emergency room visits and even hospitalization. In addition, any extra services that are now provided by the supplier will be eliminated, such as service calls to the home, demo equipment, adjustments and modifications, and so forth.

The competitive bidding program will also significantly reduce the number of current equipment suppliers available to Medicare beneficiaries in a geographical area for provision of these products. This could force many small businesses into closure, resulting in a tremendous loss of jobs and increased unemployment in a very poor economic climate. In addition, this will severely restrict the beneficiary's choice as to where they go for their medical equipment. Many will be required to travel greater distances to find a contract supplier and will no longer be able to work with the supplier of their choice or the supplier with whom they may established long term relationships. In addition, some beneficiaries may be forced to go to several different suppliers for all of their equipment needs depending on which supplier "wins" the contract for which type of equipment. This could be extremely confusing for the beneficiary, not to mention a discharge nightmare for therapists, case managers and discharge planners. Finally, some of the suppliers in the Round 1 re-bid won contracts for product categories for which they have no prior experience or expertise.

In addition to its impact on Medicare beneficiaries, the competitive program itself is significantly flawed in its design. In September, 167 auction experts and economists sent a letter to Congress citing the major flaws in the program and predicting that the program will descend to a “race to the bottom”. Suppliers will become unreliable and the quality of service and products will deteriorate.

Elimination of the First Month Purchase Option for Power Wheelchairs

Under current Medicare policy, once a power wheelchair is deemed medically necessary, Medicare beneficiaries have the option for Medicare to purchase the wheelchair from the equipment supplier in the first month of medical need or to rent it from the supplier for a 13 month period, at the end of which time ownership passes to the beneficiary. Currently, 95% of beneficiaries elect to have the wheelchair purchased on day one. These beneficiaries suffer from chronic, long-term and debilitating conditions and will need their power wheelchairs for daily use on a permanent basis and not just for short term use. These power wheelchairs are ordered specifically for that person according to his/her individual medical and functional needs.

Beginning Jan 1, 2011 the option for purchase of Group1 and Group 2 power wheelchairs without power seating options will be eliminated as mandated by Section 3136 of the Affordable Care Act. Beneficiaries will no longer have the right to make a financial decision for the purchase of a power wheelchair that is ordered specifically for them, but will be required to accept one that is rented for them. Suppliers will be forced to pay for the total cost of the power chair from the manufacturer within 30 – 90 days, but will be reimbursed for these costly items in monthly installments over 13 months. In essence this program shifts the financial burden entirely to the supplier, requiring the supplier to finance the purchase of the equipment throughout the entire rental period. This is an unreasonable expectation, especially in today’s economic environment.

Given the significant upfront costs associated with providing power wheelchairs, suppliers will be forced to purchase very low cost, potentially very low quality equipment with the minimum features. In essence, they will be required to maintain a “fleet” of power chairs available for “rent”. Beneficiaries will be issued power chairs from whatever is available in the supplier’s rental inventory whether or not it is appropriate for their size or functional needs.

Many suppliers will either be unable to purchase and provide appropriate equipment to beneficiaries or will simply stop providing the equipment altogether. This will create significant access issues for the beneficiaries. When beneficiaries are unable to obtain the power wheelchairs that they need to live independently it is expected that costs will shift to more costly types of care including hospitalization, institutionalization, home care and caregiver supports.

Finally, under current policy, when a power chair is purchased (which, again, occurs 95% of the time) the equipment supplier obtains, compiles and completes the considerable amount of required documentation just once and submits just one claim. However, there has been no guidance from CMS as to how and what documentation will be required when providing power wheelchairs on a rental basis.

Separate Benefit Category for Complex Rehab Technology

Complex rehab technology (CRT) products are defined as medically necessary, individually configured devices that require evaluation, configuration, fitting, adjustment or programming. Examples of CRT include individually configured manual wheelchair systems, power wheelchair systems, adaptive seating systems, alternative positioning systems and other mobility devices. These products and services are designed to meet the specific and unique medical, physical, and functional needs of an individual with a primary diagnosis resulting from a congenital disorder, progressive or degenerative neuromuscular disease, or from certain types of injury or trauma.

In current Medicare policy all durable medical equipment (DME) products are lumped together in one payment category (the Durable Medical Equipment, Prosthetics and Orthotics or DMEPOS benefit). This means that the CRT products are subject to the same policy changes, documentation requirements, payment methodologies and coverage criteria as standard DME products. Although many standard DME products are either commodity items or are provided for short-term or temporary use, there is no adequate differentiation between these products and CRT which are most often for long-term or permanent use by individuals with complex disabilities. This has created significant challenges regarding access to appropriate CRT products and the supporting services. These challenges have increased over the past several years and, without meaningful change to these policies, will continue to escalate in the future.

A project was initiated in the fall of 2009 to require CMS to separate CRT from DME within the DMEPOS benefit category, similar to the way in which orthotic and prosthetic equipment is separated out. This would mean that CRT would have its own specific coverage criteria, payment methodologies, and coding as well as appropriate supplier quality standards. This would protect access to CRT for the individuals who require these products for everyday function. For example, if a problem arises due to issues with a DME item and policy changes are made because of that issue, this would no longer affect CRT. Policies and regulations that affect CRT would be specific to CRT.

The creation of a separate category for CRT requires both legislative and regulatory changes. The mandate to create the category itself and certain guidelines for its development must come from Congress while the specific changes in policy (coverage criteria, HCPCS codes, and so forth) will be developed by CMS. A steering committee comprised of members from several supplier, clinician and consumer organizations within the industry has been working with various consultants to develop the legislative language for the proposal, develop a scoring regarding the cost, and find champions in Congress to write a bill. Various work groups have also spent many hours developing drafts for appropriate coverage criteria, documentation requirements, quality standards and changes in coding to present to CMS when appropriate. An update on each of these tasks will be presented at the time of this session.

Audits

The year 2010 saw an exponential increase in the number of audits on claims submitted to Medicare for DME. There are now 4 different contractors involved with CMS who are conducting various types of audits on supplier's claims.

The Durable Medical Equipment Medicare Administrative Contractors **(DME MACS)** for each Jurisdiction are conducting pre-pay "probe" reviews. With this type of audit, the DME MAC will pull specific claims before they are paid and send "development" letters to the suppliers asking for all of the documentation that supports the claim (medical records, PT/OT evaluations and LMNs, physician orders, HHA notes and so forth). If the supporting documentation is not provided and/or the documentation is deemed insufficient to justify the equipment, the claim will not be paid. Keep in mind that with Medicare the equipment has already been ordered and delivered since there is no prior approval process. If the claim is denied, the supplier does have the option to go through the regular appeals process.

The Recovery Audit Contractors **(RACs)** conduct post-pay audits. With this type of audit, the RACs will pull specific claims that have already been paid and will ask for all of the supporting documentation for that claim. The RACs are looking for claims processing errors, as well as cases or over-utilization and/or unbundling. If the claim is denied at this point, CMS will recoup the money from the supplier. Although the supplier does have the option to go through the regular appeals process, these audits are harder to fight. The RACs can only pull claims from the past 3 years. It should be noted that the RACs have a financial incentive to find overpayments for Medicare and recoup that money.

Comprehensive Error Rate Contractors **(CERT)** also audit claims that have already been paid. They look at things like duplication of claims, improper modifier usage, look backs on O2 and whether there is a continued need for items being billed as capped rentals. Their goal is to identify errors made by the DME MAC during the claims process and provide corrections and education back to the DME MACs. They also cannot go back more than 3 years. Supplier can fight denials of these claims through the regular appeals process and they are easier to fight because the CERT is looking for contractor errors.

The Zone Program Integrity Contractors **(ZPICs)** conduct both pre and post pay audits and are basically a fraud unit. They look at cases of high volume claims (i.e., if a supplier submitted a much higher percentage of K0004 manual wheelchairs compared to all other types of manual wheelchair claims during a particular time period). They are especially concerned with claims for hospital beds, CPAPs, oxygen, K0004 manual wheelchairs and K0823 power wheelchairs. Their goal is to look for fraud and abuse, refer cases to law enforcement, and recommend recovery of payments to the DME MACs. ZPICs can pull claims that go back as far as 7 years.

IC 60: Dynamic Seating: Why, Who and How?

Suzanne Eason, OTL

Neuroscience has made leaps and bounds in understanding how the brain functions, specifically in the area of neuroplasticity. We no longer think of the brain as fixed or hardwired, but as a constant changing organ which can rewire itself and even create new neurons. (How many of us were taught that once a neuron was gone or damaged, it could not be recreated!!!). Neuroscience has broadened our understanding that intentional movement is important and essential for learning and development, especially in a brain that has been damaged. Research has shown increase in neural connections when movement is allowed or encouraged. All movement – including posturing, reflexive and refined – is intended for some purpose by that individual. Can movement be accommodated in a seating system to encourage neuroplasticity? Edward Taub, PHD, a behavioral neuroscientist, has developed a technique called Constraint Induced Movement therapies which show that individuals who have had a stroke can learn how to move the affected extremity by rewiring the brain to learn how to improve the motor ability of these affected parts. Paul Bach-y-Rita, in Norman Doidge, MD's book the Brain That Changes Itself, showed how he could rewire the brain of a vestibularly challenged woman to understand movement by using a Brainport, a sensory substituting device that used stimulation to her tongue to understand how she was moving in space. Interestingly, Paul Bach-y- Rita's father suffered from a massive stroke and recovered to near full functioning after several years of extensive rehabilitation that was lead by his brother. Other research studies have shown brain rewiring, or cortical reorganization, in individuals with cerebral palsy which have improved their overall functioning. Most of the studies focus on experience dependent neuroplasticity, movement, active and intentional. Healthy individuals were found to move every 9-6 minutes when asked to sit for a 90 minute period. A wonderful pod cast that explores many aspects of neural plasticity is the brain science pod cast by Dr. Ginger Campbell. Of great interest is how neural plasticity is enhanced through exercise and movement. What are our brains for, thinking? No movement. We live to move and move to live.

How does that thought translate into everyday seating systems and bases? Most manual wheelchairs and their adaptive seating systems are static, stabilizing the individual for better head and extremity movement. Most of these systems are intended for the user to be in them for a great part of the day. When seated in such a position for so long a period their bodies end up looking like the systems. I can remember attending a seminar by Cathy Mulholland where she said all of the kids looked like her chairs and now I understand why. Static systems don't allow the body to move and explore senses. All of these individuals need some form of stabilization, as we all do, but do we over stabilize? Can these seating systems be changed easily and regularly as intended by the user for more or less self-actuated movement? Those who would benefit most from a system that they could move are individuals who have acquired a brain injury or a neurological disease such as cerebral palsy, a cerebral vascular accident or a traumatic brain injury and also for progressive disorders such as Multiple Sclerosis and Parkinson's disease.

In the last decade, medical equipment manufacturers have devised some fabulous dynamic solutions for a manual seating system. Most presentations that I have attended have focused on one or these solutions. Hopefully this presentation will give a comprehensive range of dynamic solutions available to use.

Full system approaches, such as the Kids Rock which allows for hip, back and knee movement in a flexion and extension pattern. These systems, while no longer available, can be fitted to a small child to an adult. Exo motion has an interesting back set up that allows for increased sensory information through a set up of 'butterfly' like devices that give tactile input as a person moves.

Seating systems: JCM's Triton which has a hydraulic set up to allow for hip movement and a spring loaded foot rest to allow for flexion and extension at the knee; R82 or Snug seats X-panda which has a dynamic seat to back angle.

Backs: Miller Adaptive Technology's back interface system which allows for spine flexion and extension. Degage Dynamic Rocker back, which are canes that have a rocking motion at the attaching hardware.

Seats: Corewerks has a dynamic seat which allows for graded movements in most directions through an air bladder which is adjustable and sandwiched between two firm plates. Foot rests: Miller adaptive Technology has several types of dynamic foot rest hardware from spring loaded and hydraulic. Lateral thoracic pads: JCM has a thin wrap around lateral which can allow for movement.

Head rests: Miller has a hydraulic hardware which can allow for extension and flexion; Whitmeyer Biotex has a head strap which will allow for rotation; Stealth has a graded rubberized piece, the tone deflector, housed within the mounting hardware which will allow for flexion and extension: Symmetric designs has a axion rotary interface which will allow for rotation (not available at this time).

Frame adaptations: Frog legs caster housing can be adapted with a spring versus the shock absorbing foam to allow for rocking motion.

Anterior supports: Neoprene or flexible chest harnesses or straps.

Seating hardware: Freedom designs has a spring loaded mounting hardware.

There also are more customized components that can be fabricated and/or adapted in house by a rehabilitation technician to allow for movement. We have used rubber and spring washers in our lateral hardware to allow for some lateral movement. This gives the user the ability to move and yet come back to a fixed position. These washers can be graded to increase the resistance to movement. We have lowered back heights to allow for thoracic movements. Blood pressure cuff bladders have been placed within the back or seating surface to allow for minimal flexibility to the user. Foam in our foot plates to allow for knee flexion and extension. Back rests that are made with two pieces of plywood which have spring in the middle and a hinge at the bottom. We learned about this in house adaptation from Sunny hill children's center. Jim Dawley, a rehab engineer from the Norfolk area also created a Dynamic back by using a split back that had hydraulic pistons connecting it.

Finally, how can we as a dynamic community utilize the above information to discover a wider variety of moving components? Recommendations are for dynamic lateral thoracic hardware which can allow for more lateral flexion and rotation of the trunk yet can come back to a set position. More options with pelvic and seat movement that will allow for some stability yet allow for movement. Backs that have a rotation component. Another full seating and frame system that can move with the child or adult. Research that shows dynamic seating components due have an objective value to the end user and practitioner.

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IC 61: Powered Mobility and the Effects on Visual/ Perceptual Deficits

Casey Emery

Learning Objectives

At the conclusion of this session, participants will be able to:

1. identify the literature review on visual/perceptual deficits and the application of powered mobility.
2. identify how powered mobility can be used as a treatment tool for visual/perceptual deficits in patients with cerebral vascular accidents.
3. identify how to determine if powered mobility is an appropriate mobility choice for patients with cerebral vascular accidents.

Abstract

Purpose: Traditionally power wheelchairs have been used as a transportation device for mobility related activities of daily living (MRADLs). The purpose of this case study is to determine if powered mobility would be beneficial as an adjunct treatment tool for visual/perceptual deficits in patients with cerebral vascular accidents. All three participants were dependent on caregivers for manual wheelchair propulsion. Could power wheelchairs also be used as a means of driving to learn? In return, would participants learn to drive safely and be more independent using powered mobility for MRADLs?

Sample: Participants were selected by convenience from two facilities in Phoenix, AZ. A total of 4 participants were selected; 3 males, 1 female, three right and one left CVA. A total of 10 training sessions. Videotaping and visual tests conducted before/after training sessions.
Results: Three out of the four participants showed improved with visual scanning to affected side by test and video results, also improvements with attention, awareness, fixation, concentration, and improved performances in traditional therapy session during and following the trials.
Conclusions: Powered mobility, when used as an adjunct tool for visual/perceptual deficits, can be an effective intervention for patients with cerebral vascular accidents. It was also considered when determining the best wheelchair choice upon discharge from inpatient rehab for one participant.
Discussions: The effectiveness of powered mobility as a treatment tool may be contributed to a constraint induced principle in which the participants were forced to scan, fixate, concentrate and be aware of all surroundings in order to safely maneuver while in the wheelchair. Participants reported that the device forced them to think more then they normally do in therapy. This characteristic was an effective tool in the treatment of visual neglect.

Presentation Outline

1. Review of the vision/perceptual system
2. Review of how powered mobility has traditionally been used in the past
3. Review current literature and history of powered mobility in the areas of pediatrics
   a. Case study of UD1
   b. How the UD1 correlates to adults and the effects of movement on the vision/perceptual system
4. Review of how powered mobility can be used as a treatment tool
   a. Review of the protocol used for the case studies
   b. Review treatment principles and tools used
   c. Review of locations of the facilities
   d. Review diagnosis specific deficits with participants for case study #1, #2, #3
5. Case Study presentations of powered mobility with adult populations with Cerebral Vascular Accidents
   a. Case Study #1
   b. Case Study #2
   c. Case Study #3
6. Discussions of outcomes for the case studies
7. Conclusions for powered mobility
8. Questions and Comments

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IC 62: Head Positioning: Problems or Possibilities?

Kathryn Fisher, B.Sc. OT, ATS, OT Reg.(Ont)

Positioning of the head can provide challenges to clinicians developing seating and mobility solutions. As the head represents each individual's personality its position influences social contacts. It is vital then that we attempt to position each client's heads for optimal social interaction.

Goals for head positioning must be realistic and attainable. Although we are often called to just "solve the problem with a client's head" no head positioning system will "fix" seating issues! Head support is an integral part of a seating system. It is far more than just an accessory.

In order to successfully position the head a comprehensive seating assessment must be performed. It is imperative that the positioning of pelvis, lower extremities and trunk be addressed before attempting to position the head.

A full MAT assessment is essential to determine the degree of head support required. This must include:

- Lateral flexion and rotation of the trunk and pelvis
- Tonal patterns
- Tolerance of contact and pressure
- Muscle Stength/weakness

Amount of force required to accommodate/ correct posture

During this assessment it should also be determined how much support your client will tolerate as well as caregiving support required to maintain proper positioning using the prescribed equipment. In some situations aggressive head positioning equipment may be sacrificed to achieve consistency of use or positioning.

During the assessment it is essential to simulate the head position with your hands. This is the best way to assess the forces necessary to obtain head positioning goals. The direction and amount of force required can be felt as you correct the head position. It is important to feel the client's reaction, active movement and resistance to changes in position to determine tolerance of the desired position.

In designing the head support solution consider the client's head size and shape and surface area available for pressure distribution. There are obvious areas to be avoided with direct pressure

- Temporal area and eyes
- Ears
- Mastoid process
- Mandible

Areas to focus on support

- Occiput – cradle as much as possible
- Flat areas on the side of head and forehead - ensure consistency of placement of supports

Once the assessment is complete selection of components and simulation of the system is an essential part of the process. It is important to select products to mimic the forces and shapes of your hands during the assessment. Consideration of head support systems may include:

- Occipital and suboccipital support pads
- Lateral, posterior and in some cases anterior supports
- Lateral and rotational accommodation
- Dynamic or static supports

It is important to consider ease of use of the system for client transfers, repositioning and caregiving. It is essential to provide education as to proper use of the system, proper positioning of the client in the system and ongoing care and cleaning as the products are near to the client's face.

This session will explore strategies to for head positioning using case studies to illustrate the assessment, trial and seating prescription process.

Learning Objectives:

- Participants will review the comprehensive seating assessment.
- Participants will understand basic principles of seating and positioning.
- Participants will be presented with potential challenges in head positioning
- Participants will develop strategies for successful postural and head positioning solutions.

IC 63: To Power or Not: Powered Mobility and the Obese Client with Venous Stasis Ulcers

Jenny Lieberman, MSOTR/L, ATP

Over the past 50 years, rates of obesity among adults have increased from 13% of the population to more than 35% of the population. With increased rates of obesity there is also an increased incidence of secondary complications such as arthritis, diabetes, hypertension and numerous of medical diagnoses. It is these complications that have resulted in more than 300,000 deaths a year. In addition, they result in decreased function and quality of life. Seating clinics are seeing arise in the number of obese clients requiring powered mobility due to severe complaints of joint pain from arthritis. Providing this population with powered mobility has been controversial due to concerns that use of a mobility device will result in increased weight gain. Although use of a wheelchair results in decreased ambulation, a consideration is that many of these persons are already not ambulating due to effort and pain. There are benefits to providing this population with powered mobility as it results in increased community mobility and socialization. Increased time out of bed and out of the home can lead to increased engagement in activity and decreased incidence of weight gain. There is other consideration for the obese population when determining a mobility device. Particularly in relation to another secondary complication: chronic non-healing wounds. These are classified as intertrigo, pressure sores and venous stasis ulcers. For the purposes of the presentation, the focus is on venous stasis ulcers.

Venous stasis ulcers affect more than 2% of the population, with a recurrence of 70%. They are responsible for about 1% of the overall health care costs. They occur from venous hypertension, which happens when venous flow is disturbed. Venous stasis results from damage to the valve systems of the veins in lower extremities. In extreme cases, pressure in the veins can be higher than pressure in the arteries (venous hypertension). This results in leakage of fibrinogen and white blood cells into the vessels. Inflammation develops, oxygen and nutrients can't reach cells, resulting in ischemia. There are two theories that support the cause of venous ulcers. They are the fibrin cuff theory and the white cell trapping theory. The fibrin cuff theory states that fibrogens leak from the capillaries, resulting in decreased oxygen diffusion and ulceration. The white cell trapping theory suggests that white blood cells occlude capillaries, causing ischemia and ulceration. In both theories, blood flow is occluded with ulcers developing from pressure.

There are several treatments for venous ulcers. They are compression, weight reduction, manual lymph drainage and elevation. Active compression with calf muscle contraction is an effective treatment for some persons with venous ulcers. This occurs by utilizing a manual wheelchair with the feet as the means of propulsion. This can be very effective at pumping fluid out. Especially with persons of normal weight or who are minimally overweight. However, with persons who are obese, this may not be most effective, particularly since they would be utilizing their legs to move a larger mass. The other more effective treatment would be leg elevation. Literature indicates that elevation is an effective measure for use with the overall management of venous stasis ulcers. However, under normal circumstance, in order for this to occur the patient must spend days in bed, which results in additional medical complications. Therefore, be tilting a wheelchair backward and elevating the legs is an effective intervention. This allows for out of bed activities with frequent positional change to achieve management of venous hypertension and treat ulcers.

As the percentage of obese patient's increases over time, we will continue to see these patients in seating clinics. Secondary complications must be considered during treatment, with the mobility device being used as an adjunct to other interventions. Therefore, therapists and rehabilitation technological specialists play a significant role in aiding in treatment of these complications.

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IC 64: Emphasizing Usability During Wheelchair Specification and Configuration

Steven J. Mitchell, OTR/L, ATP

For the individual who has must rely on a wheelchair for functional mobility, a new wheelchair is more than just a means of getting from point A to point B. It will play a central role in how easily they will be able do just about every other functional task for years to come. A wheelchair which meets the pressure management, positioning, and propulsion objectives of the therapist will provide few of the associated benefits if it is rarely used by the end user because it fails to meet their needs.

The International Standard Organization defines usability as "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use ". Mobility equipment that provides high usability will maximize independence and enhance quality of life. Conversely, low usability has been identified as a major factor leading to the abandonment of mobility equipment.

In recent years, several instruments have been developed to quantify the usability of mobility equipment. The growing utilization of these tools suggests a realization that usability has the potential to measure the effectiveness of seating/wheeled mobility intervention. Less is known about how individual practitioners incorporate a usability framework into the process of prescribing and providing mobility equipment, however.

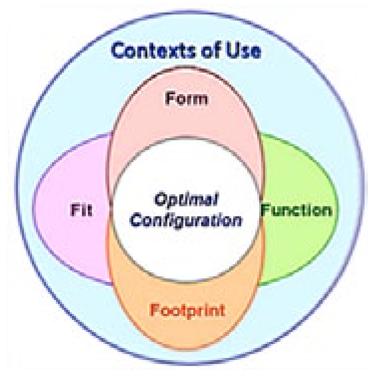
The VA's Spinal Cord Injury/Disorders (SCI/D) System of Care was established to provide lifelong care to veterans with SCI/D. In 2010, the SCI Center at the Cleveland VA prescribed over 100 complex rehab powerchairs or custom ultralight wheelchairs to veterans from Ohio and surrounding states. While there are no doubt ongoing issues being resolved with some of those wheelchairs, only one wheelchair is known to have been returned or otherwise "abandoned" by its end user. It is believed the low rate of abandonment is largely due to the clinician-driven model of mobility equipment provision used by the Cleveland VA. An underlying premise of this multidisciplinary model is having therapist oversight of the process to ensure any mobility equipment provided meets the veteran's needs, minimizes the risk of secondary complications, and provides optimal usability.

Equipment Selection—Considering the Person, Problems, Priorities, and Products

To prescribe the most-appropriate mobility equipment for an individual, it is essential that the seating therapist be knowledgeable of the vast array of products available to potentially meet the objectives of both the therapist and end user. Mobility products from different manufacturers often appear very similar. However, when those products are considered within the broader context of the needs of the end user, subtle differences in design characteristics, features, and options will often differentiate one product from the others. These differences are often discovered during equipment trials. However, when suitable demos of specific products are not available, success will depend largely on the therapist's commitment to ensuring decisions are based upon objective product information and their ability to "translate" specifications between products. Two important sources of product information are the therapist's previous "hands on" experience with a given product and feedback from actual end users of that product.

Attaining the Optimal Configuration

Optimal usability is most-likely to be achieved when the most-appropriate model is selected in the best configuration to meet as many needs of the end user as possible in their expected environment(s). The end goal of the specification process should be to attain the "Optimal Configuration" of a mobility product for a given individual. This involves striking a balance between four "F"'s--Form, Fit, Function, and Footprint.



A User-Centered Approach

A clinician-driven model will only be effective if it is multidisciplinary in nature and is based upon a user-centered approach. There is no perfect wheelchair that can fully-satisfy every need of a specific end user. Therefore, it will not be possible to select the best model in its optimal configuration without having the meaningful participation of the person who will be using the wheelchair throughout the entire specification process. Their input not only helps to establish problems, priorities, and preferences, it helps ensure that they understand any compromises/concessions that may have been necessary along the way.

Optimizing Configurations

Even when something approaching the "perfect" wheelchair has been ordered with the ideal combination of options, many manufacturer's "default" product configurations will provide less than optimal usability. A clinician who is knowledgeable of the products they commonly prescribe and employs a usability framework can greatly enhance the usability of the prescribed wheelchair by overseeing the pre-fitting configuration process.

For example, many power seating systems are designed to be mounted in different locations on a powerbase. Clinicians who take advantage of this can simultaneously reduce the “footprint” and increase the maneuverability of some of the powerchairs they prescribe. The following picture illustrates two examples where it was possible to reduce the overall length and turning radius of powerchairs by 3” without additional parts. Both were midwheel drive and had effective seat depths of 19-20 inches. An informed decision to select a 16-19” seat depth package (instead of 20-22”) during the initial evaluation and approximately 30 minutes of technician labor were all that were required.

It is not unusual for today’s custom wheelchair order forms to be both lengthy and confusing, and it is tempting for therapists to limit their focus to the clinical evaluation and leave it to others to obtain product specifications. Such an approach is likely to result in missed opportunities to provide greater usability. The therapist who makes a point to familiarize themselves with manufacturer’s products and order forms can develop a capacity to not only identify configurations that have the greatest likelihood of providing high usability, they are more-likely to “catch” potentially problematic configurations.

Today’s ultralight rigid frames represent an area where a therapist’s inability to identify potentially problematic configurations can result in significant usability or safety issues. The rigid frame pictured below replaced an older chair having nearly identical specifications, but would be extremely unstable for most end users. The seating therapist should be knowledgeable enough about this product to be able to identify “red flags” if reviewing the specifications. Even minor changes in options (e.g. using 3” rollerblade casters or suspension forks) would transform this configuration into an unusable chair for any end user. It is also an example where an end user’s optimal configuration is different than that of the therapist. This is sometimes a consequence of a user-centered approach.

http://sci.rutgers.edu/forum/showthread.php?t=123566

Case Study--The Office Chair

The Person

- 27 year old male with T6 paraplegia. S/P Harrington rod placement.
- Chronic back pain. Exhibiting symptoms of upper extremity overuse.

Problems

- Worked in an office with 3 other co-workers. Limited space.
- Unable to use keyboard/computer at desk in current wheelchair.
- Complained of discomfort in a variety of “ergonomic” office chairs.

Priorities/Context of Use

- Functional positioning, accessibility & maneuverability at work.
- Comfort.

Products

- 15x16 85 Degree Quickie GTi with a 1.5” shorter “Performance Frame”.
- Roho JetStream Pro custom back.
- Modification to allow independent selection of 3 back angles while in chair.

The Result

Wheelchair/seating which provides a functional posture for work-related activities.
(with a trade-off of slightly less-than-optimal push rim access).

http://sci.rutgers.edu/forum/showthread.php?t=122749

IC 65: Oh, The Places You'll Roll... Encouraging Adolescent Independence

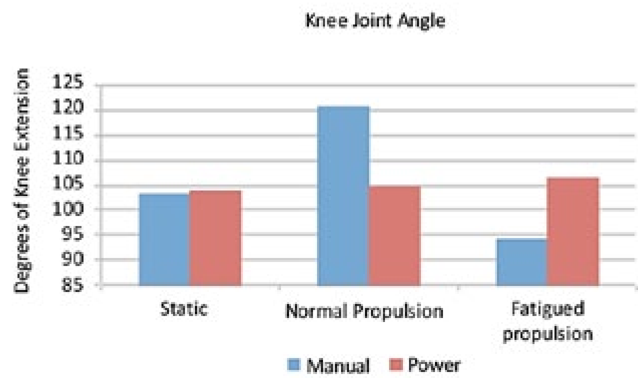
Andrina Sabet, PT, ATP
Madalynn Wendland, PT, ATP, PCS

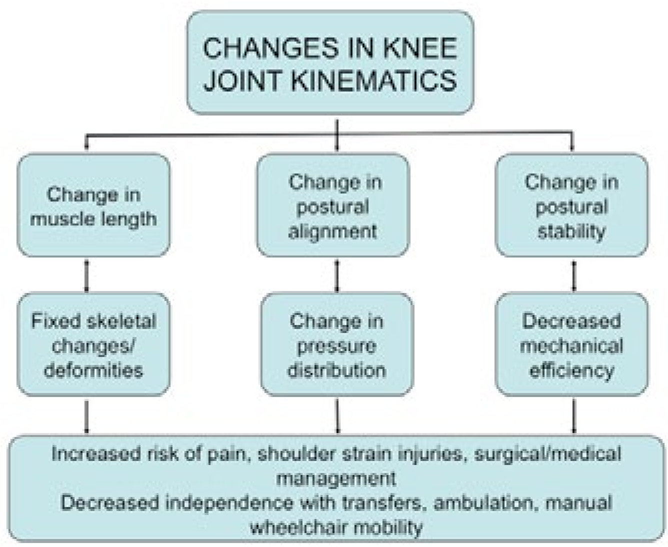
The prevalence of cerebral palsy has risen to well above two children per thousand births6. In this diagnostic group, deficits can be seen in both the sensory and neuromuscular systems1. Neuromotor impairments that affect mobility include: muscular weakness, abnormal tone (spasticity), and impaired selective motor control4. These can result in impaired timing and speed, decreased force generation, and co-contraction1 rather than isolated muscle recruitment. Increased co-contraction occurs both in anticipation and reaction to the postural demands of a functional task1,2. Mobilizing a manual wheelchair, elicits the anticipatory co-contraction in preparation for the dynamic demands of propulsion in addition to reactionary postural adaptations in response to environmental influences.

While cerebral palsy is considered non-progressive, aging with chronic spasiticity and increased co-contraction can result in degenerative changes. Changes at the cellular level include a decrease in the number of sarcomeres, stiffening of the parallel elastic structures and impaired muscle growth1. Over time, postural asymmetries often result, influenced in part by these muscular insufficiencies. Asymmetrical alignment consequently affects volitional movements while creating potential for more permanent joint contractures, bone deformation and pain1. With the rapid growth often associated with adolescence, musculoskeletal changes are accentuated and can result in decreased functional mobility3. Mobility is further challenged during adolescence as a result of increased environmental demands. These changes require higher levels of endurance, strength, and speed to participate with peers and support emerging independence. The Physiological Cost Index (PCI) has been used to demonstrate increased energy expenditure among adolescents with cerebral palsy and mild motor impairment with values 48% higher than typical peers1. Therefore, an adolescent's mobility and motor abilities are affected by the multiple interactions between primary impairments, musculoskeletal changes, environmental and lifestyle demands, and increased energy costs.

In attempts to minimize the progression of degenerative changes and create a balance between posture and function, equipment decisions to augment mobility become increasingly complex. Independent mobility is important, as it is associated with employability, economic status, and social integration1. By utilizing mobility equipment, motor abilities can be augmented to enhance independent experience and participation with age specific tasks1,8. As adolescents frequently engage in activities in a variety of environments, different types of equipment may be required to improve or maintain independence.

Evidence based practice for equipment prescription for the adolescent population needs to work within a framework of clinical expertise, research evidence and the client's goals and circumstances7. Clinical assessments are frequently qualitative in nature and often lack objective data. Therefore, a case study was designed to attempt to quantify the atypical movement patterns observed as a 12 year old adolescent used a power and a manual wheelchair during





In addition to the observed kinematic changes, consideration of the adolescent's goals and circumstances also compound the equipment choice. Manual mobility for this subject meets his goals of easy transportation, physical activity, and camaraderie with a peer group who also utilize manual wheelchairs. However, use of a manual wheelchair limits his participation due to the increased time required to traverse distances and the increased energy cost. Participation is enhanced with the use of a power mobility base, although this creates barriers of accessibility and transportation.

Future research directions should utilize alternate data collection methods to optimize resources. This includes the use of assessment tools to quantify atypical movement patterns that are more readily available at low cost in the clinic setting, decreasing time involved in assessment, and use of outcome measures such as the Functional Motor Assessment (FMA) adapted from the Functioning Everyday with a Wheelchair (FEW). This questionnaire was designed for wheeled mobility users to report function in relation to equipment use 5. The inclusion of the FMA data will expand future case studies to incorporate a more objective measure of independent function. This area of study continues to be of importance to determine the potential effects of equipment prescription on short and long term outcomes in the adolescent with cerebral palsy.

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