20TH INTERNATIONAL SEATING SYMPOSIUM

Program at a Glance

Thursday, March 4th, 2004

8:00 am	Registration & Continental Breakfast - Exhibits Open	Bayshore Foyer
8:30 am	Opening Remarks	Salon DEF
8:45 am	Keynote Address	Salon DEF
9:30 am	Plenary Sessions (x 2)	Salon DEF
10:30 am	Refreshment Break and Exhibits Open	Salon ABC
11:15 am	Plenary Sessions (x 3)	Salon DEF
12:30 pm	Lunch & Exhibits Open (Registrants on their own)	Salon ABC
2:00 pm	Instructional Sessions Group A	See detailed program, page 22
3:00 pm	Refreshment Break and Exhibits Open	Salon ABC
3:45 pm	Instructional Sessions Group B	See detailed program, page 22
4:45 pm	Reception in Exhibit Hall	Salon ABC

Friday, March 5th, 2004

8:00 am	Registration	Bayshore Foyer
8:30 am	Instructional Sessions Group C	See detailed program, page 23
9:30 am	Instructional Sessions Group D	See detailed program, pages 23-24
10:30 am	Refreshment Break and Exhibits Open	Salon ABC
11:15 am	Simultaneous Paper Sessions	See detailed program, pages 23-24
12:30 pm	Lunch (provided in Exhibit Hall)	Salon ABC
2:00 pm	Plenary Sessions	Salon DEF
3:25 pm	Refreshment Break and Exhibits Open	Salon ABC
4:10 pm	Chris Bar Research Forum (Sponsored by the Roho Group)	Salon ABC
5:15 pm	Adjourn	

Saturday, March 6th, 2004

8:00 am	Registration	Bayshore Foyer
8:30 am	Opening Remarks	Salon DEF
8:45 am	Simultaneous Paper Sessions	See detailed program, page 26
9:50 am	Refreshment Break and Posters	Bayshore Forum
10:00 am	Instructional Sessions Group E	See detailed program, page 27
11:15 am	Adjourn	
1:00 pm	RESNA ATP and ATS exams (4 hrs, exams are simultaneous), followed by RET exam (1.5 hours)	Salon A & B
1:30 pm	WGII Group Meeting (sponsored by Seating Symposium)	For details come to the Conference Registration Desk

To order additional copies of this syllabus, please contact:

INTERPROFESSIONAL CONTINUING EDUCATION
Email: interprof@cehs.ubc.ca

Tel: 604 - 822.4965

Toll Free: 1-877-328-7744 (in Canada)

Fax: 604-822-4835

Conference Information Online: www.interprofessional.ubc.ca

Additional Resources: www.seatingandmobility.ca

20TH INTERNATIONAL SEATING SYMPOSIUM

Table of Contents

Thursday, March 4th, 2004

Plenary Sessions

Instructional Sessions - Group A

Instructional Sessions – Group B

Friday, March 5th, 2004

Instructional Sessions – Group C

Instructional Sessions – Group D

Simultaneous Paper Sessions – Group 1

Simultaneous Paper Sessions – Group 2

Simultaneous Paper Sessions – Group 3

Plenary Sessions

Saturday, March 6th, 2004

Simultaneous Paper Sessions – Group 1

Simultaneous Paper Sessions – Group 2

Instructional Session – Group E

POSTER ABSTRACTS:

Planning Committee

David Cooper, *MSc. (Kinesiology)***,**
Rehabilitation Technologist
Sunny Hill Health Centre for Children
3644 Slocan Street
Vancouver, BC V5M 3E8

Margaret Francis
Administrative Assistant, Therapy Dept.
Sunny Hill Health Centre for Children
3644 Slocan Street
Vancouver, BC V5M 3E8

Elaine Liau
Director, Interprofessional Continuing Education
The University of British Columbia
Room 105 - 2194 Health Sciences Mall
Vancouver, BC V6T 1Z3

Maureen O'Donnell, *MD, MSc., FRCPC, Head and Assistant Professor*, Division of Developmental Pediatrics, Department of Pediatrics, University of British Columbia, Vancouver, BC

Maureen Story, *BSR (PT/OT)*
Sunny Hill Health Centre for Children
and Access Community Therapists Ltd.
3644 Slocan Street
Vancouver, BC V5M 3E8

Bonita Sawatzky, *Ph.D.*
BC Children's & Women's Hospital
UBC Dept. of Orthopaedics
4480 Oak St.,
Vancouver, BC V6H 3V4

Symposium Chair

Lori Roxborough, *M.Sc., OT/PT*
(Conference Chair)
Sunny Hill Health Centre for Children
3644 Slocan Street
Vancouver, BC V5M 3E8

Program Consultants,
Positioning and Mobility Team
Sunny Hill Health Centre for Children:

M. Bilabio	E. Antoniuk
M. Eastman	B. Brulé
J. Evans	C. Ellens
J. Law	D. Field
S. Magnuson	D. Jordan
L. McLean	K. Marina
A. Stewart	B. Stickney
N. Wilkins	B. Ott
J. Sawrenko	G. Broughton

Speaker Listing

Ana Allegretti, OTR/L
University of Pittsburgh & Human Engineering Research Labs
U of Pittsburgh & Human Eng. Research lab
5501 Walnut St./ 302,
Pittsburgh, PA 15232 USA
ala15@pitt.edu; szczepan@pitt.edu

"Pelvic Positioning Evaluations for Wheelchair Selection"
Simultaneous Paper Session, Room 3, March 5, 12:15- 12:25pm

Beth Anderson, OTR/l, CDRS
Shephard Centre
Atlanta, Georgia

"Essential Collaboration Between Driving & Seating Specialists"
Instructional Session D4, March 5, 9:30 - 10:30 am

Juliana Arva, M.S., ATP
Permobil Inc.
51 Highland Ave,
Chatham, NJ 07928 USA
Julianna.a@permobilus.com

"Vertical Mobility: An Overlooked Necessity"
Instructional Session E4, March 6, 10:00 - 11:15 am

Michael A Babinec, OTR/L, ATP, ABDA
Invacare Corp.
Rehab Training & Education
One Invacare Way,
Elyria, OH 44036 USA
mbabinec@invacare.com

"Powered Mobility: The Ever-Changing Story of Center Wheel Drive"
Instructional Session B6, March 4, 3:45 - 4:45 pm

Nancy Balcom, B.Sc Kinesiology
Product Design Group, Inc.
Unit 102, 366 East Kent Ave South,
Vancouver, BC V5X 4N6

"Functional Positioning/Independent Mobility for Clients with Complex Needs"
Instructional Session C6, March 5, 8:30 - 9:30 am

Michael Banks, M.A., CRTS, ATS
Walla Walla Home Medical, Inc.
329 S. 2nd Ave.,
Walla Walla, WA 99362 USA
mbanks@wallawallahomemedical.com

"Pressure Management in Positioning Clients with Severe Pelvic Obliquity using Pressure Mapping Tech."
Simultaneous Paper Session, March 5, 11:15 – 11:25 am

Ingrid Barlow, M.Sc., OT(C)
Capital Health Region
Glenrose Rehabilitation Hospital
10230-111 Ave.,
Edmonton, AB T5G 0B7
ibarlow@cha.ab.ca

"Seating Education for Clients, Caregivers, & Colleagues: Is it Worth the Effort?"
Instructional Sesssion B4, March 4, 3:45 - 4:45 pm

" Seating via Telehealth: Benefits and Challenges"
Plenary, March 5, 2:50 - 3:25 pm

Kendra Betz, MSPT
SCI Clinical Specialist
VA Puget Sound Health Care System
17400 NE 19th Place,
Bellevue, WA 98008 USA
Kendra.Betz@med.va.gov

"Just Weld It! Prescribing Custom Ultralights with Confidence"
Instructional Session C5 March 5, 8:30 - 9:30 am

"It's Just Like Riding a Bike"... Seating Evaluation and Interventions for Handcycles"
Instructional Session E5, March 6, 10:00 - 11:15 am

Gary E Birch, Ph.D., P.Eng.
Executive Director
Neil Square Foundation
220-2250 Boundary Rd.,
Vancouver, BC V5M 3Z3
garyb@neilsquare.ca

" Brain Interfacing"
Plenary, March 4, 11:40 - 12:05 pm

Amy Bjornson, PT, ATP
Sunrise Medical
7477 East Dry Creek Parkway,
Longmont, CO 80503 USA
amy.bjornson@sunmed.com

"Successful Equipment Prescription for Specialty Populations of Bariatric and Geriatric Patients"
Instructional Session A5, March 4, 2:00 - 3:00 pm

Jeanette Boily, BS.C, OT, CPL, OT
George Pearson Centre
Vancouver General Hospital & Health Sciences Centre
Vancouver, BC Canada
jboily@vanhosp.bc.ca

"Developing Client Centered Guidelines for Power Mobility"
Instructional Session E6, March 6, 10:00 - 11:15 am

Alan Boyd, B.Eng.,
Motion Concepts
84 Citation Drive
Concord, Ontario, Canada, L4K 3C1

"Power Positioning for Function"
Instructional Session D1, March 5, 9:30 - 10:30 am

Gord Broughton, Seating Technologist
Sunny Hill Health Centre for Children
3644 Slocan St.,
Vancouver, BC V5M 3E8 Canada

Seating System Fabrication
Pre-Symposium Workshop March 3, 9:00 - 4:00 pm

Andrew Brulé, M.Sc., P.Eng.,
Sunny Hill Health Centre for Children
Therapy Dept.
3644 Slocan St.,
Vancouver, BC V5M 3E8 Canada

"Poster: Proto-type Device: Clinical Determination for the Stability of an Occupied Wheelchair"

Sheila Buck, B.Sc (OT), Reg. ATP
Therapy NOW!
811 Graham Bell Crt.,
Milton, ON L9T 3T1
therapynow@cogecd.ca

"Molded Seating: Where Do I Start?"
Pre-Symposium Workshop March 3, 2:00 - 4:00 pm

"Power to the People"
Instructional Session C4, March 5, 8:30 - 9:30 am

"Power Positioning for Function"
Instructional Session D1, March 5, 9:30 - 10:30 am

Corrinne Carriere
President & Owner
Carriere Consulting Inc.
415-374 South Service Road East,
Oakville, ON L6J 2X6
ccinca@ziplip.com

"The Business Side of Assistive Technology"
Pre-Symposium Workshop March 3, 1:30 - 4:30 pm

Daryl Caves, B.Sc. PT
GF Strong Rehab Centre
SCI Programme
4255 Laurel St.,
Vancouver, BC V5Z 2G9

"Corrective Seating and Pain: A Role for Intramuscular Stimulation"
Simultaneous Paper Session, Room 2, March 5, 12:05 - 12:15 pm

JoAnne Chisholm, MSc. OT,
Access Community Therapists Ltd.
Vancouver, BC
joanne@interchange.ubc.ca

"Making the Match: From Assessment to Product"
Pre-Symposium Workshop March 3, 11:00 - 1:00 pm

Kevin Clements,
Manager, Seating & Mobility
Regency Park Rehabilitation Engineering
Seating and Mobility Department
PO Box 2438, Days Road, Regency Park SA 5010
Regency Park, 5942 Australia
kevin.clements@cca.org.au

"Lateral Tilt-in-Space: Innovative Design for a Unique Problem"
Simultaneous Paper Session, Room 3, March 5, 11:15 - 11:25 am

Laura Cohen, PT, ATP
Research Associate,
Ph.D Student,
Human Research Laboratories
Pittsburgh, PA
ljcst22@pitt.edu

"Tele Rehabilitation for Seating and Wheeled Mobility, Evaluation and Service Delivery"
Plenary, March 5, 2:50 - 3:25 pm

"Seating and Mobility Script Concordance Test Validation"
Simultaneous Paper Session, Room 2, March 6, 9:35 - 9:45 am

Elizabeth Cole, MSPT
Director of Education
Sunrise Medical, Inc.
Education Department
7477 East Dry Creek Parkway,
Longmont, CO 80305 USA
elizabeth.cole@sunmed.com

"Selecting Specialty Controls for Power Wheelchairs"
Instructional Session D6, March 5, 9:30 - 10:30 am

Dave Cooper, MSc. (Kinesiology)
Rehabilitation Technologist
Sunny Hill Health Centre for Children
3644 Slocan St.,
Vancouver, BC V5M 3E8 Canada

"Seating System Fabrication"
Pre-Symposium Workshop March 3, 9:00 - 4:00 pm

"A Retrospective of Three Years of Lateral Tilt-in-Space"
Simultaneous Paper Session, Room 3, March 5, 11:25 – 11:35 am

Barbara Crane, Ph.D.
Department of Rehabilitation, Science & Technology
University of Pittsburgh
Pittsburgh, PA

"Effects on Discomfort and Wheelchair Use"
Simultaneous Paper Session, Room 1, March 6, 9:35 – 9:45 am

Ian Denison, PT, ATP, SCI Programme
GF Strong Rehab Centre
4255 Laurel St.,
Vancouver, BC V5Z 2G9
idenison@vanhosp.bc.ca

"Power Wheelchairs: Maximizing Potential"
Pre-Symposium Workshop March 3, 9:00 - 4:00 pm

"The Effects of Tire Pressure and Type on Rolling Resistance"
Instructional Session C1, March 5, 8:30 - 9:30 am

"Corrective Seating and Pain: A role for Intramuscular Stimulation"
Simultaneous Paper Session, Room 2, March 5, 12:05 - 12:15 pm

Mark A. Dilabio
Seating Technologist
Sunny Hill Health Centre for Children
3644 Slocan St.,
Vancouver, BC V5M 3E8 Canada

" The Basis of Wheelchair Maintenance"
Pre-Symposium Workshop March 3, 9:00 - 12:30 pm

Sandy Daughen, OT
Coordinator of Rehabilitation Services,
Tillicum and Veterans Care Society
The Lodge at Broadmead and Veterans Health Centre
4579 Chatterton Way,
Victoria, BC V8X 4Y7
sandy.daughen@gems7.gov.bc.ca

"Poster: Reliability of a Method to Manage a Seating and Mobility Waitlist"

"Comparison: Manual Tilt-in-Space Wheelchairs Used in Long-term Care"
Instructional Session C2, March 5, 8:30 - 9:30 am

Todd Dinner
President,
Signature 2000
11861 E. Main Rd.,
North East, PA 16428 USA
tdinner@signature2000.net

" Molded Seating: Where Do I Start?"
Pre-Symposium Workshop March 3, 2:00 - 4:00 pm

Bengt Engström
Bengt Engstrom Seating
Jagarvagen 14,
Värmdö, S-139 40 Sweden
engstrom@posturalis.com

"Human Sitting Behaviour: What Influences What"
Pre-Symposium Workshop March 3, 9:00 - 11:00 am

"Life is Communication: Sitting Patterns - Pathological or Logical?"
Plenary, March 4, 9:30 - 10:00 am

Richard Escobar, B.Sc., ATP
Mobility for Discovery
Lucille Packard Childrens Hospital at Stanford
PO Box 700242,
San Jose, CA 95170-0242 USA
rjedesigns@hotmail.com

"Lessons Learned: The TOTWalker Grant Project"
Simultaneous Paper Session, Room 3, March 5, 11:40 - 11:50 am

"Modifications for Mobility"
Instructional Session E3, March 6, 10:00 - 11:15 am

Kathryn J Fisher, B.Sc. OT, ATS, OT(C) Reg (Ont)
Therapy Supplies and Rental Ltd.
104 Bartley Dr.,
Toronto, Ont M4A 1C5 Canada
kfisher@therapysupplies.com

"Eight Days a Week"
Instructional Session A2, March 4, 2:00 - 3:00 pm

"Power to the People"
Instructional Session C4, March 5, 8:30 - 9:30 am

Jan Furumasu, BSPT, CART
Rancho Los Amigos National Rehabilitation Center
7601 E. Imperial Highway,
Downey, CA 90242 USA
jfurumasu@dhs.co.la.ca.us

"Current Practices for Providing Pediatric Powered Mobility"
Simultaneous Paper Session, Room 2, March 6, 8:55 - 9:05 am

Doug Gayton, ATP
GF Strong Rehab Centre
4255 Laurel St.,
Vancouver, BC V5Z 2G9

"Power Wheelchairs: Maximizing Potential"
Pre-Symposium Workshop March 3, 9:00 - 4:00 pm

Wayne H Hanson
Director, Advanced Product Development for Pediatrics
Sunrise Medical, Inc.
Bozeman, MT
wayne@rocwheels.org

"Delivering Seating and Mobility to the Rest of the World"
Instructional Session A4, March 4, 2:00 - 3:00 pm

Michael Harcourt
Rick Hansen Man in Motion Foundation
Vancouver, BC
mharcourt@shaw.ca

"Towards International Collaboration on Repair Discoveries and the Accessible City"
Keynote Address, March 4, 8:45 - 9:30 am

Wendi Harder, B.Sc Kinesiology, ATS
Motion Specialties
1562 Rand Avenue,
Vancouver, B.C. V6P 3G2

"The Basis of Wheelchair Maintenance"
Pre-Symposium Workshop March 3, 9:00 - 12:30 pm

Karen Hardwick, Ph.D, OTR, FAOTA
Director,
Rehabilitation Therapies, Austin State School
Texas Department MHMR, Nutritional Management
P.O. Box 1269,
Austin, TX 78767-1269 USA
karen.hardwick@mhmr.state.tx.us

"Seating & Positioning for Medical Issues in Individuals with Developmental Disabilities"
Instructional Session B1, March 4, 3:45 - 4:45 pm

Frances Harris, Ph.D,
Centre for Rehabilitation Technology
Helen Hayes Hospital
Route 9W,
West Haverstraw, NY 10993 USA
Harrisf@HelenHayesHosp.org

"How to Do a Cost Analysis in Assistive Technology"
Instructional Session E2, March 6, 10:00 - 11:15 am

Tom Hetzel, PT, ATP
Ride Designs
4251 S. Natches Ct. Suite E,
Sheridan, CO 80110 USA
tom@ridedesigns.com

"In Search of Seating Alternatives that Elevate Both Functional and Skin Outcomes for the Aging Wheelchair User"
Instructional Session A1, March 4, 2:00 - 3:00 pm

Doug Hobson, Ph.D.
Associate Professor & Co-Director,
School of Health & Rehabilitation Sc.
University of Pittsburgh
Rehabilitation Engineering Research
5044 Forbes Tower,
Pittsburgh, PA 15260 USA dhobson+@pitt.edu

"Transporting People in Wheelchairs in Vans & School Buses"
Instructional Session D5, March 5, 9:30 - 10:30 am

"Effects on Discomfort and Wheelchair Use"
Simultaneous Paper Session, Room 1, March 6, 9:20- 9:30 am

Margo Holm, Ph.D., OTR/L, FAOTA, ABDA
University of Pittsburgh
Dept of Rehab Science & Technology
Pittsburgh, PA 15260 USA

"Effects on Discomfort and Wheelchair Use"
Simultaneous Paper Session, Room 1, March 6, 9:20 – 9:30 am

Grant Huston. B.Sc., PT
GF Strong Rehab Centre
SCI Programme
4255 Laurel St.,
Vancouver, BC V5Z 2G9

"Corrective Seating and Pain: A role for Intramuscular Stimulation"
Simultaneous Paper Session, Room 2, March 5, 12:05 - 12:15 am

Mary Isaacson, M.D., MA, OTR/L ATP
Principal, Adaptabilities and Assistant Professor,
University of Oklahoma
5930 East 31st, Suite 100
Tulsa, OK 74135 USA
mary-isaacson@ouhsc.edu

"Best Practices of OT & PT Performing Seating and Mobility Evaluations"
Simultaneous Paper Session, Room 2, March 6, 8:45 - 8:55 am

Susan Johnson Taylor, OTR/L
Rehabilitation Institute of Chicago
345 East Superior St.,
Chicago, IL 60611 USA

"Power Wheelchairs: Maximizing Potential"
Pre-Symposium Workshop March 3, 9:00 - 4:00 pm

David Jordan, B.Sc., OT
Sunny Hill Health Centre
3644 Slocan St.,
Vancouver, BC V5M 3E8

"Poster: Seating Simulator for Remote Access"

Peter Jung, CPO
Orthotec
Swiss Paraplegic Center Nottwil Orthotec
Nottwil, AG, CH-6207 Switzerland
peter.jung@orthotec.ch

"Customized Back Prothesis Fitting"
Simultaneous Paper Session, Room 2, March 5, 11:40 - 11:50 am

Karen M Kangas, OTR/L
Clinician and Consultant (Private Practice)
RR1, Box 70,
Shamokin, PA 17872 USA kmkangas@ptd.net

"Why Current Pediatric Seating Systems Configured to "Support Growth" are Not Working"
Plenary, March 4, 10:00 - 10:30 am

"Sensory Processing & Integration in Childrens' Seating and Mobility Systems"
Instructional Session B5, March 4, 3:45 - 4:45 pm

"Programming the Electronics for Powered Mobility Systems for Children"
Instructional Session D2, March 5, 9:30 - 10:30 am

R. Lee Kirby, M.D., FRCPC
NS Rehab Centre
Department of Medicine, Dalhousie
1341 Summer Street, Halifax, NS B3H 4K4
kirby@dal.ca

"Poster: Wheelchair Skills Training for OT Students: Results of a North American Curriculum Questiona"

"Wheelchair Skills Training Program (WST): Testing and Training Protocols"
Instructional Session D3, March 5, 9:30 - 10:30am

"Manual Wheelchair Skills: Past, Present and Future"
Plenary, March 5, 2:25 - 2:50 pm

Karen Lagden, RN, ET
Wound Care Specialist
Swaine & Associates
7103 Christie Briar Manor SW
Calgary, Alberta, T3H 2G5
klagden@aol.com

"A Team Protocol for Prevention and Treatment of Pressure Wounds"
Pre-Symposium Workshop March 3, 9:00 - 4:00 pm

Judy Larson, OTR/L
Staff Occupational Therapist
Carrie Tingley Hospital
Rehab - OT
1127 University NE,
Albuquerque, NM 87102 USA
jslarson@salud.union.edu

"Using a Scoring Guideline to Organize Scheduling of Wheelchair Evaluations"
Simultaneous Paper Session, Room 2, March 6, 9:10 - 9:20 am

Eva K Ma, OTR, ATP, PC
Consultant
1616 S.W. Harbor Way, A305
Portland, OR 97201 USA
evama@aol.com

"Pressure Management in Positioning Clients with Severe Pelvic Obliquity using Pressure Mapping Technology"
Simultaneous Paper Session, Room 2, March 5, 11:15 – 11:25am

Jim MacKinnon
Consumer
Calgary, AB

"A Team Protocol for Prevention and Treatment of Pressure Wounds"
Pre-Symposium Workshop March 3, 9:00 - 4:00 pm

Sonja K Magnuson, M.Sc., OT
Sunny Hill Health Centre for Children
3644 Slocan St.,
Vancouver, BC V5M 3E8 Canada
smagnuson@cw.bc.ca

"Sports Galore"
Instructional Session A6, March 4, 2:00 - 3:00 pm

"Transportation for Children and Youth: BC Law and Clinical Best Practice"
Instructional Session C3, March 5, 8:30 - 9:30 am

Mohsen Makhsous, Ph.D
Assistant Professor
Dept. Physical Therapy & Human Movement Science
Dept. Physical Medicine & Rehabilitation
Northwestern University
Research Scientist
Sensory Motor Performance Program
Rehabilitation! Institute of Chicago
Suite 140 6, 346 E. Superior St.
Chicago, IL 60611
m-makhsous2@northwestern.edu

"Reducing the Risk of Whole-Body Vibration Injury in a Car Seat using a New Seating Design"

Simultaneous Paper Session, Friday, March 5, 11:50 am

Joan Mather, B.Sc, PT
Glenrose Rehabilitation Hospital
Seating Service
Edmonton, Alberta

"Seating Education for Clients, Caregivers, & Colleagues: Is it Worth the Effort?"
Instructional Sesssion B4, March 4, 3:45 - 4:45 pm

Chris Maurer, MPT, ATP
Shepherd Center
2020 Peachtree Rd. NW,
Atlanta, GA 30309 USA
chris_maurer@shepherd.org

"Essential Collaboration Between Driving & Seating Specialists"
Instructional Session D4, March 5, 9:30 - 10:30 am

"Effect of Seat Inclination on Seating Pressures of Individuals with SCI"
Simultaneous Paper Session,Room 1, March 5, 11:15 - 11:25 am

"Development of Reliable Measures of Postural Stability"
Simultaneous Paper Session, Room 1, March 5, 11:40 - 11:50 am

Shannon McGrath
Occupational Therapist, Consultant,
Jillian Swaine Occupational Therapy Services
7103 Christie Briar Manor SW,
Calgary, AB T3H 2G5
info@jillianswaineots.com

"Interface Pressure Mapping Feet"
Simultaneous Paper Session Room 3, March 5, 11:50 - 12:00 pm

Lynore McLean, BSc OT
Sunny Hill Health Centre for Children
644 Slocan St.
Vancouver, B.C. V5M 3E8

Poster: A Mobile Rocker Base to Provide Calming Sensory Input

Patrick Meeker, MS, PT
Regional Clinical Specialist
The ROHO Group
3424 Laredo Dr.,
Lexington, KY 40517 USA patm@therogroup.com

"My Shoulder Hurts, Now What? A Review of Pathomechanics"
Instructional Session B3, March 4, 3:45 - 4:45 pm

Francine Miller, B.Sc., (OT)
Access Community Therapists Ltd.
4414 W 12th Ave.,
Vancouver, BC V6R 2R2
fvmiller@telus.net

"Making the Match: From Assessment to Product"
Pre-Symposium Workshop March 3, 11:00 - 1:00 pm

William C. Miller, Ph.D,
Assistant Professor
UBC School of Rehab Sciences
CCEE, VGH Research Pavilion, 828 West 10th Ave.
Vancouver, BC V5Z 1L8
bcmiller@telus.net

" Adding Evidence to Clinical Research and Practice"
Pre-Symposium Workshop March 3, 9:00 -12:30 pm

"Seating, Mobility and ICF"
Plenary, March 5, 2:00 - 2:25 pm

"Developing Client Centered Guidelines for Power Mobility"
Instructional Session E6, March 6, 10:00 - 11:15 am

Jan Miller-Polgar, Ph.D.
Associate Professor
UWO School of Occupational Therapy
The University of Western Ontario
School of OT, Elborn College, 1201 Western Rd.
London, ON N6B 1H1

" Adding Evidence to Clinical Research and Practice"
Pre-Symposium Workshop March 3, 9:00 - 12:30 pm

Brenlee Mogul-Rotman, B.Sc., OT, ATP, OT Reg (Ont)
Occupational Therapist
Toward Independence
34 Squire Drive,
Richmond Hill, ON L4S 1C6
brenleemogul@sympatico.ca

"Eight Days a Week"
Instructional Session A2, March 4, 2:00 - 3:00 pm

"Power to the People"
Instructional Session C4, March 5, 8:30 - 9:30 am

Ben Mortenson, Clincial Practice Leader
Occupational Therapy
Purdy Pavillion
Extended Care Unit, UBC
Vancouver, BC
bennett@vcn.bc.ca

"Developing Client Centered Guidelines for Power Mobility"
Instructional Session E6, March 6, 10:00 - 11:15 am

Cathy Mulholland, OTR
Pacific Rehab
215 North 12th Street
Santa Paula, California, 93060
cathyotr@aol.com

"Delivering Seating and Mobility to the Rest of the World"
Instructional Session A4, March 4, 2:00 - 3:00 pm

Phil Mundy, P.Eng.
Product Design Group
Unit 102, 366 East Kent Ave South,
Vancouver, BC V5X 4N6
phil_mundy@prodgroup.com

"Functional Positioning/Independent Mobility for Clients with Complex Needs"
Instructional Session C6, March 5, 8:30 - 9:30 am

Iona Novak, B.AppSc., OTR, Acc OT
The Spastic Centre
PO Box 184, 189 Allambie Rd.
Brookvale/Allambie Heights, NSW 2100 Australia
inovak@tscnsw.org.au

"Seating & Positioning: An Interactive CD Rom e-Learning Tool"
Plenary, March 4, 12:05 - 12:30 pm

Maureen O'Donnell, M.D. M.Sc., FRCP (C)
Assistant Professor
Head, Division of Developmental Pediatrics
Department of Pediatrics, UBC
Medical Director, Sunny Hill Health Centre for Children
3644 Slocan St.,
Vancouver, BC V5M 3E8 Canada

"Opening Remarks"
March 4, 8:30 - 8:45 am

"Opening Remarks"
March 6, 8:30 – 8:45 am

Beth Ott, M.Sc., PT
Sunny Hill Health Centre for Children
Physiotherapy Dept.
3644 Slocan St.,
Vancouver, BC V5M 3E8

"Recovery of Postural Control Following Brain Injury"
Simultaneous Paper Session, Room 1, March 6, 8:45 - 8:55 am

Virginia Paleg, PT, M.Sc. Candidate
Snug Seat
Silver Spring, MD 20901 USA
ginny@paleg.com

"The Evidence Basis of Using Gait Trainers"
Instructional Session E1, March 6, 10:00 - 11:15

Joan Padgitt, PT ATP
Ride Designs
4251-K South Natches Court,
Sheridan, CO 80110 USA
joan@ridedesigns.com

"In Search of Seating Alternatives that Elevate Both Functional and Skin Outcomes"
Instructional Session A1, March 4, 2:00 – 3:00 pm

Angie Perdios, M.Sc. Candidate
School of Human Kinetics
University of British Columbia
210-6081 University Boulevard
Vancouver, B.C. V6T 1Z1

"Effects of Camber on Energy Cost in the Experienced and Inexperienced Wheelchair User"
Simultaneous Paper Session, Room 2, March 5, 12:15 - 12:25 am

Richard Peter
Program Coordinator
BC Wheelchair Sports Association
224-1367 W. Broadway,
Vancouver, BC V6H 4A9
richard@bcwheelchairsports.com

"Sports Galore"
Instructional Session A6, March 4, 2:00 - 3:00 pm

Wantanee Phantachat
Director, Assistive Technology Centre
National Electronics and Computer Technology Centre
National Science and Technology Development Agency
Ministry of Science and Technology
112 Thailand Science Park, Phahon Yotin Road
Klong 1, Klongluang, Pathumthani 12120, Thailand
wantanee@nectec.or.th

"A Team Protocol for Prevention and Treatment of Pressure Wounds"
Pre-Symposium Workshop March 3, 9:00 - 4:00 pm

Joanna Rainer, B.Sc. Rehab Med
Community Rehabilitation Services
2101 32nd Ave.,
Vernon, BC V1T 5L2
joanna.rainer@interiorhealth.ca

"Seating Assessment/Prescription in a Rural Area"
Simultaneous Paper Session, Room 1, March 6, 9:10 - 9:20 am

M. Reed
5055 Forbes Tower,
Pittsburgh, PA 15260 USA
lvanroos@pitt.edu

"Click It or Ticket: Seat Belt Usability Among Wheelchair Riders"
Simultaneous Paper Session Room 1, , March 6, 8:55 - 9:05 am

Mark Richard
Hope Haven Int'l Ministries
1800 S 19th Street
Rock Valley, Iowa, 51247
mrichard@hopehaven.org

"Delivering Seating and Mobility to the Rest of the World"
Instructional Session A4, March 4, 2:00 - 3:00 pm

Kathleen R Riley, PT, ATS, CRTS
Branch Manager,
National Seating & Mobility
Equipment Supplier
224 Rolling Hills Road, Suite 1B,
Mooresville, NC 28115 USA
kriley1949@aol.com

"Delivering Seating and Mobility to the Rest of the World"
Instructional Session A4, March 4, 2:00 - 3:00 pm

"Outside the Box, NOT Out of the Box"
Instructional Session B2, March 4, 3:45 - 4:45 pm

Lisa Rotelli
Adaptive Switch Labs
125 Spur 191, Suite C,
Spicewood, TX 78669 USA
lrotelli@asl-inc.com

"Why Current Pediatric Seating Systems Configured to "Support Growth" are Not Working"
Plenary, March 4, 10:00 – 10:30 am

"Programming the Electronics for Powered Mobility Systems for Children"
Instructional Session D2, March 5, 9:30 - 10:30 am

Lori Roxborough, M.Sc., OT/PT
Sunny Hill Health Centre for Children
3644 Slocan St.,
Vancouver, BC V5M 3E8 Canada
lroxborough@cw.bc.ca

"Poster: Item Analysis of the Seated Postural Control Measure"

Yoshinori Saito
Kawasaki University of Medical Welfare
Gitu Shotoku Gakuen University
288 Matsushima,
Kurashiki, Okayama 701-0193 Japan
saiyoshi@mw.kawasaki-m.ac.jp

"Poster: Time Study on the Factors Affecting the Relationship Between Independent Mobility & Modes of Daily Activities"

Bonita Sawatzky, Ph.D.
Assistant Professor,
Department of Orthopaedics
BC Children's & Women's Hospital
4480 Oak St.,
Vancouver, BC V6H 3V4

"The Effects of Tire Pressure and Type on Rolling Resistance"
Instructional Session C1, March 5, 8:30 – 9:30 am

"Effects of Camber on Energy Cost in the Experienced and Inexperienced Wheelchair User"
Simultaneous Paper Session Room 2, March 5, 12:15 – 12;25 pm

Mark Schmeler, MS, OT R/L, ATP
Director, Centre for Assistive Technology, UPMC
Instructor, Department of Rehabilitation Science & Technology
University of Pittsburgh
Forbes Tower, Suite 3010,
Pittsburgh, PA 15213 USA

"Vertical Mobility: An Overlooked Necessity"
Instructional Session E4, March 6, 10:00 - 11:15 am

Sheena A Schoger, Dpt. OT, OT Reg (Ont)
Children's Rehabilitation Centre of Essex County
3945 Matchette Rd.,
Windsor, ON N9C 4C2 Canada
schogers@gosfieldtel.com

"Early Equipment Interventions for the Pediatric Client"
Instructional Session A3, March 4, 2:00 - 3:00 pm

Elizabeth M Sebesta, OT
Tillicum & Veteran's Care Society
4579 Chatterton Way,
Victoria, BC V8X 4Y7

"Comparison: Manual Tilt-in-Space Wheelchairs Used in Long-term Care"
Instructional Session C2, March 5, 8:30 - 9:30 am

Angela Sekulic, B.Sc., OT (C)
Glenrose Rehabilitation Hospital
10230 - 111 Avenue,
Edmonton, AB T5G OB7

"Seating via Telehealth: Benefits and Challenges"
Plenary, March 5, 2:50 - 3:25 pm

Takeshi Shigenari
Kinki Welfare University
Dept. of Welfare Business,
Faculty of Social Welfare,
Hukusaki-Cho
Kanzaki-gun 679-2217 Japan
shige@kinwu.ac.jp

"Poster: Adaptation and Evaluation on the SRC Walker for Children with Severe Disabilities"

Allen R. Siekman, BS
Director of Design,
Beneficial Designs Inc.
290 Sunlit Lane, Santa Cruz, CA 95060

"A Seating Interface Test Fixture Design"
Simultaneous Paper Session, Room 1, March 5, 11:50 - 12:00 am

"The Sub-ASIS belt: a New Concept"
Simultaneous Paper Session, Room 1, March 5, 12:05 - 12:15 pm

"The Anti-Trust Seat"
Simultaneous Paper Session, Room 1, March 5, 12:15 - 12:25

Bryan Smith
Consumer
Calgary, AB

"A Team Protocol for Prevention and Treatment of Pressure Wounds"
Pre-Symposium Workshop March 3, 9:00 - 4:00 pm

Stephen Sprigle, Ph.D., PT,
Georgia Institute of Technology
Director,
Center for Assistive Tech. & Env. Access
490 Tenth St.,
Atlanta, GA 30332 USA
sprigle@arch.gatech.edu

"A Team Protocol for Prevention and Treatment of Pressure Wounds"
Pre-Symposium Workshop March 3, 9:00 - 4:00 pm

"Effect of Seat Inclination on Seating Pressures of Individuals with Spinal Cord Injury"
Simultaneous Paper Session, Room 1, March 5, 11;15 – 11:25 am

"Relationship Between Cushion Type, Backrest Height, Seated Posture and Reach"
Simultaneous Paper Session, Room 1, March 5, 11:25 - 11:35 am

"Development of Reliable Measures of Postural Stability"
Simultaneous Paper Session, Room 1, March 5, 11:40 - 11:50 am

"How to Do a Cost Analysis in Assistive Technology"
Instructional Session E2, March 6, 10:00 - 11:15 am

Bob Stickney, Seating Technologist
Sunny Hill Health Centre for Children
3644 Slocan St.,
Vancouver, BC V5M 3E8 Canada

"Seating System Fabrication"
Pre-Symposium Workshop March 3, 9:00 - 4:00 pm

Jillian Swaine, B.Sc., (OT)
Occupational Therapist, Consultant,
Jillian Swaine Occupational Therapy Services
7103 Christie Briar Manor SW,
Calgary, AB T3H 2G5
info@jillianswaineots.com

"A Team Protocol forPrevention and Treatment of Pressure Wounds"
Pre-Symposium Workshop March 3, 9:00 - 4:00 pm

"Pressure Management"
Plenary, March 4, 11:15 - 11:40 am

"Interface Pressure Mapping Feet"
Simultaneous Paper Session Room 3, March 5, 11:50 - 12:00 pm

Maureen Story, BSR (PT/OT)
Sunny Hill Health Centre for Children
and Access Community Therapists, Ltd.
3644 Slocan St.,
Vancouver, BC V5M 3E8 Canada
mstory@cw.bc.ca

"Poster: Item Analysis of the Seated Postural Control Measure"

Eric Tam
Prince of Wales Hospital
Seating Clinic, Physiotherapy Dept.
30-32 Ngan Shing Street,
Shatin, N.T. Hong Kong
seating@ort.cuhk.edu.hk

"A New Database System for Seating and Mobility"
Simultaneous Paper Session Room 2, March 6, 9:20 - 9:30 am

Ed Thompson
Consumer
Calgary, AB

"A Team Protocol for Prevention and Treatment of Pressure Wounds"
Pre-Symposium Workshop March 3, 9:00 - 4:00 pm

Amanda Treweeke, BHEc., RDN
Fellburn Care Centre
6050 Hastings,
Burnaby, B.C. V6B 1R6
mccuskers@telus.net

"A Team Protocol for Prevention and Treatment of Pressure Wounds"
Pre-Symposium Workshop March 3, 9:00 - 4:00 pm

Margaret Turner, BSc.N
Rona Kinetics
MGTurner@shaw.ca

"Transportation for Children and Youth: BC Law and Clinical Best Practice"
Instructional Session C3, March 5, 8:30- 9:30 pm

Linda van Roosmalen, Ph.D., IDSA
5055 Forbes Tower,
Pittsburgh, PA 15260 USA
lvanroos@pitt.edu

"Transporting People in Wheelchairs in Vans & School Buses"
Instructional Session D5, March 5, 9:30 - 10:30 am

"Click It or Ticket: Seat Belt Usability Among Wheelchair Riders"
Simultaneous Paper Session, Room 1, March 6, 8:55 - 9:05 am

Tamara Vos, OTR
Dept. of Physical Medicine and Rehabilitation
Mayo Clinic and Foundation for Medical Education & Research
200 First St SW,
Rochester, MN 55905
Vos.Tamara@mayo.edu

"Poster: A Collaborative Project to Develop a Low-Cost, Low-Tech Air Loss Sensor System for Roho..."

Eric Wasylenko MD, BSc
Palliative Care Consultant,
Calgary Regional Palliative and Hospice Care Service
Calgary Health Region,
Calgary, Alberta
Eric.Wasylenko@CalgaryHealthRegion.ca

"A Team Protocol for Prevention and Treatment of Pressure Wounds"
Pre-Symposium Workshop March 3, 9:00 - 4:00 pm

Danny Webb, Rehab Equipment Specialist
MEDIchair Victoria
1856 Quadra Street,
Victoria, BC V8T 4B9
danchriswebb@shaw.ca

"*Comparison: Manual Tilt-in-Space Wheelchairs Used in Long-term Care"*
Instructional Session C2, March 5, 8:30 - 9:30 am

Mikel J. Wheeler, COTA
Department of Physical Medicine & Rehab
Mayo Medical Center
200 First St SW,
Rochester, MN 55905 USA
Wheeler.Michael@mayo.edu

"*Poster: A Collaborative Project to Develop a Low-Cost, Low-Tech Air Loss Sensor System for Roho..."*

Nicole Wilkins, B.Sc., OT
Sunny Hill Health Centre for Children
3644 Slocan St.,
Vancouver, BC V5M 3E8 Canada
nwilkins@cw.bc.ca

"*Sports Galore*"
Instructional Session A6, March 4, 2:00 - 3:00 pm

Christine Wright-Ott, MPA, OTR/L
Occupational Therapist and
Principal Investigator, TOT Walker NIDRR Project Mobility for Discovery
Lucille Packard Childrens Hospital at Stanford
PO Box 700242,
San Jose, CA 95170-0242 USA

"*Lessons Learned: The TOTWalker Grant Project*"
Simultaneous Paper Session, Room 3, March 5, 11:40 - 11:50 am

"*Modifications for Mobility"*
Instructional Session E3, March 6, 10:00 - 11:15 am

Joanne Yip, BSR, OT/PT
Access Community Therapists Ltd.
4414 W 12th Ave.,
Vancouver, BC V6R 2R2
ngyip@telus.net

"Making the Match: From Assessment to Product"
Pre-Symposium Workshop March 3, 11:00 - 1:00 pm

Jean Zanca, MPT, Ph.D (Candidate)
Research Associate,
Dept. of Rehabilibation Science & Technology
University of Pittsburgh
4020 Forbes Tower,
Pittsburgh, PA 15260 USA

"Pilot Study to Detect Blanche Response"
Simultaneous Paper Session, Room 2, March 5, 11:25 - 11:35 am

Posters

Proto-type Device: Clinical Determination for the Stability of an Occupied Wheelchair
Andrew Brulé

Reliability of a Method to Manage a Seating and Mobility Waitlist
Sandy Daughen

Seating Simulator for Remote Access
David Jordan

Wheelchair Skills Training for OT Students: Results of a North American Curriculum Questionnaire
R. Lee Kirby, Anna L. Coolen

Item Analysis of the Seated Postural Control Measure
Lori Roxborough, Maureen Story

Time Study on the Factors Affecting the Relationship Between Independent Mobility & Modes of Daily Activities
Yoshinori Saito, Takeshi Shigenari and Susumu Uehara

Adaptation and Evaluation on the SRC Walker for Children with Severe Disabilities
Takeshi A. Shigenari, Toshihiko Tsutsumi, Shigeru Ota, and Yoshinori Saito

A Collaborative Project to Develop a Low-Cost, Low-Tech Air Loss Sensor System for Roho Seat Cushions
Mikel J. Wheeler, Tamara L. Vos

A Mobile Rocker Base to Provide Calming Sensory Input
Lynore McLean

Detailed Program

Thursday, March 4, 2004

Location	Time	Event
SALON ABC	*7:30 am*	Registration and Continental Breakfast, Exhibits Open
SALON DEF	*8:30 am*	Opening Remarks **Maureen O'Donnell**
SALON DEF	*8:45 am*	Keynote Towards International Collaboration on Repair Discoveries and the Accessible City **Honourable Michael Harcourt**
SALON DEF	*9:30 am*	Life is Communication: Sitting Patterns - Pathological or Logical? **Bengt Engstrom**
SALON DEF	*10:00 am*	Why Current Pediatric Seating Systems Configured to "Support Growth" are Not Working **Karen Kangas, Lisa Rotelli**
SALON ABC	*10:30 am*	Refreshment Break, Exhibits are Open
SALON DEF	*11:15 am*	Pressure Management **Jillian Swain, Wantanee Phantachat**
SALON DEF	*11:40 am*	Brain Interfacing **Gary Birch**
SALON DEF	*12:05 pm*	Seating & Positioning: An Interactive CD Rom e-Learning Tool **Iona Novak**
	12:30 pm	Luncheon (Registrants on their own), Exhibits are Open
	2:00 pm	**Instructional Sessions Group A**
SALON D	A1	In Search of Seating Alternatives that Elevate Both Functional AND Skin Outcomes for the Aging Wheelchair User **Joan Padgitt, Tom Hetzel**

Thursday, March 4, 2004, Continued

Location	Time	Event
SALON 1	A2	Eight Days a Week **Kathryn Fisher, Brenlee Mogul-Rotman**
SALON 2	A3	Early Equipment Interventions for the Pediatric Client **Sheena Schoger**
SEYMOUR	A4	Delivering Seating and Mobility to the Rest of the World **Wayne Hanson, Kathleen Riley, Cathy Mulholland, Mark Richard**
SALON 3	A5	Successful Equipment Prescription for Specialty Populations of Bariatric and Geriatric Patients **Amy Bjornson**
MACKENZIE	A6	Sports Galore **Nicole Wilkins, Richard Peter, Sonja Magnuson**
SALON ABC	*3:00 pm*	Refreshment Break, Exhibits are Open
	3:45 pm	**Instructional Sessions Group B**
SALON 1	B1	Seating & Positioning for Medical Issues in Individuals with Developmental Disabilities **Karen Hardwick**
MACKENZIE	B2	Outside the Box, NOT Out of the Box **Kathleen Riley**
SALON 3	B3	My Shoulder Hurts, Now What? A Review of Pathomechanics **Patrick Meeker**
SALON 2	B4	Seating Education for Clients, Caregivers & Colleagues: Is it Worth the Effort? **Ingrid Barlow, Joan Mather**
SALON D	B5	Sensory Processing & Integration in Children's Seating and Mobility Systems **Karen Kangas**
SEYMOUR	B6	Powered Mobility: The Ever-changing Story of Center Wheel Drive **Michael Babinec**
SALON ABC	*4:45 pm*	RECEPTION IN EXHIBIT HALL

Friday, March 5th, 2004

Location	Time	Event
SALON ABC	*8:00 am*	Registration, Continental Breakfast and Exhibits Open
	8:30 am	**Instructional Sessions Group C**
MACKENZIE	C1	Effects of Tire Pressure and Type on Rolling Resistance **Bonita Sawatzky, Ian Denison**
SALON 2	C2	Comparison: Manual Tilt-in-space Wheelchairs Used in Long-term Care **Elizabeth Sebesta, Sandy Daughen, Danny Webb**
SEYMOUR	C3	Transportation for Children and Youth: BC Law and Clinical Best Practice **Sonja Magnuson, Margaret Turner**
SALON 3	C4	Power to the People **Kathryn Fisher, Sheila Buck, Brenlee Mogul-Rotman**
SALON 1	C5	Just Weld it! Prescribing Custom Ultralights with Confidence **Kendra Betz**
SALON D	C6	Functional Positioning/Independent Mobility for Clients with Complex Needs **Phil Mundy, Nancy Balcom**
	9:30 am	**Instructional Sessions Group D**
SALON D	D1	Power Positioning for Function **Sheila Buck, Alan Boyd**
SALON 1	D2	Programming the Electronics for Powered Mobility Systems for Children **Karen Kangas, Lisa Rotelli**
SALON 2	D3	Wheelchair Skills Training Program (WST): Testing and Training Protocols **R. Lee Kirby**
SEYMOUR	D4	Essential Collaboration Between Driving & Seating Specialists **Chris Maurer, Beth Anderson**

Friday, March 5th, 2004, Continued

Location	Time	Event
MACKENZIE	D5	Transporting People in Wheelchairs in Vans & School Buses **Linda van Roosmalen, Doug Hobson**
SALON 3	D6	Selecting Speciality Controls for Power Wheelchairs **Elizabeth Cole**
	10:30 am	Refreshment Break, Exhibits are Open

SIMULTANEOUS PAPER SESSIONS

	Room: SALON 1 Moderator: Lori Roxborough	Room: SALON 2 Moderator: Jean Minkel	Room: SALON 3 Moderator: Elaine Trefler
11:15 am	Effect of Seat Inclination on Seating Pressures of Individuals with SCI **Chris Maurer**	Pressure Management in Positioning Clients with Severe Pelvic Obliquity using Pressure Mapping Technology **Michael Banks, Eva Ma**	Lateral Tilt-in-Space: Innovative Design for a Unique Problem **Kevin Clements**
11:25 am	Relationship Between Cushion Type, Backrest Height, Seated Posture and Reach **Stephen Sprigle**	Pilot Study to Detect Blanche Response **Jean Zanca**	A Retrospective of Three Years of Lateral Tilt-in-Space **Dave Cooper**
11:35 am	**Q & A**	**Q & A**	**Q & A**
11:40 am	Development of Reliable Measures of Postural Stability **Stephen Sprigle, Chris Maurer**	Customized Back Prothesis Fitting **Peter Jung**	Lessons Learned: The TOTWalker Grant Project **Christine Wright-Ott, Richard Escobar**
11:50 am	A Seating Interface Test Fixture Design **Allen Siekman**		Interface Pressure Mapping Feet **Jillian Swaine**

Friday, March 5th, Continued

SIMULTANEOUS PAPER SESSIONS

	Room: SALON 1 Moderator: Lori Roxborough	Room: SALON 2 Moderator: Jean Minkel	Room: SALON 3 Moderator: Elaine Trefler
12:00 pm	**Q & A**	**Q & A**	**Q & A**
12:05 pm	The Sub-ASIS belt: a New Concept **Allen Siekman**	Corrective Seating and Pain: A role for Intramuscular Stimulation **Daryl Caves, Grant Huston, Ian Denison**	Reducing the Risk of Whole-Body Vibration Injury in a Car Seat using a New Seating Design **Mohsen Makhsous**
12:15 pm	The Anti-Thrust Seat **Allen Siekman**	Effects of Camber on Energy Cost in the Experienced and Inexperienced Wheelchair User **Angie Perdios, Bonita Sawatzky**	Pelvic Positioning Evaluations for Wheelchair Selection **Ana Allegretti**
12:25 pm	**Q & A**	**Q & A**	**Q & A**
12:30 pm	Lunch (provided in the exhibit hall)		

Location	**Time**	**Event**
SALON DEF	*2:00 pm*	Seating, Mobility and ICF **William C. Miller**
SALON DEF	*2:25 pm*	Manual Wheelchair Skills: Past, Present and Future **R. Lee Kirby**
SALON DEF	*2:50 pm*	Seating via Telehealth: Benefits and Challenges **Angela Sekulic, Ingrid Barlow** and Tele Rehabilitation for Seating and Wheeled Mobility, Evaluation and Service Delivery **Laura Cohen**
SALON ABC	*3:25 pm*	Refreshment Break, Exhibits are Open
SALON DEF	*4:10 pm*	**Chris Bar Research Forum** (*Sponsored by the Roho Group*): This House Believes that Responsible Clinicians Restrict Their Client Information Purely to the Solutions they can Provide. House Leader: **Geoff Bardsley**
	5:15 pm	Adjourn

Saturday March 6th, 2004

Location	Time	Event
BAYSHORE FOYER	*8:00 am*	Registration, Continental Breakfast and Exhibits Open
SALON DEF	*8:30 am*	Opening Remarks **Maureen O'Donnell**

SIMULTANEOUS PAPER SESSIONS

	Room SALON DEF Moderator: Bonita Sawatzky	Room: SALON A Moderator: Maureen Story
8:45 am	Recovery of Postural Control Following Brain Injury **Beth Ott**	Best Practices of OT & PT Performing Seating and Mobility Evaluations **Mary Issacson**
8:55 am	Click it or Ticket: Seat Belt Usability Among Wheelchair Riders **Linda van Rossmalen, M. Reed**	Current Practices for Providing Pediatric Powered Mobility **Jan Furumasu**
9:05 am	**Q & A**	**Q & A**
9:10 am	Seating Assessment / Prescription in a Rural Area **Joanna Rainer**	Using a Scoring Guideline to Organize Scheduling of Wheelchair Evaluations **Judy Larson**
9:20 am	Effects on Discomfort and Wheelchair Use **Barbara Crane, Margo Holm, Doug Hobson**	A New Database System for Seating and Mobility **Eric Tam**
9:30 am	**Q & A**	**Q & A**
9:35 am		Seating and Mobility Script Concordance Test Validation **Laura Cohen**
9:45 am		**Q & A**

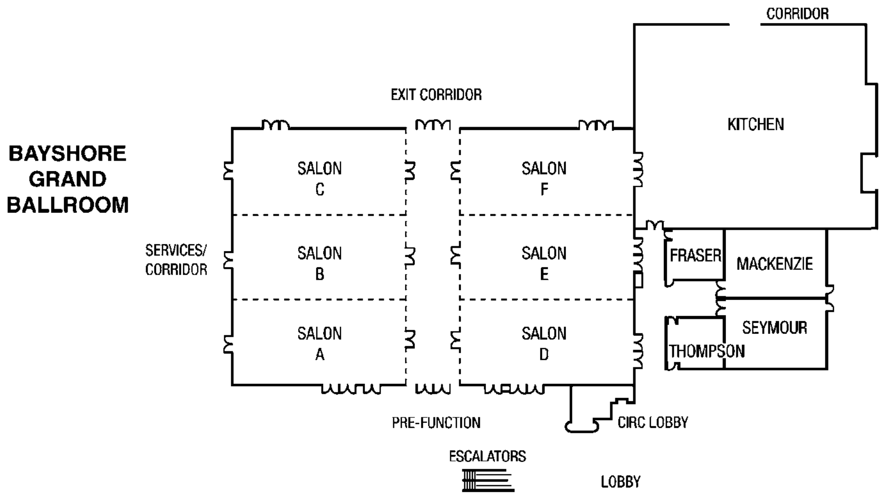
Saturday March 6th, 2004, Continued

Location	Time	Event
Bayshore Foyer	*9:50 am*	**Refreshment Break and POSTERS**
	10:00 am	**Instructional Sessions Group E**
SEYMOUR	E1	The Evidence Basis of Using Gait Trainers **Virginia Paleg**
SALON 3	E2	How to do a Cost Analysis in Assistive Technology **Frances Harris, Stephen Sprigle**
SALON 2	E3	Modifications for Mobility **Richard Escobar, Christine Wright - Ott**
SALON 1	E4	Vertical Mobility: An Overlooked Necessity **Julianna Arva, Mark Schmeler**
MACKENZIE	E5	"It's Just Like Riding a Bike" ... Seating Evaluation and Interventions for Handcycles **Kendra Betz**
SALON D	E6	Developing Client Centered Guidelines for Power Mobility **Ben Mortensen, Jeanette Boily, William Miller**
	11:15 am	Adjourn
SALON A & B	1:00 pm	**RESNA ATP and ATS exams (4 hrs each, exams are simultaneous), followed by RET Exams (1.5 hrs)**
MACKENZIE	1:30 pm	**ISO – WGII Group Meeting**

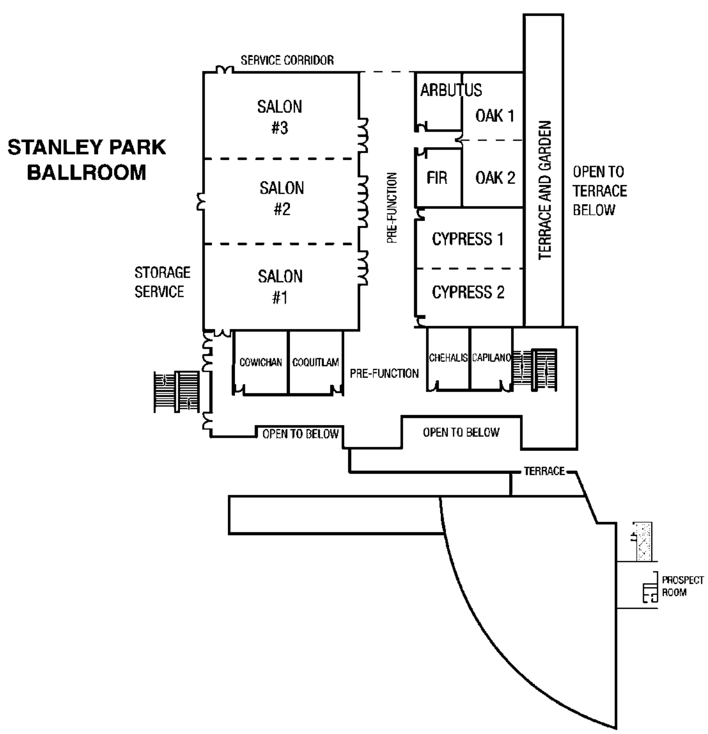
Have a Safe Journey Home!

Meeting Room Layout

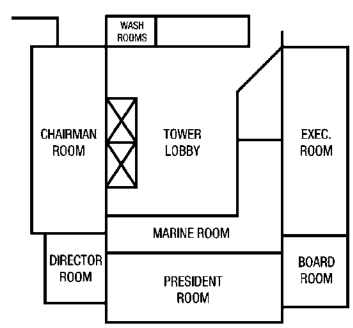
LEVEL ONE CONFERENCE FACILITIES



LEVEL TWO CONFERENCE FACILITIES



TOWER CONFERENCE FACILITIES



Exhibitors and Booth Assignments

COMPANY	BOOTH NUMBER/S
Accessible Designs (ADI)	47
Action Products	3, 4
Adaptive Engineering Lab, Inc.	36, 37, 38, 39
Adaptive Equipment Systems	30, 29, 18, 17
Advanced Health Care Products, Inc. & Columbia Medical	49
Altimate Medical Inc.	11
Amey Systems	74
Body Tech N.W.	6
Bodypoint Designs	40, 41
CAMP Healthcare	62
Convaid Inc.	73
Dolomite Home Care Products	5
Freedom Concepts Inc.	9
Froglegs, Inc.	81
Independence Technology	19 & 20
Innovation in Motion	7 & 8
Invacare Corporation	69, 70, 71, 72
Kuschall	68
Lifestand	54
Marken International Inc.	10
MK Battery	78
Mobility Management	28
Motion Concepts / PDG	50, 51, 52, 53
Nadachair	80
Ontario Rehabilitation Technology Consortium & Variety Ability Systems Inc.	15
Otto Bock HealthCare	12, 13

Local Restaurant Guide

CONFERENCE VENUE

CURRENTS RESTAURANT & BAR
Lunch and Dinner (full menu)

SEAWALL BAR & BISTRO
Lunch and Dinner (full menu)

STANLEY PERKS
Coffee, soup, sandwiches, pastries to go

WITHIN WALKING DISTANCE

WHITE SPOT RESTAURANT
1616 Cardero Street (At W. Georgia)
Burgers, Pasta, Salads, Dessert, licensed

CARDERO'S RESTAURANT & MARINE PUB
1583 Coal Harbour Quay
Seafood, Steak dining/Pub fare, licensed

LE GAVROCHE
1616 Alberni Street (at Cardero)
604-685-3924
Fine French Cuisine

CAFÉ DE PARIS
751 Denman Street (at Alberni)
604-687-1418
Informal French dining

THE FISH HOUSE
Stanley Park at English Bay
8901 Stanley Park Drive
Seafood dining in a park setting
604-681-7275

THE TEA HOUSE
Stanley Park at Third Beach
Light meals by the Seawall
604-669-3281

DELILAH'S
1789 Comox Street
Upscale modern restaurant, martini bar
604-687-3424

RAINCITY GRILL
1193 Denman Street (at Davie)
BC Cuisine with views of English Bay
604-685-7337

KRISHNA VEGETARIAN CURRY RESTAURANT
1726 Davie (between Bidwell and Denman)
604-688-9400
Value! Indian Vegetarian Menu and Buffet

OLYMPIA PIZZA & PASTA RESTAURANT
998 Denman Street (at Nelson)
604-688-8333
Hearty Pizza, Pasta and Greek specialties

FURTHER AFIELD - Recommended

IMPERIAL CHINESE SEAFOOD
355 Burrard Street (at W. Pender)
604-691-2788
Fine Chinese dining

DIVA AT THE MET
645 Howe Street (at W. Georgia)
604-602-7788
Award-Winning BC Cuisine

KOBE STEAK HOUSE
1042 Alberni Street (at Burrard)
604-684-2451
Japanese steakhouse and sushi

PICCOLO MONDO
850 Thurlow (at Nelson)
604-688-1633
Fine Italian cuisine, excellent wine cellar

Vij's
1480 West 11th Avenue
Best South Asian Fusion in North America
Early seating – 5:30 – no reservations
604-736-6664

Plenary Sessions

Thursday, March 4th, 2004

Towards International Collaboration on Repair Discoveries and the Accessible City

The Honourable Michael Harcourt

Key Note Presentation

The Accessible City

-Mike's experience

-Rick Hansen Foundation work

-Rick Hansen

-ICORD

-description-advisory committee-membership focus, focus on community, briefly stats 62% unemployment & other issues.

-Vancouver history 1970's – present and examples

-Accessible City

a) SCI

b) others

a) SCI-ICORD

b) others-City of Vancouver

a) Disability Community

b) 2006 – World Urban Forum

c) 2010

Concept – Leeds-Buildings

-people with disabilities

bronze, silver, gold

Life is Communication: Sitting Patterns – Pathological or Logical?

Bengt Engstrom
Bengt Engstrom Seating, Värmdö, Sweden

Description: Life is communication. Losing body position decreases the ability to face the world to communicate with head and hands. When the inner desire is to communicate, the body will assist the head even if posture becomes strange. This session reviews normal sitting behaviour in non-disabled humans and compares the findings with the sitting behaviour often seen in physically challenged humans.

- What are “we” doing and what are “they” doing?
- What factors makes a perfectly normal behaviour become abnormal?

Notes:

Why Current Pediatric Seating Systems Configured to "Support Growth" are Not Working

Karen M. Kangas, OTR/L
Occupational Therapist, Clinical Educator,
Practicing Clinician and Consultant, Shamokin, Pennsylvania

Presentation Summary:

Children are NOT small adults, yet their seating systems are smaller versions, or in some cases, similar versions of seating systems created, configured and used with adults. Frame size, seat depth, back height, trunk and pelvic guides have not been created, nor are they utilized with children's bodies. Yet, a pediatric system is often chosen since it "can grow with the child." However, the systems themselves, have not been developed nor based on any current anthropometric childhood data.

To support "growth" within a seating system, (both seat frame & adapted seating), often 12" x 12" or 14" x 14" sized systems are provided, even to a children younger than 8 years old, whose own hip width is less than 8 inches and whose leg length is less than 6 inches. This largeness is "created to be smaller" by placing the child within the middle of the seating system, and near the front of the seat frame. The child is surrounded by her system, and is expected to NOT participate in activities, since she can't reach anything from this seated posture.

We must alter dramatically how we are seating children in the size of chair's and components utilized. We must truly "FIT" the system to their actual and current size, allowing the child access to more independent control within her environment. Multiple systems for different activities must be supported and provided, as well as recognizing the need for structures which provide growth in an individual child rather than a presumption they will become wider, most often, as in adults.

Beginning at the beginning; the history of pediatric seating systems:

Pediatric seating systems have not been developed for children. They are simply smaller versions with adaptations of adult systems, with one exception. This presents two primary problems for the child. First of all the size doesn't fit. This is less critical for a "resting" child. However, seating that does not fit adequately greatly compromises any ability to independently manage any task, develop postural control, explore the environment or aid in accessibility to the upper extremities

The stroller itself, comes closest to being "made for a child" in that it attempts to imitate strollers in the commercial market place. (However, I am sorry to say that commercially available strollers also rarely fit a child adequately. This fact does not generally present a problem to most children, since most children are in strollers for limited periods of time, and not expected to use them for any independent activity.)

Consequently we have two problems. Children with disabilities are in their seating systems for long periods, since a single seating system is usually the only seating system provided, and this system does not actually fit them.

For those of you readers who have not attended any of my sessions in the past, let me first come to terms with you regarding terms of seating. Seating for postural management and management of the child (by adults) is seating which by its very nature is looking to confine the body, restrict movement of the child, and hope the child can "rest" within it. This is stroller seating. It is also the seating styles of all children's car seats. This seating has a high back with padded sides, confines the child within it, and supports a reclined posture (more than 90 degrees at the hips), placing the shoulder girdle behind the pelvic girdle, or in other words, placing the pelvis in a posterior tilt. This stroller/car seat's seating angles and sizes are also arbitrary. We do not see a great variation in sizes of strollers available even within the commercial marketplace. It is expected that an adult will simply add cushions or blankets to assist in the fit of the stroller to the size of the child.

This is not true for car seats. At one time, they were also all the same size. However, now we have newborn sizes which do NOT grow very much, as they must truly fit this very small and vulnerable being. After a newborn carseat has been "grown out of" the next size is chosen. These car seats do have growth "built in" by providing adjustable strap placement, presuming that seat depth and back height are not actually important for a sleepy or resting child. In the USA we are now having a next size car seat, also available, for the larger school age child.

For this activity of safely managing children, or keeping them safe while being passively transported, we have developed better products to ensure safety and comfort but not "fit.". The emphasis on development has been based on "crash testing" and the product development has been focused on the materials chosen, not the attributes or true "fit" to the child. Ranges of average growth are chosen, but seat depths and back heights to not change. Strap adjustment is simple and managing sizes of the child is still relatively un-noticed. This does not make these seats inadequate, as the "true fit" for these systems is not needed to be exact, since the presumption is that the child will be resting when within the seat. (This is no different than the choice of adult seating within our automobiles. It is not very exact because it presumes we are capable of moving our bodies within the seat, and the adjustments are minimal. The seating also presumes we will get out of our cars often and frequently.)

Strollers and wheeled chairs used for children with disabilities, in order for parents to manage them, also have become more "safety" conscious (this is a good thing). However, a single system is expected to fit a child through many years and the child is expected to be seated within the system for most of her waking hours. In order to do create a seating system which "allows for growth" the system must be built to manage the largest child who might be seated within it.

Building systems to fit children who are at their largest can't possibly fit them at their smallest.

Not only is "growth" not really considered, meaning systems were not built with anthropometric studies in mind, but instead, simply are built to an arbitrary "end" stage of some specific size. This system then is provided with some flexibility, hoping to fit the child at her smallest. My biggest problem with this idea, is that the smallest child is still vulnerable to an inadequately fit system. Any system which "grows" and has all of its parts ON the system, does not function for the smallest child. Also, it must be noted that often children with disabilities are smaller in size, than their chronologically aged peers. This places them within the smallest part of the seating system, longer than at the "larger" end.

An example: to allow for growth, trunk supports are brought "in" the frame, usually on a I-back, but the armrests are not. If the armrest pads can be brought in closer, they interfere with the trunk supports.

Hip guides can be pulled in, but the seat width is still wide. The back height and seat depth are not considered issues for the smaller child, and must simply be tolerated at the highest point with added padding. This padding does not resemble the firmness of the back or seat, but is simply added to hold the child within the seat. .

The trunk lateral pads although adjustable are not actually smaller. They are smaller in width and height, but the same depth of foam is used as well as the same shape as large ones. If looked at from the front, their actual depth (depth of foam and metal frame, and/or plywood, and/or plastic) these trunk laterals still measure at least one half inch in foam. (This is the exact same depth of foam used for adults.) When a child's arm is observed and measured from the front, their own arm is not much wider than the pad. In short, we place between their trunk and arm a whole other "arm." This trunk lateral then forces the child's arms away from the body. The child cannot possibly use her upper extremities as she is unable to have them lying next to her trunk for support. This placement "away" from the body then causes the shoulders to fall into internal rotation, causing the trunk to collapse, and the pelvis to drop into a posterior tilt. This position does not allow for full lung expansion, nor does it allow for weight bearing.

These trunk pads, this wider seat, this higher back, all prevent the child from being able to be near anything except the seating. The child cannot reach out and explore her environment, she cannot be seated close to another child, and she cannot even attempt to truly hold herself upright. Since the child is so collapsed, then, and observed to be most of the time, we add a tilt, to "drop" the child back. This is not seating for function.

What changes are needed:

All children need seating which is adequate for an activity. If the activity is actually safe passive transport, then one type of seating is needed (the car seat and stroller). When a child needs to be fed, a feeding seat is needed. When a child is learning to feed herself, different seating is needed. When at school, seating which allows a child's feet to be on the floor, which allows the child to be near other children, to be under a table, or seated on the floor, must be available.

Children with disabilities needs multiple seating systems, just like all of us and all children. These systems really need to fit them at the size they are, not at some size they might become. Growth is less of an issue for the car seat, and for the stroller, however, it is a critical problem for "daily" seating for function.

We do not provide children with seating systems which allow them to explore or participate within their environments. We have created systems which prevent them from participation and are totally inaccessible to other children or children's activity.

"But what about funding? We can't possibly try and get more systems. . . ." we whine. Oh, but why are pediatric systems so expensive. They cost so much because they are built for larger children than those who would ever use them. Why are pediatric powered chairs able to tolerate weights up to 125 lbs? Where is the powered chair for the child who weighs under 40 lbs.? The pediatric systems available today are too large for most school age children, and certainly do not fit toddlers and pre-schoolers.

These systems are this large because we are making them like we make adult systems. In fact, the frame size, and the tubing and the hardware is identical to adult seating. The frame sizes, the seat to floor height all resemble those of adult seating.

Why? Children will not possibly use their systems for as long as adults. We need small, small, smaller systems. We need systems which will be available for various activities. We need to expect children to be moved from various seats.

If we truly built systems for children, we would, in fact, have various sizes of chairs, straps, and tables and supports.

It was not until the last two years, that a pelvic belt was available in a one inch size, with its pads and hardware equally small (thank you to Adaptive Equipment Systems). We need straps and pads, and hardware which allow for functional use. Trunk supports should allow the upper extremity to lie right next to the trunk.

(Not to mention they should be developed in a style which does not place the child's inner arm onto the swingaway hardware of the trunk lateral).

We need to start over. We must recognize that we are not supposed to build a single system to do all things. I have found as we continue to move in this direction, that we have successfully built expensive pediatric systems which do not perform any task adequately for any size child.

We need a full range of pediatric systems, ranges of sizes for infants, ranges of sizes for preschoolers/toddlers, ranges of sizes for early school age.

We need to develop data on children served, their height, weight, trunk length, seat depth, seat width, leg length, head size, and from their develop data bases, based on actual growth measured. We can then develop products for what we need.

We need to have systems much lighter weight, much smaller, much more maneuverable, and much more child friendly for accessibility to the environment.

Seating systems for children with disabilities should not look much different than seating systems for any child. However, they do need some additional supports which should be readily available, easily attached, and supportive for activity.

Notes:

Pressure Management

Jillian Swaine, B.Sc (OT), Occupational Therapy Consultant,
Sue Munro, B.Sc. (O.T.), Occupational Therapy Consultant
Karen Lagden, RN, ET - Enterostomal Nurse Consultant
Salimah Mitha, B.Sc., R.D - Registered dietitian/Nutritional Consultant
Jillian Swaine Occupational Therapy Services, Calgary, Alberta

Pressure wound healing algorithms/clinical pathways have typically only included assessment and treatment. They have not addressed how to maintain a wound that is "healed" or closed. Many of these algorithms have been derived from a medical model and typically include detailed protocols for when to use specific categories of wound care products and dressings. This presentation will describe a novel multi-disciplinary framework for pressure wound assessment and healing in the community: *The ATM Framework.* This framework has three distinct **phases**:

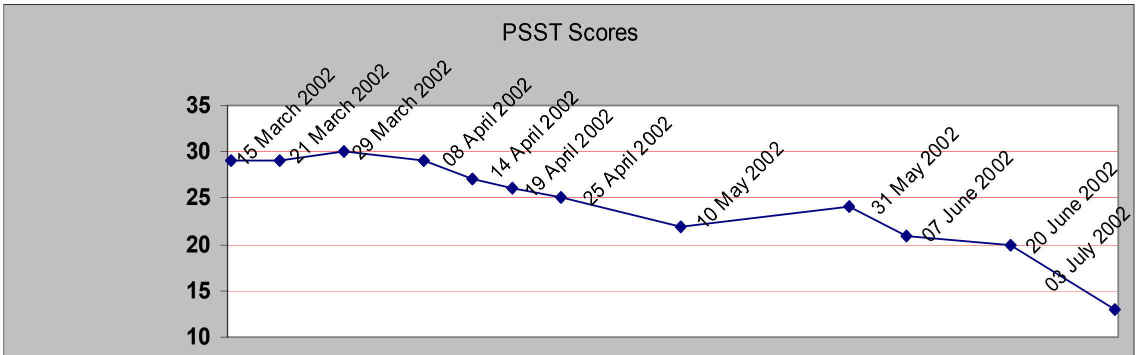
1. *Assessment of the pressure wound.* This includes a multidisciplinary approach to assessment of the wound and etiology of the pressure wound. A multi-disciplinary **assessment package** is used. It includes assessment of risk factors, pain, support surfaces and wound. It also includes the assessment of a client's daily routine, food intake, their use of equipment, and barrier tasks to wound healing and goal setting.

   The *ATM Phase I (A*ssessment) protocol will be demonstrated. The assessment is a comprehensive forms package that is designed to be modular. The modules are divided up into several categories: Background Information, Assessment of Risk, Nutrition & Feeding, Wound, Surfaces, Tasks, Tools & Strategies and Goal Setting. Within each module, they are published tools when applicable (e.g. *Beck Depression Inventory, Pressure Sore Status Tool).* In addition, there are assessment questions that have been designed by the team. When appropriate, a module can be pulled from the package and given to the client and their team to complete. The goal of the forms package is to provide an opportunity to review all the information within the team to establish goals with the client. Action plans are made for each goal. A review date is set for the goals and action plans.

2. *Treatment of the pressure wound.* This includes traditional wound care concomitant with off loading the wound site and nutrition intervention. The *Pressure Sore Status Tool (PSST)* is used as the common outcome measure for all interventions.

3. *Maintenance of the closed or "healed" wound.* This is the most challenging phase. Equipment and strategies for maintaining wound closure are critical to prevent the wound from reoccurring.

Table 1. The PSST scores are graphed over time. A total score of 13 indicates the wound has healed completely. Note on May 10, 2002, a new mattress was introduced and the PSST score went up which indicated that the wound was deteriorating.



	15 March	21 March	29 March	08 April	14 April	19 April	25 April	10 May	31 May	07 June	20 June	03 July
PSST Scores	29	29	30	29	27	26	25	22	24	21	20	13

Table 2. Description of roles on the multidisciplinary wound care team in the community. There is also a pain physician who consults to this team.

	Wound Healing (RN, ET)	Seating and Positioning (O.T., P.T.)	Nutrition
Phase I Assessment	• Baseline assessment of wound with standardized measures: PSST (5), photo, • nutrition screen, hydration screen, • depression screen. • Design wound management protocol (i.e. cleaning and dressing).	• Client history of all transfers, seating surfaces and schedule. • Occupational performance (ADL, IADL screen). • Swallowing screen. • Use interface pressure map on all key surfaces. • Determine goal for off loading or increase tissue perfusion with equipment.	• Client history of weight, alcohol intake and smoking. • Food and fluid intake using food records. • Estimation of energy, protein and fluid requirements • Food preferences • Biochemical analysis and medical history. • Ability to cook and shop • Financial status • Refer to nutrition screen done by RN/OT • Vitamins, minerals and herbal supplements consumed • Incontinence
Phase II Treatment	• Weekly assessment of wound with PSST and photo. Alter dressings as indicated. • Train and coach family.	• Determine and provide equipment for off loading. • Provide leisure time activities for client with restricted sitting schedule or bed bound. • Coach family.	• Weekly nutrition assessment. • Alter nutrition care plan as necessary • Monthly weights • Provide suggestions on how to implement nutrition recommendations. • Support client and family.
Phase III Maintenance	• Wound is close to being healed/closed. • Discuss how to monitor wound as the client moves to a graduated upright position protocol wound is healed • Maintenance program	• Determine long term equipment and strategy needs. • Educate client regarding the need to maintain a changed habit of off loading.	• Determine long term strategy.

Table 3. The table below is a part of the Nutrition module in the Assessment Forms Package. This is a combination food record and bowel and bladder incontinence record. The instructions are: ***Please write down all food and drinks that you eat every day for 3 days. Try to estimate the portion sizes as accurate as possible.***

Meal	Amount?	What Food?	Urinate?	Bowel Movement?	Bowel Accident *U=Bladder accident *B=Bowel accident
EXAMPLE					
Breakfast 8 am	1 ½ c	Sweetened cereal			
	2 c	Coffee			
	1c	2% milk		Small & hard	
9:30 am Snack					*B
Lunch					
Snack					
Supper					
Snack					

Table 4. The example below from the Assessment Forms Package is a table that requires the client to list their routine and the equipment and strategies that they are presently using. The instructions are: ***Tasks: Please fill in the position and seating/mobility device you are using for each task.***

Time	**Tasks** (list all functional activities, tasks, routines)			**Position, Seating, Mobility**
EXAMPLE				
9 am – 11: 30 am	Wake up routine…	Bedroom,	spouse	Standard mattress, Invacare commode chair, sliding board transfer with pulling on clothes.
11:30 – 12:00	Breakfast	Kitchen	caregiver	Power wheelchair (Jazzy 1120) with Jay 2 backrest, Stimulite 18 x 18 contoured cushion, standard footrests.

REFERENCES

1. Barnett R, Shelton F (1997). Measurement of support surface efficacy. Pressure. Advances in Wound Care, 10, 21-29.

2. Flanigan, K.H. (1997). Nutritional aspects of wound healing. Advances in Wound Care, 10, 48-52.

3. Shelton F, Barnett R, Meyer E. (1998). Full body interface pressure testing as a method for performance evaluation of clinical support surfaces. Applied Ergonomics, 29, 491-497.

4. U.S. Department of Health and Human Services, Agency for Health Care Policy and Research. Public Health Service, May 1992. Pressure ulcers in adults: Prediction and prevention. Clinical Practice Guideline, Number 3. Rockville, MD: AHCPR. Publication No. 92-0047

5. U.S. Department of Health and Human Services, Agency for Health Care Policy and Research. Public Health Service, December 1994. Pressure ulcer treatment: Prediction and prevention. Clinical Practice Guideline, Number 15. Rockville, MD: AHCPR. Publication No. 95-0653

6. Von Zweck C. (1999). The promotion of evidence-based occupational therapy practice in Canada. Canadian Journal of Occupational Therapy, 66, 208-213.

7. Bates-Jensen BM, Vredevoe, DL, Brecht, ML. (1992). Validity and reliability of the Pressure Sore Status Tool. Decubitus Nov;5(6):20-8

Notes:

Brain Interfacing

Gary Birch, Dr.,BA. Sc.
Executive Director, Neil Squire Foundation and Adjunct Professor,
Department of Electrical and Computer Engineering, UBC

Seating & Positioning: An Interactive CD Rom e-Learning Tool

Iona Novak, B. AppSc., OTR, Acc OT Occupational Therapist,
Research Fellow, The Spastic Centre, Brookvale, New South Wales

Instructional Sessions – Group A

A.1 In Search of Seating Alternatives that Elevate Both functional and Skin Outcomes for the Aging Wheelchair User

Tom Hetzel, PT, ATP, Joan Padgitt, PT, ATP,
Ride Designs, Sheridan, Colorado

Through the advancement of medical technology, people who use wheelchairs are living longer with their disability. Wheeled seating and mobility providers are now starting to see the first generation of clients who have used a wheelchair for 15-20+ years and are faced with supporting the largest-ever generation of people aging with severe disabilities. This is the challenge.

As people age with disabilities that impair mobility, their needs for wheelchair seating and mobility solutions become more complex. In the case of acquired or traumatic injuries, early intervention has emphasized support of good skin integrity. Traditional seating interventions utilize a variety of designs and materials with the emphasis on distributing pressure evenly over the surface of the cushion support and, to some extent, controlling shear forces. To do this, a material must conform to body shape and bony prominences, and respond dynamically to movement and shear. Unfortunately, the more effective a material is at distributing pressure and controlling shear, the less effective it is at supporting postural stability. Imagine trying to walk on an air or water bed and you will understand the impact these materials have on postural control.

People aging with spinal cord injury who have had success with traditional seating technologies are developing severe over-use syndromes of the upper extremities, chronic pain and deterioration of postural alignment and control. Their skin's tolerance of pressure, no matter how well distributed, diminishes with age. In addition, deteriorating functional independence and postural issues become superimposed over severe and chronic skin problems, and people often lose their ability to sit. It is not uncommon to meet formerly active and independent paraplegics, fifteen years post-injury, relying on power or power-assisted mobility, tilt and recline systems, overhead lift systems for transfers and modified minivans for transport.

The mobility side of the industry is doing a relatively good job at introducing new and/or enhanced manual, power, and power-assisted wheelchairs with or without power seating options. The seating industry, however, has developed few significant improvements for addressing the constellation of seating challenges faced by people aging with disability. Good pressure distribution through use of foams, gels, fluids and air most often comes at the price of postural stability. The consumer and seating practitioner are forced to choose between skin OR posture. But if the provided system results in skin breakdown, it can't be used. Skin always wins.

More aggressive custom contoured systems may provide a better platform for postural control but are not appropriate for high-risk skin clients due to the systems' inability to respond to postural dynamics and positioning error. Imagine a cushion made by having the consumer sit in wet concrete. In its liquid state, the concrete will flow to conform to body shape. Once it solidifies it will match the exact shape of the consumer's bottom at that point in time. Now imagine moving even subtly within the contours of that custom seat. What happens? The relationship of bony prominences to the contours of the seat changes, and the result is increased loading of at-risk areas and unloading of areas that should be supported. Movement within the shape increases shear and thus the risk of skin break-down.

This is how conventional contoured seating performs. It has little to no ability to accommodate change in a person's activities, weight, tissue atrophy, posture and functional skills.

Conventional contoured seating systems are also hot and non-breathing. Heat and moisture are gaining on pressure and shear as primary risk factors for skin breakdown, yet few wheelchair seating systems effectively reduce heat and moisture build-up at the seating interface.

In a perfect world nobody would need a wheelchair. But in this imperfect world, wouldn't it be better if people could have wheelchair seating that is built uniquely for them? That achieves optimal skin integrity and postural control without compromise? That is breathable to keep them dry, and also help them stay warm in the winter and cool in the summer? That doesn't weigh much at all? Why not construct it in a way that ensures an accurate fit to the wheelchair to further enhance the user's balance, control and mobility? Why not make it capable of changing as a consumer's needs change?

All these goals can be achieved by presently available techniques and materials. Transfer of material technologies from other industries, coupled with orthotic and prosthetic principles, has created seating options that can be uniquely applied to each consumer. These products can promote good skin Integrity without compromise of postural control. The cushion material can be breathable, thereby reducing heat and moisture build-up. Information about peoples' shapes can be captured in their wheelchairs, not in simulators detached from mobility, ensuring optimal functional performance. Though currently available on a very limited basis, this material-savvy, orthotically informed approach will define the future of seating and mobility.

Notes:

A.2 Eight Days a Week

Kathryn Fisher B.Sc.O.T., ATS, OT Reg. (Ont.)
Therapy Supplies and Rental Ltd.
Brenlee Mogul-Rotman B.Sc.O.T., OTR, ATP, OT Reg. (Ont.)
Toward Independence, Ontario

In our everyday lives we endeavor to do more than just "get around". For our clients, no matter what the activity is, the goals remain the same:

Protect skin integrity
Maintain optimal posture
Enhanced safety and function
Manage discomfort
Improve quality of life
Maximize independence

Creativity is the key as we develop systems for our clients. We must always keep an eye to the future in assisting our clients in choosing appropriate equipment. Equipment should meet the client's present needs but should be flexible enough to allow changes or additions to meet future changing needs.

A critical difficulty faced by clients with mobility limitations, both adult and pediatric, is surface-to-surface transfers. These include transfers from bed to wheelchair, wheelchair to toilet, wheelchair to bath, bed to stretcher, poolside to pool. As a client's mobility decreases these transfers become more difficult to perform independently and pose a great safety risk for both client and caregivers.

Another issue is skin integrity. What has caused a client's ulcer?? This is an important question in the healing protocol. Surfaces including cushions, back supports and mattresses are usually assessed first, however, it is critical that activities and other surfaces be considered as cause of the ulcer. These may include the bathtub, shower bench, commode chair, mechanical lift sling, floor, seat of car/van, sofa/easy chair, and any other surface that the client may sit or lie on during their day. Beyond the surface itself is activity. Consider transfer method (transfer board, sling, self transfer but landing on the wheelchair brake), clothing (rivets on rear pockets, zippers, folds in clothes), safety (transporting hot items on lap, falling out of wheelchair), "bumming" up stairs or "dragging" self along flooring. Very often, our clients are sitting on high end cushions and have been assessed for optimal posture and seating, however, the other activities and areas that are used during the day are not considered. As a therapist, client centered practice is essential for optimal independence and achievement of goals. We must include the client in determination of needs, setting of goals and identification of problem areas. Education of ourselves and our clients will only help to assist in healing and prevention of further skin breakdown.

Leisure and vocational activities are essential for balance in our daily lives. Vocational pursuits allow the individual establish themselves as being "productive". Defining a role for the individual is critical in establishing one's self worth. "Games" are not only an activity to fill our leisure time but also provide us with an opportunity to develop both motor and psychosocial skills. It is important to consider a client's potential leisure and vocational activities when developing prescriptions for seating and mobility equipment. Equipment should not limit a client from becoming involved in any activity even if this is not the primary goal at the time of prescription.

As daily life becomes more hectic, our clients must be provided with the tools to keep up the pace…eight days and week.

Figure 1: Analysis of issues

	Skin integrity	**Posture**	**Safety/function**	**Comfort**	**Quality of Life/Indep.**
Sleep	Regular turns, shear, drainage	Breathing, deformities, growth, spasticity, symmetry	Staying on surface, side rails, transfers/repositioning, care giving	Quality of sleep, endurance during day	Privacy, transfers, self care
ADL Transfers Bathing Dressing Self Care	Shear, pressure, moisture, skin vs. other issues	Stability, deformities, spasticity,	Slippery surfaces, ability to cleanse self (bowel care), accommodation of transfer device, attendant care needs	Commode opening!, slings, tubs	Type of bathing, access issues, attendant care needs
Standing	Change in position, sit to stand, shear/friction	Support needed, breathing, orthostatic hypotension	Need for monitoring, orthostatic hypotension, activity during standing, transfer to device	Weight shift,	Increased endurance to daily activities, pain management
Sports/Leisure	Change in cushion, moisture, temperature, shear/friction, shock absorption,	Dynamic stability for power & movement, position of action, maneuverability	Strapping, protection of body/skin, rules/regulations/standards	Pain reduction, injury prevention	Social, activity/fitness, integration
Vocational Activities	Concentration(non- weight shift), work related activities	Work site set up, access, ability to change position	Access, assistance, transfer, bathroom	Time spent in equipment, time to weight shift	Financial independence, assistance required, social, life roles

A.3 EARLY EQUIPMENT INTERVENTIONS FOR THE PAEDIATRIC CLIENT

Sheena Schoger Dip.OT, OTReg.(Ont.)
Children's Rehabilitation Centre of Essex, Windsor, Ontario

Babies, newly diagnosed with a medical condition or disability, often have parents who are overwhelmed; unable to comprehend a future that involves medical interventions such as surgeries, therapy appointments, wheelchairs, walkers, etc.. Complex early intervention rehabilitation equipment can be totally rejected by parents, although well made, very adjustable, and esthetically pleasing (to those of us in the rehabilitation field). If parents think this equipment is their only option, they may comply with the "experts" and agree to the purchase of the equipment but not use it, or they may refuse, possibly because of financial reasons and as a result, not have the equipment they and their child may desperately need.

Modifications can be made to commercial baby and toddler equipment, to enhance the child's alignment, positioning, and function and to make their care easier. This can be as simple as demonstrating to a parent how to roll towels and/or receiving blankets and place them strategically in strollers, car seats etc., to custom fabricated equipment from such materials as foam and ethafoam. With a little foresight and ingenuity, these materials can be used in the NICU, ICU, the home, or paediatric ward and are often more easily accepted by the parent.

The NICU

The primary consideration is:
Keeping the baby alive
Obtaining the best outcome possible, regardless of diagnosis

Prematurity:
Less than 37 weeks gestation
Have not developed fetal flexion

Low birth weight:
Below 2.5 kg or 5.5 lbs

Traumatic birth:
Asphyxiation
Meconium aspiration
Shoulder Dystocia
Etc.

Congenital/chromosomal condition or anomaly:
Spinal muscular atrophy
Osteogenesis imperfecta
Dandy Walker syndrome
Down syndrome
Heart conditions
Etc.

Babies in the NICU often have many and varied complications which affect their outcome. Examples of these are:

Anemia
Apnea
Bradycardia
Bronchopulmonary Dysplasia (BPD)
Chronic Lung Disease (CLD)
Feeding Intolerance

Growth Restriction
Hyaline Membrane Disease (HMD)
Intrauterine Growth Restriction (IURG)

Intraventricular Hemorrhage (IV)
Narcotizing Enterocolitis (NEC)
Patent Ductus Arteriosus (PDA)
Pneumothorax
Respiratory Distress Syndrome (RDS)
Retinopathy Of Prematurity (ROP)
Seizure disorder
Sepsis/Infection
Weight Gain/Loss

These complications will often preclude positioning interventions. Any of the above conditions, plus many others, will determine the intervention allowed for positioning, as well as the previously listed reasons for the baby being in the NICU initially. It is vitally important to obtain the neonatologist's permission, prior to attempting to change the baby's posture and positioning. Positioning, as previously stated, can be in the form of rolled receiving blankets, arranged to achieve the required results. How one rolls and applies these however, will determine how effective the intervention is and also whether or not the nursing staff and parents will actually use the intervention. If it is seen as being easy and beneficial to the infant, it is much more likely that it will be carried out, not only in the NICU, but also by the parents, once the infant is discharged and goes home. Other types of intervention for positioning in the NICU include the use of:

Foam wedges and bolsters
Soft stuffed toys
Baby "bowls"
Infant car seats
Commercial strollers

When the infant is ready for discharge, the most pressing need is for modification of an infant car seat, to allow for safe transport home. Depending on the size of the infant, tone (high or low/floppy), reflexive postures, respiratory status, etc., this can be difficult to achieve. Methods of modification will be discussed during the presentation as well as interventions that should not be done, as they can compromise the integrity of the car seat.

Once the infant arrives home, a whole new set of circumstances has to be adjusted for and parents often have limited ability to cope after weeks and months of wondering if they will ever take their child home. If the infant is irritable on arriving home, the parent, usually the mother, becomes the primary caregiver. She finds it difficult to trust the care of the infant to another, even to the father, and soon becomes the only person able to feed, soothe, bathe, and change the infant. She finds that she cannot go shopping with or without the baby, as he becomes distressed in the vehicle and he cannot be left with another caregiver, as he cannot be separated from his mother. Soon the mother feels trapped at home, with a demanding baby, and with little energy for day-to-day activities.

On discharge from the NICU, therapy is often provided in the home but is limited by the reluctance of the child to tolerate handling by the therapist. When the baby is ready to attend a therapy facility, he is often found to be extremely irritable and cannot be transported without extreme agitation. If a baby cries going to and from therapy appointments, the value of the therapy will be lost and the parent will be more likely to avoid outings that could provide much needed social contact and support from other parents and professionals. Our work then is to provide techniques to allow the baby to separate from the parent and to tolerate the car seat and vehicle. This requires diligence but will be eventually be successful, although for some babies this takes months to achieve.

This can be achieved by the use of a baby “bowl”, car seat, wagon, stroller and vehicle as well as a co-operative husband or friend. When the baby can be placed in the baby “bowl” and carried without getting upset and without the mother holding him, the baby “bowl” is placed in a wagon or stroller and is moved slowly within the home. Often it is movement the baby cannot tolerate, possibly because of the influence of the tonic labyrinthine reflex. Once this is successful, the baby should have a car seat adapted to fit him snuggly and when he is able to tolerate sitting in the car seat in the home, it is then placed in the wagon or stroller and moved within the home. The next step is to place the baby in the car seat, to carry him while still in the car seat, and place him and the seat in the car. If it is cold weather, blankets should be used to bundle him, rather than extra clothing, which would change the experience. Initially, the vehicle should be started but not moved and gradually short trips added, first only a few feet, then around the block and gradually for longer and longer distances. During this time, the mother should sit with the infant, reassuring him as needed until gradually she can move away and eventually drive the vehicle herself. This technique has been successful for several very “difficult” babies.

I have mentioned the baby “bowl” several times. This is a piece of equipment I designed and have made for many years from 4” foam slabs, individually fabricated for every child. It can be used in the NICU, ICU, pediatric ward, or home. Primarily, it positions the child in symmetry, with trunk and hip flexion, the arms/shoulders in slight flexion, and the head in midline. Care is taken to maintain the head in the desired position. The head posture is very important, as too much capital extension does not inhibit extension and too much capital flexion can impede respiration and swallowing. The ‘bowl” allows the parent to hold the baby without actually holding him in her arms and it can serve to assist in removing an irritable baby from the constant shelter of the mother’s arms. The end result is usually tolerance, inhibition of abnormal posturing and reflex activity, and good maintenance of midline orientation. Most babies settle down when placed in the “bowl” and often fall asleep, a good indication of your success. Feeding often improves due to the improved head and body posture. An irritable baby is often comforted if an article of clothing, used by the mother, is placed in the crib, car seat, etc.. The scent of the parent comforts the child when the parent is not actually present and consistent use of one perfume by the mother makes this easier to maintain.

For high chair modification, I have found that Ethafoam, a closed cell foam that is heat bondable, can be relatively easily configured to meet the custom requirements of our clients and is easily modified as the infant grows. I usually provide positioning in long leg sitting, as this is the easiest method of safely adjusting a high chair for a small child, while also providing passive stretching and inhibition of flexor and adductor tone in the lower extremities. The insert can be as simple or as complex as required, and if more complex support is required initially, this can be cut down or removed as the infant grows and matures.

A wedge seat, also constructed from Ethafoam, is often provided as a therapy intervention, providing elongation of the muscles of the lower extremities while also providing a play table and seat. The wedge seat utilizes a seat that is wedged anteriorly, so that the child sits with an open or greater then 90° hip angle. This is provided to allow the pelvis to assume an upright orientation, despite tight hamstrings. Initially we were concerned that the hamstrings, no longer on stretch, would actually shorten and tighten, however the exact opposite was found to occur. When the pelvis is upright, the hamstrings and other muscles do not have to work as hard to maintain the upright posture, and we find that with regular use, the hamstrings actually relax and gain length, despite the open hip angle.

There are many commercial products available, which provide excellent positioning for the neonate as well as older children. These products, some of which are sold under the name of Snuglbuds, are convenient and reasonably priced. Custom made products or customized commercial products generally provide the best interventions, however not all babies require this degree of intervention. Non-slip products or such items as the inflatable highchair inserts from Ikea, can be used for babies who need some support but who do not have high positioning needs. Sometimes parents only have to be shown why and how to use every day products, to provide the intervention their child requires.

As the baby gets older, wheeled mobility becomes an issue. If funding is available, I have found that parents have been very positive when offered the Quickie Kid Kart Xpress, made by Sunrise Medical. Families report that parents of “normal” children will ask where such a stroller can be purchased, as they would like one for their child. It is very important that, in the early years, the parents are able to feel positively about their child and this type of interaction is very important. Even with this type of stroller, I have found that it is possible, and often necessary, to customize it, without compromising the crash test rating, while providing the child with the support required. This system can also be integrated with the Zippie P500 to provide power mobility. For older children, whose needs are related more to size rather than maximal positioning, the Kimba TRS is readily accepted. There are many other systems that can be prescribed and each system has its pros and cons. No system is perfect for all children.

I do not believe that an older child should use a stroller, as he may be regarded and treated by peers and adults as a baby, very dependent and cognitively and developmentally immature. Children should be assisted to function at an age appropriate level whenever possible. This includes sitting in highchairs, strollers, and wheelchairs. The “normal” child learns to walk between the ages of 8 to 15 months; this then is the ideal time to provide mobility equipment.

When therapy is provided in the home, it is more difficult for a therapist to provide some of the higher levels of equipment interventions, as these are more easily constructed within the rehabilitation facility, where specialized equipment and facilities are available. However, the therapist should not be deterred from fabrication within the home. The end result may not look quite as professionally made, but if successful in its function, the equipment will be used by the family.

This presentation will address the early equipment and positioning needs of our clients and families and hopefully most participants will feel ready to go into the NICU or out into the community with confidence, knowing we can make a difference.

A.4 DELIVERING SEATING AND MOBILITY TO THE REST OF THE WORLD

Kathy Riley, PT, ATS, CRTS, Branch Manager,
National Seating and Mobility, Mooresville, North Carolina - "Kenya Kids 2002"
Wayne Hanson, Director, Advanced Product Development for Pediatrics, Sunrise Medical,
Bozeman, Montana - ROC Wheels - "Reach Out and Care Jamaica 2004"
Mark Richard, Hope Haven International Ministries - "Networking from the Ground Up"
Cathy Mulholland, OTR - "Providing Long-Term Seating and Mobility Support"

With a focus on Seating and Positioning, One Child at a Time

It is estimated that 20,000,000 people need a wheelchair in developing countries. Approximately 6,700,000 of these people are children.

We will address the many challenges that confront the wheelchair distribution team when they deliver seating and mobility to these people. The harsh environment, lack of communication, refurbished equipment and sometimes physical dangers can stand in the way of delivering proper equipment that is fit individually to each wheelchair recipient.

Important Elements of a Wheelchair Distribution:

Get complete information on each individual to be fitted.
Bring a highly qualified and prepared team.
Bring the proper wheelchairs and special equipment.
Partner with people and organizations on location.
Sometimes the disabled need more than a wheelchair. (Bring other mobility options)
Return to the same location.
Train the local therapists and caregivers about your product.

We must help them help themselves. Programs that can be provided in-country:

Repair shops, seating clinics, clinical support programs, and wheelchair manufacturing.

The team will give a report on the recent 'Reach Out and Care Jamaica' event where they:

Delivered 350 wheelchairs, primarily for children with moderate to severe disabilities.
Hosted a hands-on seating and mobility workshop for therapists and caregivers from Jamaica.
Held the 2004 Association of Mobility Providers Symposium.
Delivered specialized pediatric wheelchairs, designed for children in developing countries.

How do we:

Serve the masses without diluting the masses?
Help the passive user become an active user?
Manufacture an inexpensive wheelchair for them without making it a cheap chair?
Provide world-class product and services in a third world environment?

A5. Successful Equipment Prescription for Specialty Populations of Bariatric and Geriatric Patients

Amy Bjornson, PT, ATP
Sunrise Medical, Longmont, Colorado

Geriatric Population

The aging process results in:
Gastrointestinal changes
Urinary changes
Immunological changes
Vision and perception changes
Cognitive changes
Communication problems
Decrease in mobility

Challenges Specific To The Geriatric Population:

Time spent in gravity
Discomfort / pain
Asymmetrical postures / Fixed deformities
General health
 Multiple secondary diagnoses
 Multiple medications / Medical care givers
Home environment
Accessibility
Functionality
Older care-givers / off-site caregivers
Institutional challenges
 Limited resources
 Equipment use & maintenance
Funding
 Medicare
 Coverage criteria
 Location dependent
 Private Insurance / Other

The Geriatric Evaluation: Goals

Client: comfort, decrease pain, easy to use
Clinician: good positioning, easy to use, promotes independence, safe
Family: minimal cost, easy to use
Facility: low cost, safe, durable, increase mobility
Supplier: fits funding requirements, easy to adjust, durable

Seating Equipment Selection – General Principles
Choosing seating system depends on the needs of the client in three areas:
Postural support
Pressure reduction and distribution
Shear reduction
Client needs will vary from low to high in each area dependent on evaluation findings.

Mobility Equipment Selection – General Principles

Successful LE Propulsion Set Up	
Proper seating set up:	Proper wheelchair set up:
Flat or anterior sloped seat	- Appropriate STFH
Firm sacral support	- Appropriate seat depth
Firm anterior control at ASIS	- Maximal chair roll-ability
Proper back height and angle	- Flat of slight anterior seat slope
Proper seat depth	

Successful UE Propulsion Set Up

Proper seating set up:	Proper wheelchair set up:
Posterior seat slope	- Appropriate size
Firm posterior pelvic support	- Optimal rear wheel position
Appropriate back height and support	- Optimal wheelchair roll-ability
Seat depth for full femur loading	
Accommodate hamstring length	
Feet supported	

Successful Dependent Mobility Set Up

Proper seating set up:	Proper wheelchair set up:
Pressure relief	- STFH for transfers
Firm posterior pelvic support	- Care-giver friendly options
Appropriate backrest and head support	- Optimal weight distribution
Seat depth for full femur loading	- User COG over pivot point
Accommodate hamstring length	- Optimal tilt range
Feet supported	
Removable Hoyer sling - if needed	

Common Geriatric Diagnoses

"Residents of Facility"

"Characteristics"

One size fits none

Misplaced/ misused parts

Differing goals of caregivers, poor communication / education

Funding

"Clinical manifestations"

Pain

Poor mobility

Medical complications

"Residents" Priorities

Mobility	Seating
Low maintenance, durable	- Comfort, pressure reduction
Few removable components	- Facility friendly
Facility friendly	- Provide positioning and stability
Enhance mobility	

Amputations
Characteristics:
Traumatic
Disease related
 Diabetes
 Vascular disorders

Clinical Manifestations
Limb pain / phantom pain
Infection / poor healing
Weakness
Contractures
    Hip flexion
    Knee flexion
Asymmetric postures
Fatigue, continued vascular compromise and/or poor personal care = revision of amputation (higher) or additional amputation

Amputee Priorities

Mobility	Seating
Accommodate for change in COG	- Accommodate hip and knee ROM
Offset / Amputee axle plate	- Support residual limb
Maximize functional propulsion	- Provide upright positioning
Light weight manual wheelchair	
Appropriate STFH: transfers, LE propulsion	
Simplify equipment	
Power vs manual?	

Cerebral Vascular Accident (CVA)
Characteristics:
 Vascular compromise – cerebral insult affects opposite side of body
Clinical Manifestations
Effects of tone and/or spasticity
Postural deformities due to asymmetric muscle pull
Client assumes postural accommodations to improve function
Cognitive dysfunction?
Swallowing/speech dysfunction?
Skin breakdown?

CVA Priorities

Mobility	Seating
Maximize functional propulsion	- Support hemiparalysis
Appropriate STFH	- Position for tone optimization
Simplify equipment	- Accommodate ROM deficiencies

Arthritis

Characteristics

Rheumatoid arthritis
- Bilateral joint involvement
- Inflammation of the joint (synovial) fluid
- Joint and tendon swelling
- Joint instability
- Multiple joint involvement

Osteoarthritis
- Large weight bearing joints
- Joint degeneration
- Unilateral involvement

Clinical Manifestations

Pain
Stiffness
Joint deformities
Contractures
Fatigue
Decreased mobility

Arthritis Priorities

Mobility
Maximize efficiency
Appropriate COG and components
Light weight chair
Appropriate STFH
Provide client stability
Power vs manual?

Seating
- Comfort
- Low weight
- Postural deformities
- Accommodate joint positions

Parkinson's Disease
Characteristics
Basal ganglia disease - deficiency of dopamine
Rigidity
Bradykinesia
Tremors

Clinical Manifestations

Muscle atrophy/weakness
Contractures, deformity
Kyphosis common
Hamstring tightness
Respiratory compromise
Postural
Decreased muscle assist
Swallowing issues
Cognitive deficits / Sundowning

Parkinson's Priorities

Mobility
Accommodate for progression of disease
Facilitate independence
User friendly

Seating
- Protect skin
- Accommodate kyphosis
- Ind. weight shifts

Alzheimer's Disease

Characteristics
Brain degeneration due to plaque formation
Short term memory loss
Poor processing of information
Inability to learn

Clinical Manifestations
Physical changes are a result of cognitive changes
Kyphotic postures
Rigidity
Agitation
Poor nutrition

Alzheimer's Priorities

Mobility	Seating
Accommodate for decreased ROM	- Protect skin
Accommodate for loss of endurance	- Accommodate kyphosis
Accommodate preferred postures	- Provide comfort and security
Provide comfort and security	
Appropriate STFH	
Simplify equipment	

Bariatric Challenges

Obesity results in:	Skin issues
Gastrointestinal changes	Behavioral / emotional issues
Urinary changes	Decrease in mobility
Endocrine issues	

Challenges Specific To The Bariatric Population
Difficult to find bony landmarks
Difficult to get control of pelvis due to excess of "redundant" tissue
Skin issues: maceration, skin folds, pressure, poor circulation
Environment accessibility
Mobility

The Bariatric Evaluation: Goals
Client: comfort, easy to use, functional
Clinician: Good positioning, promote mobility
Dealer: safe, durable, increase mobility

Seating Equipment Selection – General Principles
Choosing seating system depends on the needs of the client in three areas:
Postural support: difficult to provide support – too much tissue
Maceration and tissue fold relief
Shear reduction

Mobility equipment selection – General Principles

Proper seating set up:	Proper wheelchair set up:
Flat or anterior sloped seat	- Appropriate weight capacity
Firm sacral support	- Appropriate size
Accommodate rear adipose tissue	- Maximal chair roll-ability
Accommodate front adipose tissue	- Flat or slight anterior seat slope
Proper seat depth	- Appropriate STFH

A6. Sports Galore

Nicole Wilkins, B.Sc., OT, Sunny Hill Health Centre for Children
Richard Peter, Program Coordinator, BC Wheelchair Sports Association,
Sonja Magnuson, M.Sc., OT, Sunny Hill Health Centre for Children, Vancouver, BC

BC Wheelchair Sports is a not-for-profit organization devoted to providing opportunities for athletes with physical disabilities. During this presentation a video will set the scene of Wheelchair ***Sports*** in BC, showing recreational, high level athletes and ***Paralympians*** playing their sport. The video is an effective way to show how the competitive nature of the game (s), strength, speed and agility of the athlete shapes the "engineering" of the wheelchair. After the video, Richard Peter will explain the different sport specific wheelchairs. Richard will compare and contrast everyday wheelchair set up with sports wheelchair. Please use the space below to write your notes on each of these chairs. Richard Peter currently works with BC Wheelchair Sports and also an athlete on the Men's National Basketball team. He promotes wheelchair sports at all levels.

Athletic wheelchair: seating, camber, wheel position, casters, rear tires ____________________

____

Athlete position for performance ____

____

Basket ball wheelchair: seating, camber, wheel position, casters, rear tires __________________

____

Athlete position for performance ____

____

Tennis wheelchair: seating, camber, wheel position, casters, rear tires _____________________

____

Athlete position for performance ____

____

Power soccer: equipment ____

____

Athlete position for performance ____

Instructional Sessions – Group B

B1. Seating & Positioning for Medical Issues in Individuals with Developmental Disabilities

Karen Hardwick, Ph.D., OTR, FAOTA, Director , Rehabilitation Therapies, Austin State School, Texas Department MHMR, Nutritional Management, TDMHMR, Austin, Texas

B2. Outside the Box, NOT Out of the Box

Kathleen Riley, PT, ATS, CRTS®
National Seating and Mobility, Inc.
Mooresville, North Carolina

Patient Name: Ari
DOB: 07/07/1982 (20 y.o.)

Social History:
Lives with mother and sister in 1 level home. House fully accessible. Family has a mini van with kneeling system, ramp and permalock with occupant restraint system.

School/Vocation/Avocation:
Full time college student. Uses computer with eye gaze.

Clinical Intake:
Werdnig-Hoffman Disease, hyperhydrosis (profuse sweating of the digits), S/P spinal instrumentation and fusion, has sensation and no skin problems, has tracheostomy and requires occasional suctioning. Uses voice amplifier to be heard.

Present Equipment:
Invacare Arrow Power chair with Tarsys power seat purchased in January 1997. Tilt, recline and variable shear are controlled with Max Box . Has a custom seat cushion, curved back, swing away laterals with curved pads and Otto Bock headrest with RHO Adaptor pad for cushioning.

Function per intake:
Totally dependent for all ADL's. Tube fed. Nursing care 20 hrs/day Receives PT 3X/wk and OT 2X/wk.

Functional needs/goals:
Not a functional driver in present system. Requires multiple attempts to get hand and fingers in the correct position. Issue with sweating requires hand to be dried and the positioning repeated. Unable to drive up inclines due to pull of gravity. Unable to return from recline or tilt because of gravity and movement of his hand.

Client/Caregiver Concerns:
Has six to eight different caregivers at any one time. It is difficult to get his hand positioned for function. Since he is a full time college student when he can't drive himself they must operate the chair, which is set at a high speed and high sensitivity and very difficult for anyone else to control, or push him. Would like it if he could drive and always be in a position to operate power seat functions without repeated repositioning.

Posture:
Alignment maintained with lateral supports. There is an ischial relief in his seat for comfort. His positioning is critical and he knows exactly where he wants to be! He does not want anything changed. Therefore he does not want a new chair.

Pressure issues:
Has sensation. Has seat position changed frequently through tilt/recline and VSR functions. No skin issues. Stays up in chair for 10 hours or more per day.

Functional Skills:
Totally dependent for all activities. Has some movement in right hand and forearm, and left thumb. Requires exact positioning to use the movement. Can no longer use any type of touch switch. Previously operated a single switch for environmental control and page turner.

Simulation:
Tried mini proportional joystick mounted below and through the AEL armrest trough. This was tried because Ari wanted to maintain the proportional function. There is minimal pressure or movement required to operate. The movement required is in four quadrants. Ari could only flex and extend the index finger, he could not abduct and adduct it. Therefore he could not functionally use the joystick.

We determined that fiber optics was the only interface available. To allow Ari to have choice of speeds and seat functions we needed to find four switch sites. This required that we split the fiberoptics. Three to be controlled with the right hand (index finger and thumb), and the other with the left thumb. Several fittings were required to build the infrastructure on which the fiber optics were mounted. They had to be fabricated with some adjustability because millimeters made the difference between success and failure. His hand would be in a pronated position using flexion and extension of the index finger for two switches and adduction of the thumb for the third. We had to support the outer three digits between the MP and PIP joints and the index behind the MP joint while keeping the space below available to access the fiber optic with his thumb.

Also at issue was the fact that Ari wanted to keep on using the joystick on the chair even though it was not functional for driving. He felt that it was his only means of independent exercise. Therefore the fiber optic system ,which was mounted in the AEL arm trough, had to be above that device and easily removable.

AEL's mounting hardware was clamped to the armrest tube in front of the armrest pad. We creatively interfaced two brackets to make a device that was at the right height, allowed for rotation of the arm trough for comfortable positioning of his arm and allowed for securing the device in place for driving but with ease of removal.

Trial with fiber optic system showed that the chair drifted rather than tracking straight. We were unable to balance the motors using the programmer. Now that he was using single switch input Ari was unable to adjust for this imbalance as he could with the joystick.

Recommendations:
Install new motors, upgrade the control module to support the new electronics and install ASL fiber optic four switch specialty controls.

<u>Problems:</u>
The fiber optics that cross in the trough are very vulnerable to damage. We cannot figure out a way to protect them since the position of his fingers is so critical and the fiber optics cannot be bent at an acute angle. They have broken one fiber optic and it was very difficult to remove the damaged one and rethread the new one through the protective tubing. Some additional protective flex tube was added but the fibers above the trough are still exposed.

<u>Outcome:</u>
Ari is using the fiber optics at home and in the community. Unless he fully tilts or reclines his hand does not need to be repositioned. Three drive programs were set up. Program 1 is for the proportional joystick. Program 2 is no drive. Program 3 is set up with moderate speed and high torque to work in his mother's living quarters which has deep carpet and thick carpet pad. This created a lot of drag on the casters and made turning difficult. He also uses this program when he drives into his van since he has to overcome the ramp threshhold and drive up the ramp at a slow speed. Program 4 is set with three forward speeds which he chooses using the reset/select switch with his left thumb. It is programmed at 75% of full and the choices are 25%, 50% and 75% which he steps through. He can access the seat functions in all programs.

Ari, his mother and the caregivers are pleased with the independence and control that this system has given him.

Patient Name: Rama
DOB: 2-12-50 (50 y.o.)
MR#: 05-23-16
Date of Eval: 12-7-00

<u>Social History</u> (present living situation/caregiver, transportation, home access):
Lives with 80 y.o. mother in 1 level home with ramp. Current w/c fits through doorways. Family has a 4-door car. IL helping with purchase of van with a lift, tiedowns and occupant restraint. Hard to get over grass outside.

<u>School/Vocation/Avocation:</u>
Works on computer – uses EZ keys and foot switches. Previously an RN.

<u>Clinical Intake</u> (Diagnosis, surgical procedures, skin, respiratory, tobacco use, continence, pain, seizure, communication, medications, contractures, behavioral concerns, feeding, cognition):
ALS onset 23 years ago at age 27. Started in July of 1977 in her left hand. Noticed it when she couldn't hang IV bags as an RN. Following the birth of her daughter in 1978, she had a myelogram at Chapel Hill and was diagnosed. Doctors gave her 3-5 years to live. She had the diagnosis confirmed at the Mayo Clinic. Progression has been slow. She has been in a manual wheelchair for 18 years, but couldn't push it herself. Up until 2 years ago she could take steps and walk a little with assist of two people. Swallowing has been a problem for a long time. She eats pureed and chopped food. Chokes on liquids. Her diet includes various nutritional supplements and no bread based on research she did regarding her diagnosis. Not always continent. Cognition is normal and she attempts to talk, but speech is difficult. Uses computer to communicate.

Height: 5'7" **Weight:** 110#

<u>Present Equipment</u> (manufacturer, model, size, vendor, age, problems):
E&J Traveler Recliner 18 x 16 purchased about 4 months ago from Total Home Care with private funds. 2" foam cushion plus egg crate foam on top. ELR's in the down position, but she doesn't use the legrests at home.

<u>Mat Assessment:</u>
In supine, her pelvis rests in neutral and is flexible. In short sitting on mat table, her pelvis is level regarding obliquity and neutral regarding rotation. She has a significant posterior pelvic tilt, which is flexible, but not to neutral. She has a moderate kyphosis and flattened lumbar lordosis.

<u>Simulation</u> (devices and positioning tried and results):
<u>12-7-00</u>
Trial in Permobil ChairMan 2K Corpus 16 x 18 with standard seating, power tilt, power recline, power seat elevator and power ELR's. Power tilt of 30° allowed her to weight shift and rest. Power recline by itself helped her head control, accommodated her posterior pelvic tilt and aligned her spine. Combination of both power tilt and recline caused her to have problems with swallowing. She commented the seating felt good to her bottom and back, but needs more neck support.

<u>3-27-01</u>
Permobil ChairMan Corpus with Magitek Lautzenhiser Drive Control. Initially placed this system on her left foot, but she was unable to control turning. The commands to operates are: ankle pf = forward, ankle df = reverse, ankle pronation = right turn, ankle supination = left turn. She could df and pf for reverse and forward, and she could df/supinate which allowed her to go in reverse and to the left. But she could not supinate separate of df and she could not pf and supinate to go forward and to the left. She was also unable to propel forward/right nor reverse/right due to her inability to pronate.

Noted with the seat to back angle open 20°, she did keep her head upright during this movement without a forehead strap. Placed a small pillow behind her neck and trailed the Magitek headband. She could now control right and left turns, but she could not go forward nor reverse because her head would fall forward especially if she started from midline. Reset the CoG with her head tilted laterally to the left and this helped, but not enough to allow her independence.

Next trailed the Whitmyer foot control for driving on the same power w/c. This system uses inversion and eversion to go right and left, but to go forward and turn, she was unable to combine pf with inversion/eversion.

4-6-01:

Retrial with same power w/c using Magitek split switches. Placed forward and reverse switch on the top of her left foot and placed right and left switch on a headband. Used a sample piece of TAG foam sparkle push rim under her left foot to provide a pivot point and to keep her from slipping off the footplate. She then demonstrated independence propelling the power chair down hallways and through 36" wide doorways. Her head did drop forward and she required assist to bring it back up. She was able to hold a barrel shaped switch mount with a small button on the end to access the reset with her first finger. She expressed interest in a switch that she could access to allow her to tilt herself back to get her head back up on her own. She commented on how comfortable the seating was and how excited she was to drive herself! Concerned that her foot may still slip off the footrest.

Recommendations:

Completed order forms for the Permobil Entra with Corpus Seating and Magitek split switches drive control, reset switch, mode select switch. Power seat functions to include 45 degree power tilt, 135 degree power recline, power seat elevator, power ELR's. Whitmyer Pro 2D headrest with DFS, pelvic belt, custom modifications to left footrest.

Goals:

Improve posture – Align pelvis in neutral and spine upright to help prevent orthopedic deformities.
Pressure Relief/Distribution – Provide even pressure distribution on buttocks, thighs and trunk to prevent skin breakdown.
Independent weight shift – Rama will utilize power tilt and recline for independent weight shift and to change positions.
Accommodate joint limitations – Recline will allow for an open seat to back angle to accommodate her limited hip flexion.
Relieve pain/Increase sitting tolerance – Rama will remain in this power wheelchair for 8-10 hours per day.
Improve functional level – Rama will independently propel her power wheelchair inside her home. She will utilize the power seat elevator for stand pivot transfers and ADL's.
Improve head position &/or control – Rama will manage to keep her head upright on her own within the external support system.

B3. My Shoulder Hurts, Now What? A Review of Pathomechanics Conservative and Surgical Treatments for the Upper Extremity

Patrick Meeker, MS, PT, Regional Clinical Specialist,
The ROHO Group, Belleville, Illinois

Introduction

Defining the problem

- Research among wheelchair users
- Wheelchair setup and shoulder kinematics

Anatomy and physiology

- The shoulder joint
    - Bony architecture
    - Muscle-tendon complexes
    - Musculotendinous avascular zone
    - Neural pathways

Understanding the complexity of the joint

- Glenohumeral joint kinematics
- Scapulohumeral rhythm

Stabilization

- Roles of the rotator cuff musculature
- Joint moments

Conservative treatment

- Examination and assessment is critical
    - Active motion
    - Passive motion
    - Functional assessment
    - Strength testing
    - Special tests
    - Pain management

Therapeutic exercise programs

- Joint mobilization for the hypomobile GH joint
- Proprioceptive Neuromuscular Facilitation (PNF)

When it comes to surgery…

Assessment in the surgeon's office

- Special tests
- Impingement syndromes

Diagnostic imaging and surgical findings

- Rotator cuff tears
    - Partial thickness
    - Full thickness

Ruptures
SLAP lesions
Joint capsule laxity
Articular cartilage changes
Bankart lesions

Surgical procedures and outcomes
Open procedures
Arthroscopic procedures
Acromioplasty
Subacromial decompression
Anatomic repairs- double layer, single layer, transosseous tunnel and suture anchor techniques
Capsular shifts
SLAP lesion repairs

What's next?

References

Gagnon D, et al. Biomechanical analysis of a posterior transfer maneuver on a level surface in individuals with high and low-level spinal cord injuries. Clinical Biomechanics, 18 (2003) no. 4, 319-331.

Goldstein B, Escobedo E. Rotator cuff repairs in individuals with paraplegia. American Journal of Physical Medicine and Rehabilitation, 76 (1997) no. 4, 316-322.

Escobedo E, et al. MR imaging of rotator cuff tears in individuals with paraplegia. American Journal of Roentgenology, 168 (1997) no. 4, 919-923.

Perry J, et al. Electromyographic analysis of the shoulder muscles during depression transfers in subjects with low-level paraplegia. Archives of Physical Medicine and Rehabilitation, 77 (1996) no. 4, 350-355.

Reyes M, et al. Electromyographic analysis of shoulder muscles of men with low-level paraplegia during a weight relief raise. Archives of Physical Medicine and Rehabilitation, 76 (1996) no. 5, 433-439.

Powers C, et al. Isometric shoulder torque in subjects with spinal cord injury. Archives of Physical Medicine and Rehabilitation, 75 (1994) no. 7, 761-765.

Burnham R, et al. Shoulder pain in wheelchair athletes. The role of muscle imbalance. American Journal of Sports Medicine, 21 (1993) no. 2, 238-242.

Robinson M, et al. Surgical decompression of impingement in the weightbearing shoulder. Archives of Physical Medicine and Rehabilitation, 74 (1993) no. 3, 324-327.

Bayley J, et al. The weight-bearing shoulder. The impingement syndrome in paraplegics. Journal of Bone and Joint Surgery, 69 (1987) no. 5, 676-678.

Kulig K, et al. The effect of spinal cord injury on shoulder joint kinetics during manual wheelchair propulsion. Clinical Biomechanics, 16 (2001) 744-751.

Boninger M, et al. Shoulder imaging abnormalities in individuals with paraplegia. Journal of Rehabilitation Research and Development, 38 (2001) no. 4.

Cameron M, et al. The prevalence of glenohumeral osteoarthrosis in unstable shoulders. The American Journal of Sports Medicine, 31 (2003) no. 1, 53-55.

Gill T, et al. Open repairs for the treatment of anterior shoulder instability, The American Journal of Sports Medicine. 31 (2003) no. 1, 142-153.

Cools A, et al. Scapular muscle recruitment patterns: Trapezius muscle latency with and without impingement symptoms. The American Journal of Sports Medicine, 31 (2003) no. 4, 542-549.

Lo I, Burkhart S. Current concepts in arthroscopic rotator cuff repair. The American Journal of Sports Medicine, 31 (2003) no. 2, 308-324.

Nam E, Snyder S. The diagnosis and treatment of superior labrum, anterior and posterior (SLAP) lesions. The American Journal of Sports Medicine, 31 (2003) no. 5, 798-810.

Paine R, Wilk K. Rehabilitation of impingement syndrome (rotator cuff compression). Operative Techniques in Sports Medicine, 2 (1994) no. 2, 118-135.

Waltrip R, et al. Rotator cuff repair: A biomechanical comparison of three techniques. The American Journal of Sports Medicine, 31 (2003) no. 4, 493-497.

Hsu A-T, et al. Characterization of tissue resistance during a dorsally directed translational mobilization of the Glenohumeral joint. Archives of Physical Medicine and Rehabilitation, 83 (2002) Mar, 360-365.

Burkhart S, et al. The disabled throwing shoulder: spectrum of pathology Part I: pathoanatomy and biomechanics. Arthroscopy, 19 (2003) no. 4, 404-420.

Burkhart S, et al. The disabled throwing shoulder: spectrum of pathology Part II: evaluation and treatment of SLAP lesions in throwers. Arthroscopy, 19 (2003) no. 4, 531-539.

Burkhart S, et al. The disabled throwing shoulder: spectrum of pathology Part III: The SICK scapula, scapular dyskinesis, the kinetic chain and rehabilitation. Arthroscopy, 19 (2003) no. 4, 641-661.

Sperling J, et al. Magnetic resonance imaging of painful shoulder arthroplasty. Journal of Shoulder and Elbow Surgery, 11 (2002) no. 4, 315-321.

Severud E, et al. All-arthroscopic vs. mini-open rotator cuff repair: A long-term retrospective outcome comparison. Arthroscopy, 19 (2003) no. 3, 234-238.

Ruotolo C, Nottage W. Surgical and nonsurgical management of rotator cuff tears. Arthroscopy, 18 (2002) no. 5, 527-531.

Kibler W, McMullen J. Scapular dyskinesis and its relation to shoulder pain. Journal of the American Academy of Orthopedic Surgeons, 11 (2003) no. 2, 142-151.

Kibler W, et al. Qualitative clinical evaluation of scapular dysfunction: a reliability study. Journal of Shoulder and Elbow Surgery, 11 (2002) no. 6, 550-556.

Ruben B, Kibler W. Fundamental principles of shoulder rehabilitation: conservative to postoperative management. Arthroscopy 18 (2002) Suppl. 2, 29-39.

Notes:

B4. Seating Education for Clients, Caregivers & Colleagues: Is it Worth the Effort?

Ingrid Barlow M. Sc., OT(C), Joan Mather B. Sc. P. T.,
Angela Sekulic B. Sc., OT(C), Glenrose Rehabilitation Hospital Seating Service
Edmonton, Alberta

We all provide some level of client, care giver and colleague education. When is the right amount at the right time, to maximize client outcomes and seating clinic efficiency?

What are some of the benefits for the client and/or caregiver when they have more information?

- Contacting the right person to do the right thing at the right time
- Empowered to make more informed decisions about equipment choices and how to will use them
- Getting the wheelchair and seating "prescription" right the first time
- Choosing how they would like the service provided (e.g. through TeleHealth assessment, through a closer clinic, through the Glenrose)

What are some of the benefits of better colleague education?

- More appropriate, timely referrals
- They are able to better identify issues that would impact seating, and provide this information on the referral
- Equipment they order will "mesh" better with seating components
- They can better prepare or educate clients about options/equipment available
- They are better able to solve minor seating problems so that only more complex issues are sent to the Glenrose

What are some of the benefits of better informed colleagues and clients for the seating clinic?

- Clients and other stakeholders are ready to make <u>decisions at the time of the assessment</u>, and can identify all environmental, functional and positioning issues that need to be addressed/incorporated into the prescription.
- Follow-up/repair concerns are identified early before it becomes an "emergency"
- Follow-up/repair concerns are scheduled with the most appropriate person (e.g. wheelchair frame issues dealt with by wheelchair repair technician)

Factors to consider when planning education sessions:

- Finding a teachable moment
- Identifying target audiences
- Clear learning objectives
- What is the most appropriate method of communication: Lecture style, visuals, handouts, answering questions, practical "hands-on" session
- Getting feedback on what worked and what didn't

Different methods/modalities of teaching:

1. **Individual counseling in assessments and fittings**

- Describe different options to consider prior to assessment so clients and Care givers have time to consider pros and cons, and are ready with questions or feedback at assessment
- Encourage them to go wheelchair frame shopping and talk to vendors; if we anticipate using commercial cushion options, getting them to look at those, too
- Discuss options for seating at a repair/modification appointment, so they know what to expect at the next major seating prescription
- After discussing options, give them something in writing to assist them with remembering details, or names of things to look at

- Sharing assessment findings with the client or care giver as the assessment progresses, and engaging them in the discussion about the pros and cons of various options.
  - Findings – condition of seat & chair, physical limitations of client, functional aspects -- that need to be considered
  - Equipment characteristics – describing the equipment you are thinking of prescribing, what characteristics will meet their needs. It is important to get their feedback on it – if they have tried it before, if they can think of problems with this particular device or design
- Providing information in writing – assessment summaries, intervention summaries

Printed materials – newsletter, brochures, single page handouts

- Consider the reading level (can do reading level checks on word processor – in Canada, they suggest reading level at grade 6 or 8 for various "public" materials)
- Consider the point of view of your expected audience
- Consider how much time they will spend reading it

e.g.

TeleHealth Tips Sheet
How to tell if your cushion is worn out
Wheelchair features to consider
Care & Use Booklet
Handouts for Wound Conference

Presenting at conferences/Inservices

- Who will you be presenting to?
- What do you want them to come away with?
- Which format best conveys your information?

e.g.

Wound Care Conference
Spasticity and Seating Inservice

Workshops

- Marketing to the appropriate audience
- Clarity of who the workshop is intended for, learning objectives

e.g.

Alberta Seating Course
Seating and Wheelchair Maintenance Course

Evaluating Education:

- Did you meet your objectives - if not, why not?
- How well did you present the material?
- Is this worthwhile repeating? When? Under what conditions?

Notes:

B5. Sensory Processing & Sensory Integration in Children's Seating and Mobility Systems

Karen Kangas, OTR/L,
Occupational Therapist, Clinical Educator,
Practicing Clinician and Consultant, Shamokin, Pennsylvania

Presentation Summary:

In the past, primarily, adaptive seating systems were developed from an anatomical perspective with principles of physics implemented. Managing the body's skeletal system, particularly the spine and pelvis were believed to provide a child with the "right" and "optimal" posture to use. However, the body and its control of the skeletal system is not anatomical, but rather physiological in nature. Postural control is needed and occurs only when the child can self-initiate, self-modulate , and subsequently self-integrate. Postural control requires the body's vestibular system to be active, and support the structural components of independent movement and control.

We need to provide children with seating which promotes independent, postural control, besides providing their parents and adult caregivers with safe postural management. This presents a challenge, as often the principles utilized in submissive, relaxed bodies, are not the principles needed to support active independent bodies.

Sensory processing and utilizing sensation in an integrated mode is how the human body interprets and utilizes postures to assist an individual in managing tasks and work. Seat cushion, back heights, armrest locations, and fixed seating parts, can often prevent a child from postures of mobility within the seated posture. Creating systems which support pelvic mobility, trunk control, and shoulder girdle strength can be challenging as children attempt to gain control and grow.

Postural stability must be supported, but postural mobility must also be able to occur within a system . Sensory processing and sensory integration must be understood and supported as a repertoire of postural movements are supported and promoted within the structural components of seating systems.

I will be sharing actual cases and strategies which work with children in providing them with increased awareness and use of sensory processing within their seating systems.

Notes:

B6. Powered Mobility: The Ever-changing Story of Center Wheel Drive

Michael Babinec, OTR/L, ATP, ABDA Manager, Rehab Training & Education, Elyria, Ohio

Abstract:
As the demands and expectations of power wheelchair users continue to increase, the technology available for power wheelchair electronics and power mobility bases continues to evolve. The pace of this evolution continues to increase exponentially. Matching the users clinical needs, functional requirements, personal preferences and available resources is becoming evermore a challenging balancing act. The most recent technology advances in powered mobility over the last five years include those inherent to center wheel drive chairs. Not all center wheel drive chairs perform the same, and not all Center Wheel Drive Power Chairs have the same application.

This presentation will explore the development of Center wheel drive power wheelchairs, address center of gravity management options for this choice, detail clinical and functional application of recent advancements, correlate these advancements to related needs of the powered mobility user, and discuss the strengths / liabilities of this evolving mobility option.

Notes:

Instructional Sessions – Group C

Friday, March 5, 2004

C1. Effects of Tire Pressure and Type on Rolling Resistance

Bonita Sawatzky PhD, BC Children's Hospital,
Ian Denison, PT ATP, GF Strong Rehab Centre, Vancouver, British Columbia

Tires provide a wheelchair's only contact with the floor. They transmit motive force, braking force, absorb shock and are responsible to a large degree in determining the rolling resistance.

Tire Pressure

Over time tires loose air. Rubber is porous, valves leak. So check your tires regularly. Every time the client sits in the chair he should give his tires a squeeze, if they squish even a little they need air. We have found that tires need to be inflated on a monthly basis to maintain adequate pressure.

Filling tires:

It is very difficult to get adequate pressure in a tire using a hand pump, even a high-pressure hand pump. We recommend an electric pump (although they are quite noisy) or go to the gas station where the lines are normally maintained at 150 psi. Suggested maximum pressure is listed on the sidewall of the tires casing.

Valves:

Most tubes are made of butyl rubber rather than latex. Tubes come with one of two kinds of valves, either Schraeder or Presta. A Schraeder valve is the type that is on your car and works the same way. A Presta valve is the type that you have to unscrew the top to actually open the valve to let air in or out. The Presta valve also requires its own adapter (about 3 bucks at a bike shop), so the air pump at your local gas station may not be very helpful to you if you don't have one. Most bicycle pumps are set up for Schraeder valves and come with the adapter for the Presta valve and lately some pump manufacturers have been making pump heads that fit both, no adapter needed. We prefer the Schraeder valve.
IMPORTANT – When ever you get a flat don't just pull the old tube out and put a new one in, try to check the tire for what caused the flat. Experience has shown whatever caused it may still be in there. Do a visual check first then carefully run your finger on the inside of the tire and check for protruding objects.

Tires:

Manufacturers mix different additives with the rubber to achieve desired traction/wear characteristics. Generally, a softer formulation will give better traction, but at the expense of more rapid wear. Rubber is normally a sort of tan color, Tires are made black by adding carbon black to the mix. Carbon black considerably improves the durability and traction of the rubber in the tread area but is unsuitable for wheelchairs used indoors since it tends to mark.
Some manufacturers substitute a silicon compound for the carbon black. These tires usually have a grey tread. Whether silicon or carbon black provides better traction is subject to dispute.

Traction:

Factors that determine the traction of a tire include: inflation pressure, rubber formulation, tread design, suspension, weight and the coefficient of friction of the floor.

Bicycle tires for on-road use have no need of any sort of tread features; in fact, the best road tires are perfectly smooth, with no tread at all! This applies to wheelchairs used on smooth hard surfaces. Treads can help improve off-road traction in two ways: On hard, irregular surfaces, the knobs of the tread can hook onto projections of the road surface, reducing the tendency to slip. On soft, squishy surfaces, like carpet and grass or gravel the knobs poke into the surface, digging in for improved grip and increasing the surface area to help the tires “float”.

Rolling Resistance:

Rolling resistance determines the energy required to propel a chair up to speeds of about 2 metres per second, at which point air resistance plays an increasingly significant role.

Rolling resistance is the combined drag created by tires, casters and bearings. It stays fairly constant whatever the speed of the wheelchair.

The cause of rolling resistance is the combined deformation of the wheel, tire and road surface at the contact point. Energy is lost (and rolling resistance occurs) when these structures do not spring back elastically (hysteresis), failing to return all the energy to the wheelchair.

Rolling resistance is proportional to the total weight on the tire. Therefore, for a given user the tire/air pressure combination which produces the least deformation of tire, wheel and road surface will result in the lowest rolling resistance.

For example, a hard tire on a hard surface will produce hardly any deformation at all resulting in low rolling resistance. The same tire on soft ground won't deform but the ground will deform significantly, thereby increasing the rolling resistance. The higher the air pressure, the less the tire will deflect. We found that reducing tire pressure in a Pr1mo V Trak to 75%, 50% and 25% of the recommended pressure increased rolling resistance by 4.2%, 11.8%, and 32% respectively. The trade-off with this is that if you pump the tire up too hard, you lose the benefits of pneumatic tires: the ride becomes excessively harsh, and traction will be reduced. In addition, extremely high pressures require a stronger (heavier) fabric and stronger (heavier) rim flanges.

Wide treaded tires perform best on soft and/or rough terrain e.g. grass, snow, sand and gravel etc. On soft ground, the coefficient of friction is so high that a large contact patch spreads the weight over a larger area and produces a relatively low rolling resistance

Tire width and pressure are inextricably linked. It is a serious mistake to consider one independantly of the other. Generally, wider tires call for lower pressures; narrower tires call for higher pressures.

Footprint:

The part of the tire that is actually touching the ground at any moment is called the “foot print” or "contact patch." Generally, the area of the contact patch will be directly proportional to the weight load on the tire, and inversely proportional to the inflation pressure. The stiffness of the tire walls also determines to some extent how the footprint increases with added load and reduced pressure. We found that reducing tire pressure in a Pr1mo V Trak to 75%, 50% and 25% of the recommended pressure increased the footprint to 140%, 190% and 320% of the fully inflated tire respectively.

Airless Tires:

Of all the inventions that came out of the bicycle industry, probably none is as important and useful as Dr Dunlop's pneumatic tire. In the bicycle and automotive world airless tires have been obsolete for over a century, but they continue to thrive in wheelchair applications. They are heavy, slow and give a harsh ride. They are also likely to cause wheel damage, due to their poor cushioning ability. A pneumatic tire uses all of the air in the whole tube as a shock absorber, while foam-type "airless" tires/tubes only use the air in the immediate area of impact. We feel that people working in hazardous areas such as a workshop with many sharp objects on the floor is about the only person who will benefit from airless tires

Energy Expenditure:

Is closely related to rolling resistance which in turn is related to the size of the footprint. We found that the energy cost of wheeling at four different pressures with VT tyres showed a 3%, 12% and 25% increase in energy cost of wheeling at 75%, 50%, and 25 % of recommended pressure.

The energy expenditure results are similar to those found in the rolling resistance study signifying that the increase in energy is primarily due to change in rolling resistance.

In our tests; pneumatic tire performance showed no statistically significant deterioration until pressures had decreased to 50% of the recommended value. Performance of solid tires is inferior to pneumatic tires even when they were inflated to 25% of the recommended pressure. This increase in rolling resistance directly affects users as shown by oxygen consumption tests. The tyres inflated to 25% corresponded to almost a 25% increase in energy expenditure.

Cost:

There is a misconception that the overall cost of pneumatic tyres is significantly greater than solids. The initial purchase cost of the two tyre types is comparable, with the solid tyres being slightly more expensive. Complaints are also frequently expressed regarding the time required to maintain the pressure in the tyres. Since wheelchair tyres lose 10-25% of their pressure in the first two weeks and 25-40% after a month, pneumatic tyres need to be pumped once per month to maintain adequate pressure >50%. In our experience, the frequency of punctures that a typical ECU resident might expect in a chair whose tyre pressures are maintained at 50% or more is somewhere in the region of one every three to five years (tyres are more likely to puncture if pressures are low). A typical resident may have to replace pneumatic tyres after about ten years. Solids will last indefinitely.

A more active user might average two punctures per year and have to replace tires between one and two years.

Other Benefits of Pneumatic Tires:

Pneumatic tires also have the extra benefits of a surface easier to grip during propulsion if they find the push rim too smooth, Pneumatic tires provide significantly more vibration dampening which gives the individual a smoother ride and decreases the vibration that often triggers spasms and pain (Gordon et at, 1989). This is particularly true in the spinal cord injured individual. And finally, the improved rolling resistance decreases the strain to the caregiver who is often pushing the chair longer distances.

So next time you help someone with a wheelchair order make sure that you consider the tires.

C2. Comparison: Manual Tilt-in-space Wheelchairs Used in Long-term Care

Elizabeth Sebesta,, OT, Sandy Daughen, OT,
Tillicum and Veterans' Care Society, Victoria, British Columbia
Danny Webb, Rehab Equipment Specialist, Victoria, British Columbia

The main purpose of this workshop is to identify some key features of a variety of manual tilt-in-space wheelchairs, and clinical indicators for prescribing a specific chair in a long term care setting. Before discussing the features of the chairs, it is necessary to review clinical reasons for choosing tilt, and information the therapist will need about the resident in order to prescribe the most suitable chair for that individual.

A review of the literature identified no articles specifically addressing the use of tilt in long term care. Criteria for choosing dynamic tilt for a resident include:
Inability to weight shift independently.

Poor head and trunk control, which results in difficulty maintaining an upright seated posture.
Pain or pressure when seated, which increases the risk for skin breakdown.
Impaired sensation, as this increases the risk for skin breakdown.
Generalized weakness or lack of endurance.
High tone which increases in the upright position.
Residents who become easily agitated.
Skeletal deformities such as kyphosis.

There are a number of steps needed in order to correctly prescribe any wheelchair.

1. Information gathering to learn the resident's diagnoses; medical history; prognosis; weight, and whether the weight is increasing, decreasing or stable; type of transfer used; whether the resident will be self-propelling and if so, by hands or feet or both; the environment including floor surfaces, doorway widths, table heights; anticipated use pattern i.e. inside only, or outside as well; compatibility with anticipated means of transport.

2. The mat assessment, which will give the required information about the resident's current physical abilities and limitations, as well as the measurements.

3. Clinical reasoning to put all this information together with the features of the various chairs in order to make the best choice of chair and seating components for that individual.
By completing all these steps it should be easier to justify to a third party funding source, to the resident, or to the family, why one chair is more suitable for the resident than another.

Definitions
Recline occurs when the wheelchair back is moved in relation to the seat.

Fixed recline is achieved by changing the angle of the back using bolts through a series of holes in a plate at the base of the canes. The angle of recline is determined by the amount of hip flexion the resident can comfortably achieve. It is our experience that it is unusual for individuals in a long term care setting to achieve and comfortably maintain 90 degrees of hip flexion, so the feature of fixed recline is used on most manual wheelchairs.

Tilt occurs when the orientation of the seat and back as one unit is changed in relation to the horizontal plane i.e. the floor.

Dynamic tilt is a feature in which the amount of tilt can be adjusted by a caregiver using the tilt control lever(s) mounted at the back of the wheelchair.

The pivot point is the point at or around which tilt occurs. One of the main differences among the eight wheelchairs to be presented is the location of the pivot point. This affects the function of the wheelchair, and thus the clinical applications. This will be explained in detail when we look at the individual wheelchairs.

Caster loading occurs when more of the resident's weight is over the casters than over the rear wheels. Depending on the size of the resident this can make the chair very difficult to propel, either independently or by a caregiver.

Key Features
The following key features of eight tilt-in-space wheelchairs will be compared: types of tilt, frame lengths available, propelling, transfers, stroller bars/handles and special features.

Types of Tilt:
In standard design tilt the pivot point is along the frame. This tilt is similar to a teeter-totter in that when the back of the seat goes down, the front comes up. Depending on where the pivot point is located, the features of the wheelchair, and thus the clinical applications, will change. Four of the wheelchairs have standard type tilt.

The other four wheelchairs have what is called weight-shift tilt. This is a more complex design than standard tilt. The path of the tilt is similar to the arc of a moving swing. In each of them the resident's weight is moved down and forward as the wheelchair is tilted. In these wheelchairs the pivot point is harder to identify, and will be explained individually.

Frame Lengths Available:
Some of the wheelchairs come in a number of frame lengths to accommodate well a wide range of resident heights.

Self-Propelling:
In discussing hand propelling, it is assumed that the smallest wheel size which will allow this is 20".

Whenever the axle is moved, which may be done to facilitate reaching the wheels, it is essential to check the wheelchair for stability.

In general, the use of small casters if a resident will be foot propelling, reduces the likelihood of the resident's ankles being hit by the casters as they rotate.

Transfers:
A standing transfer works well for residents who foot propel their wheelchairs because the seat to floor height will be the same as his/her lower leg length. This allows the resident to "land" far enough back in the wheelchair that repositioning should not be necessary.

If a resident is able to do a standing transfer, but will be hand propelling or dependent for mobility, the front seat to floor height will be higher than if he/she is foot propelling. The front of the wheelchair seat will then be higher than the resident's knee height, so it will not be possible for that person to land all the way to the back of the wheelchair seat. The resident is likely to require repositioning once in the wheelchair.

For a transfer using equipment, it has been our experience that we are able to position a resident better in a tilt wheelchair if the wheelchair is slightly tilted during a transfer. How, and from what point, each wheelchair tilts will have an impact on the ease of these transfers, and will need to be considered by the therapist.

For a resident who is transferred using a sit-stand system, there are two factors to consider:
The sling is often thick, and takes up room behind the resident, preventing the resident from sitting all the way back unless the wheelchair is tilted.
When the wheelchair is slightly tilted, the seat to floor height must be no higher than the back of the resident's knees in order for the resident to "land" at the back of the seat.

For a resident who is transferred using a mechanical lift there is not usually a problem related to the seat to floor height and/or tilt mechanism of the wheelchair. The exception would be a tilt wheelchair with a high seat to floor height and/or a pivot point towards the back of the seat pan. When these wheelchairs are put into tilt, raising the front seat to floor height even more, the front of the wheelchair may be too high for the best access with the lift. Approaching a tilted wheelchair from the side with a mechanical lift tends to make this transfer more functional.

Stroller Bars/Handles:
The design of the stroller bar/handle is important for two reasons:
Most tilt-in-space wheelchairs will frequently be pushed in tilt by caregiver(s), even if the resident is able to self propel some of the time. A removable or adjustable stroller bar makes it possible for caregivers to comfortably push the wheelchair while it is tilted.
Many residents require repositioning from behind once in the wheelchair. A removable or adjustable stroller bar helps facilitate repositioning a resident from behind.

Comments/Special Features:
This section will provide extra information about each wheelchair which does not fit in any of the previous categories.

Wheelchairs
The following eight tilt-in-space wheelchairs will be compared:

Quickie TS
Invacare Compass SPT
PDG Stellar
PDG Bentley
Future Mobility Orion
Invacare Concept 45
Invacare Solara
Quickie IRIS

Important

All tilt-in-space wheelchairs come standard with anti-tippers, which help provide rear stability. These should never be removed.

A headrest should typically be part of the standard tilt-in-space wheelchair prescription. Exceptions to this might be if a resident has a severe kyphosis, or if only a small amount of tilt will be used.

Summary

The availability of tilt-in-space wheelchairs has provided therapists with a versatile, adaptable means of meeting the increasingly complex needs of residents in long term care settings. It is an exciting and dynamic field of practice. This information is just a beginning for each participant. Ask questions of the residents, the dealers, your colleagues, the manufacturers, and mostly of yourselves, as you take this information back to your workplace. You will find that you come up with applications other than those we have mentioned, as well as problems and solutions not yet identified.

References

1. O'Neill, Colleen, & Tait, Diane (2000) Dynamic Seating – The Bare Necessities, Canadian Seating and Mobility Conference 2000
2. Boyd, Allan, & Leibel, Gloria, & Meisinger, Christel (2002) To Tilt Or Not To Tilt, Canadian Seating and Mobility Conference 2002

Acknowledgements

The authors wish to acknowledge the assistance they have received from the staff and residents of The Lodge at Broadmead; Veterans Affairs Canada, which provides equipment for some residents; therapists in Victoria who have shared with us their experiences using tilt-in-space wheelchairs; and dealers in Victoria with whom we have worked.

C3. Transportation for Children and Youth: BC Law and Clinical Best Practice

Sonja Magnuson, M.Sc., Occupational Therapist on the Positioning and Mobility Team at Sunny Hill Health Centre for Children, member of the Pacific Infant/Child Restraint Advisory Committee (P.I.C.R.A.C.) and Certified Children's Restraint Systems Technician.
Margaret Turner, B.N. past member of P.I.C.R.A.C. and a certified Children's Restraint Systems Technician.

Transportation safety is an important area for clinicians working with children and youths who have disabilities. An ex-coroner presents the circumstances of a tragic car crash that occurred in British Columbia (BC). Four of the five occupants of this crash were children. The ensuing investigation of this crash highlights how child restraints (CR) and seat belts work to save lives. In BC law, Division 36 of Motor Vehicle Act Regulations describes children restraint use. It can be summarized as follows:

36.01 A person shall not drive…a vehicle with a child under the age of 6 unless the driver…securely fastened (the child) by a properly utilized and adjusted restraint system".

36.02 states all drivers must use a CR for infants weighing less than 9Kg (20lbs.),

36.03 states parents or legal guardians must use a CR children weighing 9-18Kg (20-40lbs) others must use a CR or pelvic restraint. And,

36.04 states children under age 6 but over 18kg (40lbs.) "shall comprise of the pelvic restraint of a seat belt".

There are a number of exemptions 36.06 including: taxi, peace officers, those with an exemption certificate, vehicles that do not require a seatbelt, emergency vehicle and bus. Please refer to the BC Motor Vehicle Act if you need more information. These laws apply to all children regardless of ability or medical needs.

Best practice for all children encompasses the law and is more detailed. Transport Canada, British Columbia Auto Association (BCAA) and Insurance Corporation of British Columbia (ICBC) advocate for safe transportation by all adults of all children in 4 stages. These best practice stages are summarized as follows:

1) Infant to 1 year: rear-facing CR up to approx. 9Kg. (20lbs),
2) 1-4 years: forward facing CR up to 18Kg. (40lbs),
3) 4-8 years: booster seat up to 36 kg. (80lbs.),
4) 8 years and up: use shoulder belt in back seat.

What is clinical best practice for transporting children with disabilities? Children and youth with disabilities often have complex medical or behavioral issues that need to be addressed for safe transportation. Parents and other health professionals often refer to occupational therapist, physiotherapists, seating technicians and rehabilitation engineers to find special solutions. The references below describe clinical strategies that are currently considered best practice for children and youths with disabilities. The following content is a summary please refer to the original documents for more detailed information.

CR modifications
Instructions: Always follow the manufactures instructions for installation, tether systems and securing the child in the seat!

CR Shell: Can not structurally modify or alter the shell.

Seatbelt/straps: Can not cut, change the angle of pull, re-sew or otherwise change the harness or tether.

If you are doubt about something check with someone who specializes in this area to brainstorm solutions.

Transportation strategies for specific situations
Pre term, low weight, medically fragile infants or infants with respiratory difficulties: Follow recommendations prior to discharge (Safe Start at BC Children's Hospital) O2 levels tested prior to leaving the hospital and need to be maintained for the time twice the length of the car trip, may need to travel with a 2nd adult, babies with apnea may need to travel in the front seat, then the airbag needs to be deactivated. Rolled receiving blankets or towels can be used laterally along the trunk and head and between the groin and crotch strap to improve the fit of the child in the CR.

Reflux: Use rolled towels or foam to provide lateral support along the trunk and head, find a CR that allows as much tilt as possible following the manufactures instructions, with medical supervision, modification to feeding schedule.

Hip spica: Spelcast seat for kids 40lbs or under (including the cast), EZ-On Vest, Handidart (wheelchair accessible public bus) in wheelchair.

Tone: Low or high tone, look for CR with appropriate seat depth, can add rolled towel under the front of the thighs, i.e. under knees to add seat depth, lateral supports to trunk and head, nothing behind or under the child, small ishial block as long as bum is on the CR.

Skeletal deformities: Lateral supports e.g. summate or carved foam type modifications into a CR shell; these can not interfere with the harness system or foam under seat or behind back.
Head control: Lateral supports for the trunk and head, soft neck collar used only around the neck i.e. not attached to anything.

Tracheostomy: Avoid CR with shields and look for a 5 point harness system.

Behavioral Issues: Problem with child unbuckling seat belt, turn buckle over and insert, commercial buckle guards, EZ-On Vest rear opening.

In all situations document the client rationale, history or low sitting tolerance, pain and pressure problems. Very last resort in BC is a Child Restraint or Seat Belt Exemption, form available from Motor Vehicle branch.

Transportation in wheelchair
Use tie down system in vehicle installed by a dealer or qualified person.
Remove hard tray and forehead strap; make sure the child has a headrest. If a tray is necessary for posture, a custom made foam tray is acceptable.
A shoulder/lap belt from vehicle frame is the best, if shoulder part is not available, use chest straps on seating system.

Tilt chairs need to be in the upright position, very few exceptions being around client posture i.e. severe kyphosis. Do not tilt to gain head control, consider a soft collar first.

Clinical Reasoning
Gather your resources and gain knowledge in this area. Educate parents, therapists, school staff and others involved with the child. Tap into resources on the web. Problem solve with parents and colleagues. Try different CRs, there needs to be a good fit with the child and the CR and the CR and the vehicle seat. Document.

References
American Academy of Pediatrics, Transporting children with special health care needs (RE9852) (January 22, 2004) http://aappolicy.aappublications.org/cgi/content/full/pediatrics%3b104/4/988
British Columbia Auto Association (January 22, 2004) http://www.bcaa.com/auto/safetyandsecurity/default.asp
Children's and Women's Health Centre Safe Start Program, Vancouver BC (January 22, 2004) http://www.cw.bc.ca/safestart/saferide.asp
Insurance Corporation of British Columbia Child Seats – Child Restraint Laws (January 22, 2004) http://www.icbc.com/Road_Safety/carseat_kindof.html
Riley Hospital for Children, Automotive Safety program, Indianapolis, Indiana, (January 22, 2004) http://www.preventinjury.org/specNeeds.asp
Transport Canada, Keep Kids Safe 1-2-3-4 (January 22, 2004) http://www.tc.gc.ca/roadsafety/tp/tp13511/en/menu.htm

Notes:

C4. Power to the People

Sheila Buck B.Sc.OT, ATP, OT Reg.(Ont.), Therapy NOW!, Milton, Ontario
Kathryn Fisher B.Sc.OT, ATS, OT Reg.(Ont.),
Therapy Supplies and Rental Ltd., Toronto, Ontario
Brenlee Mogul-Rotman B.Sc.OT, OTR, ATP, OT Reg. (Ont.)
Occupational Therapist, Toward Independence, Richmond Hill, Ontario

For most wheelchair users, recapturing and maintaining independence is the most significant goal in life. Accepting more help or using more advanced equipment can be seen to some individuals as "giving up" or as failure. But it is hard to deny the fatigue and pain that may come from time spent pushing a manual wheelchair or walking with a wheeled walker. Switching to power mobility may be the way to maintain independence! There is often a stigma attached to using power mobility and for many clients with various conditions, use of power mobility may be a failure, lack of progress or even a sign of being more disabled. Some individuals will require the use of some sort of power at the time of their first mobility system while others will require the use of some sort of power later on during their life and disability. It is important when looking at the various types of power to anticipate long term needs such that the equipment will be appropriately and safely used over this time span. The use of power for sensory stimulation, energy conservation, prevention of overuse and psychosocial interaction is not always thought to be basic and essential need.

A good wheelchair 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 manual versus power wheelchair frames and the design of such. How do product design features meet specific client needs? How do you balance the client's needs and wants for function with theoretical concerns for basic and essential needs? Establishing a list of priorities and goals is essential in developing a wheelchair prescription that addresses physical as well as functional and lifestyle concerns.

Common Physical Concerns:

- Range of motion of joints
- Muscular strength
- Breathing capacity
- Repetitive strain
- Upper vs. lower extremity function

Common Functional Concerns:

- Sitting endurance / tolerance
- self care / ADL skills required
- comfort
- transfers

Lifestyle concerns/Current:

- transportability – weights, ease of assembly
- maintenance/cleaning
- cost effectiveness
- accessory accommodation
- aesthetics

Future

- prevent postural deformity
- growth adjustability
- durability
- use in alternate environments

Lifestyle/environment

- Home /Other locales
- Transport methods
- Climate/environment
- Independent/caregivers
- School, work, leisure
- Past, present, future

Perceptual /Cognitive Status

GOALS FOR POWER MOBILITY

There are numerous factors that may impact an individual's decision to choose some sort of power mobility instead of or following manual wheelchair use. These include

- Decreased strength or function
- Increased pain
- Decreased mobility
- Weight gain or loss
- Less activity
- Skin breakdown
- postural deformity
- fatigue
- Aging of primary caregivers.

Other considerations may include:

- Enhancement of social skills – taking control over the environment, decision making for encounters, self esteem, body image, responsibility, risk taking, interpersonal relationship development
- Enhancement of cognitive skills – cause and effect, judgment, decision making, expressive language development
- Joint protection and pain management
- Energy conservation
- Compensation for limb dysfunction
- Reduction of associated reactions from increased stimulation during manual wheelchair propulsion
- Early enhancement of visual/perceptual skills such as object permanence, spatial relations, distance and directions

Clinical Considerations:

- Progressive neurological changes
- Cognitive limitations/changes
- Orthopedic changes
- Transfers
- Growth and weight changes
- Over use/ repetitive strain
- Aging
- Skin issues
- Environmental changes
- Changes in caregiver status

POWER PRESCRIPTIONS

SCOOTERS

Difficulties in maintaining longer distance walking may arise from a number of physical limitations. If one or more of the following impairments are identified, your client may benefit from the use of a scooter to increase independence and conserve functional energy.

- arthritis
- heart condition
- breathing difficulties
- leg vascular difficulties
- obesity
- lower leg amputation
- degenerative disc disease

It is important that trunk stability, skin integrity and transfers are assessed to determine ability to access and sit on a scooter, and these may be determining factors in moving the prescription forward to the use of a power wheelchair.

Energy conservation is significant where energy can now be spent on alternate tasks other than walking. Independence to complete functional tasks of laundry, grocery shopping, work duties and vacation/leisure sightseeing makes a significant improvement on one's outlook on life and sense of well being. It is important to remember that scooters are still motorized units and therefore drivers must be responsible for their actions. Perceptual/cognitive and driving skills of the client must be assessed by a therapist prior to the use or purchase of a scooter to ensure safe use.

Considerations for scooter prescriptions:

Environmental access:

- indoor turning radius – three vs. four wheels
- outdoor terrain – battery size, stability, traction
- suspension
- incline angles for stability
- overall length/width

Transportation:

- ability to disassemble into manageable pieces, component weights
- ramp weight capacity and edge heights/troughing for wheel size
- compatibility with public transit, trunk of vehicle, lifts

Transfers:

- ability to move arms out of the way for transfers
- ability to turn seat – access to levers on seat and tiller – able to reach with left or right hand
- seat height to the floor to assist with independent mobility on/off the scooter
- ability to come close to objects for access

Vocational/leisure:

- shroud durability – exposure of batteries/wires to environmental conditions
- overall durability
- battery range and method of charging (on board vs. off board charger)
- ability to access environments (desks/tables) – able to turn seat, move arms
- size and position of basket (attached to tiller or off tiller for balanced loads) – clients with weak upper extremities or shortness of breath are recommended to use a basket off tiller to reduce the load and fatigue on their arms

Seat support and comfort:

- arm pad length, width, height and angle adjustments for support of arm on tiller hand grips
- seat height from floor pan for optimal leg position
- seat width, depth, adjustments for forward /reverse positioning to minimize back discomfort and support the legs and pelvis
- back height, adjustments and contours
- seat and back materials for environmental wear and tear
- clearance for foot maneuvering between tiller and battery boxes, and angle of foot platform

Controls:

- ease of adjustment lever function and position for hand use (tiller, seat)
- key style and speed control – ease of operation and visual display
- position of battery plug and ease of use
- hand controls – thumb, finger, combination

POWER ASSIST

If one or more of the following impairments describe your client, they may require the use of a power assist.

- strain and difficulty when propelling a manual wheelchair
- experiences fatigue and loss of energy throughout the day
- deteriorating conditions
- conditions that require energy conservation
- soft tissue injuries related to overuse
- weakness and fatigue
- Ability to propel short distances or flat surfaces only.

Power assist allows the individual to remain in their manual wheelchair. By staying in the manual chair, the seating and posture will also remain unchanged and the transition to the new "device" may be faster and easier. Some of the therapeutic benefits of power assist include:

- maintenance and improvement to the cardiovascular system
- reduced strain on muscles and joints
- prevention and reduction of carpal tunnel syndrome and other repetitive movement syndromes
- prevention of deformity and skin breakdown from improper positioning resulting from strained propulsion with power assist
- psychological benefits of using a manual wheelchair instead of a power chair
- energy conservation
- improved functional ability
- community integration
- enhanced quality of life.

Things to consider

The following considerations are specific to power assist. The client will have already been assessed for the appropriate manual wheelchair and seating system. All appropriate considerations for stability and balance in the manual wheelchair will have been taken into account. However perceptual /cognitive status and safety issues must be assessed as separate from the propulsion of a manual wheelchair.

- Portability/weight of overall system.
- Removal of the power assist wheels and batteries
- Propulsion once the power is off - if not is battery longevity sufficient?
- Charging the system - need/availability of extra batteries
- Overall width of a manual wheelchair with power assist – approximately 3" added
- Access issues - Doorways, hallways, ramps, elevators.
- Van lift and interior space
- Compatibility with the type of manual wheelchair
- Access to on/off, speed settings

POWER WHEELCHAIR

Consideration of a power wheelchair begins when the needs of the client are not felt to be appropriate for a scooter or power assist, or when the client's needs are no longer being met by the power product that they are currently using. In addition clients who are identified as being in need of specialty switch options, power positioning, or fully programmable electronics should automatically be considered for a power wheelchair. Perceptual /cognitive status and safety issues must be assessed for all power wheelchair users.

Things to Consider:

- Frame style: folding vs. power base
- Drive wheel position: centre vs. front vs. rear
- Suspension
- Electronics – programmable and modifiable
- Battery size and longevity
- Motor power
- Accommodation of frame to power positioning
- Access issues - Doorways, hallways, ramps, elevators.
- Van lift and interior space
- Access to controls
- Compatibility with seating and accessories

In summary, when considering power products each client should be individually assessed. Postural evaluation including a mat assessment, and assessment of skin integrity, strength, coordination, tone, associated reactions, balance and sensation must be completed. In addition an assessment of neuropsychological functioning including cognitive/perceptual/visual, insight, ability for new learning and relearning and safety should be included. Funding is an issue with power products and therefore a review of the client's social support system and ongoing financial status is important however, should not the determining factor in what type of system the client receives. Everyone deserves the opportunity to be autonomous in their decision to be independent.

C5. Just Weld It! Prescribing Custom Ultralights with Confidence

Kendra Betz, MSPT, VA Puget Sound Health Care System, Seattle, Washington

Objectives: Participants will gain knowledge and skills that will allow them to:

1) Understand & discuss the key features and benefits of ultralight manual wheelchairs
2) Gather client information and coordinate details to design a custom ultralight chair
3) Clearly communicate the desired configuration for a custom welded ultralight frame

<u>The Ultralight Manual Wheelchairs</u>

HCPCS Code K0005: weighs less than 30 #

Key features of the Ultralights

- Lightweight
- Durable *(Cooper, 1999)*
- Customized configuration via adjustability or specific frame design for:
  - Comfort *(DiGiovine, 2000)*
  - Postural support *(Hastings, 2003)*
  - Skin protection *(Cook, 2002)*
  - Efficient propulsion *(Brubaker, 1986; Beekman 1999)*
  - Injury prevention *(Boninger, 2000)*

Ultralights vary widely

- Folding designs
- Rigid options (box frames, axle tube designs, cantilever configuration)
- Suspension options (front and/or rear)
- Materials (aluminum alloys, chromoly, titanium, composites)
- Degree of adjustability
  - Highly adjustable
  - Partially adjustable
  - Highly customized with little adjustability

* Ask for RESNA/ANSI test data

<u>The Custom Ultralights</u>

- Most dimensions are welded; very little adjustability
- Relative to the entire class of Ultralights, the custom designed/welded frames are:
  - Lightest
  - Most durable
  - Most comfortable
  - Best performance
  - Lowest maintenance
  - Utilized as an *ORTHOTIC* device

    Can provide postural stability, substitute for impaired trunk to optimize function *(Hastings, 2003)*

Examples of Custom Designed and Welded Ultralights

* Diagrams by the Manufacturers with Permission

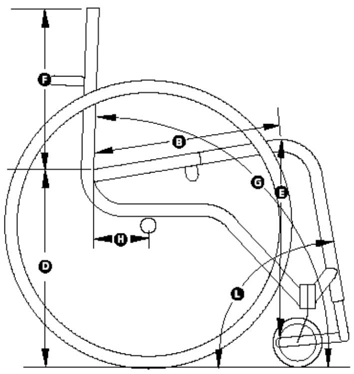


Figure 1: TiLite TRC

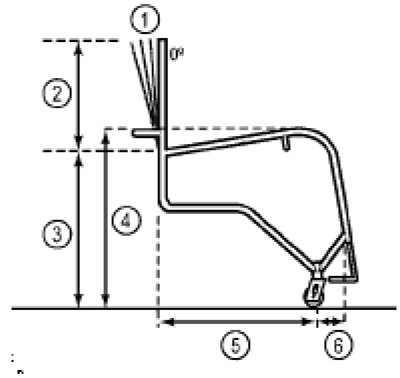


Figure 2: Invacare Top End Terminator

- **Concerns with the custom Ultralights**
  - Not much room for mistakes – gotta get it right (that's why we're here)
  - Most expensive due to materials and manufacturing processes (think long term)
  - Variances in specifications of each chair creates a challenge (read the directions)

- **The role of the Seating & Mobility Specialist**
  - Knows what technology options are available
  - Matches the technology to the individual
  - Understands the process for obtaining & providing the technology
  - Provides comprehensive education to the client to facilitate decisions

"It is imperative that consumers be knowledgable and <u>seek expert advice</u> when selecting a new chair" (Cooper, 2003)   <u>*That's where we come in!*</u>

<u>Prescription of Custom Welded Ultralights --- FAQ's</u>

Which wheelchair users should be considered for a custom ultralight chair?
- Those who know where they want to sit.
- Those who would benefit from a lightweight, supportive, comfortable, responsive, durable chair.
- Those whose condition is not likely to significantly change in the near future.

Who are the key players in prescribing the custom welded ultralight chair?
- The client (and sometimes family members/caregivers can offer valuable insight)
- The clinician
- The DME dealer/vendor
- The funding source
- The manufacturer

How do I figure this out?

- Interview the client
  - Past medical history, current issues
  - Preferences, habits, skills, life necessities
  - Intended environments and uses of the chair
  - Review equipment history to understand the "gotta haves"
  - Transportation mechanisms and stow techniques

- Complete a comprehensive evaluation
  The client
  - Postural presentation, ROM, tone, strength, functional skills observed
    Examine the client in chair, sitting on firm mat, supine on mat

  - Current equipment
    Seating system configuration, patterns of wear
    Examine the equipment both with and without the client in it

- Utilize equipment trials
  Empirical trials to "mock up" configurations
  - Identify features that might provide benefit to the client
  - Use good "assessment chairs" to trial various configurations
    (i.e. TNT, A4, R2, others)
  - Use of extra parts/pieces for "mock ups" in whatever chair is available
  - Evaluate support, comfort, performance
  - Assess functional skills in proposed system (Cook, 2002)
  - Must identify cushion and back supports as integral components
  - Identify what modifications necessary to optimize the seating system

<u>Specifications for the Custom Ultralights: Generating the Order</u>

The Dimensions

- Refer to Appendix A of this document
  Case Studies with photos will demonstrate key points

Communication of the dimensions

- Refer to Appendix B of this document for variances between (3) manufacturers
  - Each company asks for different measurements
  - For the specifications that are similar, reference points for measures vary widely
  - Once you know what you want, clear communication becomes CRITICAL

How to get the frame you want

- Know what you want in the frame design
- Know what specifications you will need to provide
- Clearly understand the reference points for all measures
- Read every detail and footnote on the order form
- Communicate with the company (ideally the design engineers)
- Be able and willing to give specs that may not have been requested; give justification
- Confirm the frame design by a schematic drawing
- Submit the agreed upon frame design with the final order

Fine-tuning features – Suggestions for a great fit

- Adjustable rear wheel position in horizontal plane
- Adjustable tension back upholstery
- Adjustable height footrest

Options and Accessories – Putting it all together

- If the goal is lightweight, efficient pushing go for:
  - Lightweight rear wheels
  - Solid maneuverable casters appropriate for intended terrain
  - Minimal extras unless medically/functionally indicated (armrests, tip bars)
  - Consider appropriate low weight cushions & backs
- If the goal is push efficiency and/or injury prevention, handrim choice is critical:
  - Surface shape
  - Custom tube diameter and/or pushrim diameter
  - Material options
- The cushion is a critical piece of the puzzle

<u>Fitting the Custom Ultralight</u>

Fit the chair to the client

- Review the final product– measure every specification. Don't settle for less.
- Get in the chair and push it to rule out any problems (i.e. pull to one side)
- Adjustments and fine-tuning make all the difference in the world (not much to do)
  1. Check basic fit with cushion in place
  2. Adjust backpost angle
  3. Adjust backrest height
  4. Adjust footrest height
  5. Adjust rear wheel position (don't forget to adjust the wheel locks)
  6. Check chair skills, maneuverability in varied environments and terrain
  7. Further adjust as needed
  8. Provide comprehensive education

Education – a key component for issuance of any chair

- Safety
- Maintenance
- Adjustments (back upholstery, wheel position)
- Push mechanics for efficiency and injury prevention
- Wheelchair skills progression
- Transfers review to and from the chair to varied surfaces
- Stow techniques
- Weight of the "system" *(Boninger, 1999)*
  - Body weight
  - Accessories and brackets
  - Heavy items transported on chair
  - Tie down systems

When the custom Ultralight is NOT the best choice . . . several great options exist.

- Some Ultralights offer both fixed & adjustable features
  (i.e. TiLite ZRA, Quickie ST/DT, Ti, and R2, Invacare A4, others)
- Some Ultralights offer a great degree of adjustability
  (i.e. Quickie box frames, Colours box frames, various folders, others)

<u>Conclusions</u>

- Consider the custom Ultralights as a viable option for your clients
- Recognize that every chair order is an opportunity for improvement
- A well configured chair provides improved quality of life – we CAN make a difference

<u>References and Recommended Reading</u>

Beekman CE, Miller-Porter L, Schoneberger M. Energy cost of propulsion in standard and ultralight wheelchairs in people with spinal cord injuries. Phys Ther. 1999;79:146- 58.

Boninger ML, Cooper RA, Baldwin MA, Shimada SD, Koontz AM. Wheelchair pushrim kinetics: body weight and median nerve function. Arch Phys Med Rehabil. 1999;80:910-915.

Boninger ML, Baldwin MA, Cooper RA, Koontz AM. Manual wheelchair pushrim biomechanics and axle position. Arch Phys Med Rehabil. 2000;81:608-613.

Brubaker CE. Wheelchair prescription: an analysis of factors that affect mobility and performance. J Rehabil Res Dev. 1986;23:19-26.

Cook AM, Hussey SM. Assistive Technologies: Principles and Practice. Philadelphia: Mosby, Inc; 2002. ch. 6.

Cooper RA, Boninger ML, Rentschler A. Evaluation of selectedultralight manual wheelchairs using the ANSI/RESNA standards. Arch Phys Med Rahabil. 1999;80:462-67.

Cooper, RA, Cooper R. Spoke-Tacular: 21st Annual Survey of Lightweight-Wheelchair Manufacturers. Sports-n-Spokes. March 2003:pp 34-36

DiGiovine MM, Cooper RA, Boninger ML, Lawrence BM, VanSickle. DD, Rentschler AJ. User assessment of manual wheelchair ride comfort and ergonomics. Arch Phys Med Rehabil. 2000;81:490-4.

Hastings JD, Fanucchi ER, Burns SP. Wheelchair configuration and postural alignment in persons with spinal cord injury. Arch Phys Med Rehabil. 2003;84:528-533

Koontz AM, Boninger ML. Proper propulsion. Rehab Management. July 2003.

Richter WM. The effect of seat position on manual wheelchair propulsion biomechanics: a quasi-static model-based approach. Med Eng Phys. 2001: 23:707-12.

Van der Woude LH, Veeger DJ, Rozendal RH, Sargeant TJ. Seat height in handrim wheelchair propulsion. J Rehabil Res Dev. 1989;26:31-50.

.

Websites for Products Demonstrated in Presentation

3rivers.com
Colourswheelchair.com
Invacare.com
Per4max.com
RideDesigns.com
Sunrisemedical.com
Tilite.com

See the following pages for Appendix A and B

Appendix A: Custom Ultralight Specifications

Kendra Betz, MS, PT

a. Seat Width	Recommend snug fit without causing adverse effects; rigid clothing guards help with control/protection of soft tissue near rear wheels. Consider clothing bulk especially relative to the seasonal differences. Tapered seat is an option (front more narrow than back).
b. Seat Slope	AKA: *dump, squeeze, positive seat angle* Generally specified as difference front seat to floor height relative to rear seat to floor height in inches rather than as a slope in degrees. Information from the mat eval and empirical trials is *CRITICAL* for determining where the client is optimally positioned in seat angle. General rule: the greater the degree of trunk compromise, the greater the degree of seat slope to substitute for trunk instability (i.e. extensive trunk paralysis best with 3-4" slope vs intact trunk 1-2" slope) although highly variable. Seat slope has significant impact on postural alignment. (Hastings, 2003)
c. Rear seat height	Consider seat position relative to rear wheel. 100-120 degrees of elbow flexion with hand at top dead center of handrim recommended (van der Woulde, 1989). Center of finger at center of axle is a strong clinical correlation with that elbow angle. Consider height in space and seat slope as discussed above. For suspension chairs, consider the impact of suspension on rear seat height when the suspension is loaded (lose seat height when loaded?)
d. Front seat height	Impacts clearance for tables/ desks, floor access, height in space. Incorporate lower leg length and cushion height.
e. Front frame angle	Consider ROM, spasticity, overall chair length, front stability of chair.
f. Footplate position	Determine vertical position relative to seat height and ground clearance. Clearly related to front frame angle. Also need to understand position relative to front casters for front chair stability and foot clearance.
g. Seat depth	Determined from evaluation, identified needs, front frame angle and knee flexion position. Impacts frame length dimensions.
h. Back angle	Can be fixed angle or adjustable posterior (recline) & anterior (squeeze); adjustable tension upholstery or after market backs give flexibility. In conjunction with seat slope, backrest position strongly influences posture.

	Consider influence of rear suspension on back angle (do the backposts assume a more reclined position when suspension loaded?)
i. Back height	Fixed or adjustable. Should be high enough that pelvis and trunk are well supported, low enough to allow available full upper body function
j. Rear wheel (COG)	See seat height section for rear wheel position relative to rear seat height. For position in horizontal (fore/aft) dimension, want wheel as far forward as possible without compromising rearward stability (Bonninger, 2000; Koontz 2003)
k. Caster position	Impacts maneuverability & stability. Must consider in 3 planes: • <u>Sagital plane (from the side)</u>: caster position relative to the rear & front of the frame. Short wheelbase (center of rear wheel to center of front caster) gives compact frame but recommend preserving a long enough wheel base to allow safe mobility with obstacles and uneven terrain. With front suspension, consider extending front caster placement forward an additional inch for stability) • <u>Frontal plane (from the front)</u>: distance between the 2 casters (center to center). Changes lateral stability and clearance of casters with feet, front hanger. Add 1" width when using front suspension. • <u>Transverse plane (from above)</u>: caster swivel impacted by position as well as fork lengths and caster size selections.
l. Frame lengths	Taking into consideration all of the above, determine frame lengths: 1) overall (most posterior aspect of frame to most anterior) 2) break it down to component lengths rear frame to center rear wheel (COG) rear frame to center caster center rear wheel to center front caster center caster to front frame angle *requested specs vary widely. See Table 2 for more information.
m. Footrest width	Typically measured as "inside width" at designated position on front hangers. Consider shoe wear in various seasons. Recognize the impact of footrest width on front rigging configuration. Be careful when a specific measure is not requested as you may get a footrest width that is quite narrow (i.e. a 14" wide seat with (-6) footrest width is 8" – tight!)

Appendix B: Custom Ultralight Comparative Measurements

Disclaimer: table demonstrates variances in frame measurements; it is not intended to substitute for manufacturer's order forms or information provided directly by any company

Kendra Betz, MS, PT

	TiLite TRC	***Top End Terminator***	***Per4Max Shockwave***
Seat width	Measure outside of seat tubes at backpost in 1" increments to max 20".	Outside of seat tubes to max 18".	Outside of seat tubes.
Tapered Seat	Optional. Designate measure *inside* of seat tubes at front of upholstery relative to rear width (-4 is a 2 inch taper)	Optional. Designate measure outside of seat tubes at front of upholstery.	Available. Designate measure outside of seat tubes at front of upholstery.
Seat depth	Front of backpost to front of upholstery.	Same	Same
Front seat to floor	Top of seat tube from *beginning* of bend to floor	Floor to apex of bend at top frame.	Floor to "very top of the seat" which is the apex of the bend.
Rear seat to floor	Floor to top of seat tube at backrest.	Floor to top of seat tube at rear of the frame.	Floor to top of the seat in front of backpost *when suspension system is loaded by specified body weight.*
Front frame angle	Measured floor to frame front in 5 degree increments from 60-90 degrees.	Not requested	Not requested
Frame length	Not requested. Can specify a custom frame length (i.e. 15" seat depth on 17" frame) or clearly communicate what you want in which case front of back tube is a key reference point.	Two measures requested: a) rear of frame (behind the tube) to center caster (default is seat depth plus 3") b) center caster to weld where bottom frame meets front frame horizontal measure (default is 4" which is approximate 80 degree front)	Total length requested measured from front of backpost to front of the bend ("end of bend") were top tube angles down.
Caster position	Not requested	Designate position relative to a) rear of backpost b) weld where front rigging meets bottom frame 3) designate distance between casters	Referenced relative to a)distance between rear axle and center caster b) distance center caster to front footrest
Backrest angle	Fixed or adjustable. Available 80 -101 degrees with vertical reference 90 degrees	Fixed or adjustable. Available forward and back with vertical reference zero degrees	Available in zero, 3 or 5 degrees with vertical reference is zero.
Rear wheel position	Front of backpost to center wheel. More adjustability rearward with square rear frame.	Not requested. Adjustable. Will have more adjustability back with square rear frame.	Designated as front of backpost to center of rear axle.
Footrest width	Requested for custom V front angle. Specified inside of front frame 2.5" above footrest.	Inside measurement at front frame. (default is 5" less than seat width for tapered front end)	Inside measure between footplate tubing.

C6. Functional Positioning/Independent Mobility for Clients with Complex Needs

Phil Mundy, P.Eng., Product Design Group, Vancouver,
Nancy Balcom, B.Sc, Kinesiology, PDG Inc., Vancouver

Instructional Session Outline: This program is intended for individuals involved in assessment and delivery of complex mobility devices, primarily manual wheelchairs and device mounting systems. The target audience includes people who are involved in client assessment, delivery and servicing of positioning and mobility devices. The seminar objective is to provide practical instruction in assessing and dispensing adaptive mobility devices for people with disabilities.

The presentation draws on clinical experiences of prescribing therapists, Rehab Technology Suppliers and PDG staff during their work developing various mobility related products with an emphasis on manual wheelchair positioning, bariatrics, individuals exhibiting high agitation, and device mounting applications. In developing 'special application' mobility devices, PDG staff gathers input from all sources to facilitate development of equipment that meets the intended-client need. Presenters will discuss several factors as they relate to each case history and product application. The following list provides an introduction.

- Physical problems - This is often the first issue that comes to mind when identifying aspects contributing to increased complexity.

- Functional Potential – Determining functional potential often requires extra assessment time and flexible Rehab Technology options.

- Care Giver issues - Issues for caregivers may conflict with client issues and need to be addressed.

- Funding issues - Relatively uncomplicated cases can become difficult to address if funding issues limit options available to the team.

In presenting this material, recent case histories will be used to demonstrate a variety of unique solutions. Each case will be done with emphasis on the process used to work through delivery of sophisticated equipment. Information will be presented in a way that delineates the relationship between physical need, functional goals, and equipment design. Clients are introduced via power-point presentation. Information needed for attendees to become familiar with functional limitations will be reviewed including disability, functional status, environment, equipment funding issues, etc.

Instructional Sessions – Group D

D1. Power Positioning for Function: Considering Clinical Assessment and Prescription

Sheila Buck B.Sc.OT, ATP, OT Reg.(Ont.), Therapy NOW!, Milton, Ontario
Alan Boyd, B.Eng, Vice President, Business Development, Motion Concepts, Milton, Ontario

When discussing mobility options, prescribers and technicians often consider forward, reverse and turning motions such that directionality can be achieved. Once that mobility is found it is often tempered by the need to accommodate basic and essential funding criteria. As a human race we are dynamic in function such that we not only move in straight lines, but our function is also affected by leaning, twisting and bending of the trunk to maximize reach and balance points.

When considering powered positioning for function we need to look outside the box and open our minds to the endless possibilities of maximizing independence for our clients with resulting improvements in quality of life. People are not static sitters, but indeed have constant dynamic changes in posture to enhance function. It is also important to consider the environment in which equipment is utilized. Often, tens of thousands of dollars are spent on renovating homes to make cupboards, shelves and counters accessible with in the client's home, yet that same client is unable to visit friends or family due to restrictions within their homes. Provision of powered positioning devices may in the end cost less and allow the client to have access and function in a greater variety of situations. We therefore need to start considering the usefulness of bringing technology into the hands of the client rather than just modifying the outside world. To move outside of the traditional box of posterior tilt and recline, we need to consider the functional/physical goals of the client which may include:

- improved cardiovascular endurance
- prevention or decrease of kyphosis/scoliosis
- prevention of pressure sores
- improving self esteem by bringing the client to "peer level" or normal
- postural interaction with others
- assist in balance restoration through upright posture
- improve independence in transfers
- improve normal spatial orientation
- enhance comfort and decrease fatigue
- increase tolerance for activity participation
- aid in normal skeletal development

Areas of assessment may include:

- client ROM with emphasis on hip and knee flexion and extension
- circulatory and respiratory status with O2 levels
- bone density
- tone/spasticity/reflex patterns
- bowel/bladder function
- skin integrity
- head control
- sitting balance
- foot positioning and use of orthotics
- transfers
- transportation
- school/employment
- mobility status
- activities of daily living (current status of independence)
- living environment: room size, moving space

Beyond the assessment of the client, however, we also need to consider the activity at hand or those tasks which the client wishes to complete to enhance independence. A task or activity analysis needs to be completed in order to determine the predominant physical demands required for task completion. After completion of this analysis, it is put together with the client assessment data to determine the feasibility of alternate positioning. A form of backward chaining is used to formulate the design criteria. It is imperative not to start with a design and fit the client to the mold, but to develop the mold from the task analysis, client needs, and assessment data. It is also important to trial the client where possible in the static positions of the proposed dynamic area, in order to ensure client compliance physically and mentally.

The following are thoughts for alternate powered positioning technology:

Status Quo

Power posterior tilt, power recline with shear reduction, power elevating legrests (non-articulating), vent support systems

Beyond the Status Quo

Power anterior tilt, power negative recline, power elevating seat, "Pivot Plus" power elevating footrests/foot platform, power elevating/articulating foot platforms, integrated balanced vent support systems with short profiles, power options (i.e. swing-away chin control systems, joysticks, headrests, foot platforms), power "scooper", power swivel seat, power stander

DESIGN CRITERIA

- Stability and power base drive characteristics. The relationship between the power base manufacturer and the power positioning manufacturer.
- The relationship between the design team and the people who use the products. The stronger the relationship, the stronger the connection. Without this relationship, you will become disconnected with your market.

BUSINESS VISION

- The importance of doing custom systems. The market is "talking" to you.
- Pushing the "envelope". The need for continuous innovations. Never ending product development. We can always do better.

ACCESSING FUNDING

- Justify access by emphasis on all areas of improved function or independent function
- Complete a cost comparison of construction vs. technology
- Complete a cost comparison of attendant care dollars vs. technology
- Describe how the technology can meet and enhance functional goals
- Compile data and list the physical benefits
  i.e. prevent muscle atrophy in trunk and leg muscles
  decrease or prevent kyphosis, scoliosis, pelvic obliquity
  prevent or decrease muscle/joint contractures
  decrease muscle spasms
  enhance independent transfers
  aid in kidney/bladder function with decreased infections
  increase ROM
  increase strength in trunk and lower extremities
  improve cardiovascular system and build endurance
  improve bowel function and regularity
  maintain bone integrity
  decrease swelling in the lower extremities
  decrease or prevent pressure ulcer formation
  improve circulation to the trunk and lower extremities
- Most importantly describe how the purchase of this type of technology will save the insurer money in the long run by decreased alternate services or technology needs.

Notes:

D2. Programming the Electronics for Powered Mobility Systems for Children who Utilize Head Access to Support Independent Control of Powered Seat Functions as well as Augmentative Communication Systems and Computer Access

Karen M. Kangas, OTR/L
Occupational Therapist, Clinical Educator,
Practising Clinician and Consultant, Shamokin, Pennsylvania,
Lisa Rotelli, Education Coordinator and Consultant

Presentation Summary:

Programmable electronics and alternative head access allow us to assist children in becoming independently mobile. Their mobility and skills with mobility increase as their experience increases. Their "machine knowledge" (how to manage the chair itself) as well as their "body knowledge" (how they control their bodies within the chair), and their mobility knowledge (managing multiple environments and accessibility) all change. It is important that the chair's performance reflect these changes, too.

When a child is first learning to be mobile, the mobility system needs to be programmed to be as simple as possible, so that success and control are insured. However, as the child develops experience and competence, the configuration of the chair, and its programming must change.

Control of reverse, of multiple drives and/or speeds, control of on/off, and subsequent control of augmentative communication systems, control of computer access, and control of powered seat functions all can occur with head access use and with some variability. However, adding this control, and teaching this control must be accomplished with planning, observation, and in configurations which work best for each individual child.

Today, Lisa and Karen will share processes of changing the programming, especially what can and cannot be changed readily within the software available within programmable powered chairs. This session will share both MKIV ("Mark 4" Invacare's electronics) and P&G (Penny & Giles electronics, used in Quantum, Qtronix & Permobil), as these are the two most commonly used electronic packages used in the USA.

We will be able to compare and contrast how the programming is different when using head access, and how it needs to be programmed "in process" with the experience of each child's skills and needs.

Definition of Terms:

1. Digital & proportional controls
2. Rim Control
3. Dual switch Control
4. Mechanical & Electronic switches
5. Global reactions
6. Reset/mode change
7. ECU, Auxiliary, COM interface
8. Separate drives, profiles
9. Mouse Emulation
10. Other issues

D3. Wheelchair Skills Training Program (WST): Testing and Training Protocols

R. Lee Kirby, MD, FRCPC
Division of Physical Medicine and Rehabilitation, Dalhousie University, Queen Elizabeth II Health Sciences Centre, Halifax, Nova Scotia

Presentation Summary:

The Wheelchair Skills Program (WSP) consists of the Wheelchair Skills Test (WST) and the Wheelchair Skills Training Program (WSTP). The WSP is a set of evaluation and training tools designed to help practitioners optimize the safety and maneuverability challenges that face wheelchair users and their caregivers. The WST and WSTP Manuals can be downloaded from *www.wheelchairskillsprogram.ca*. During this session, we will focus on how the testing and training is performed, including many videotaped examples of how skills should and should not be performed. On completion of the session, attendees will be better able to explain the rationale and elements of the WSP, and how the WSP might be implemented in their own settings.

Notes:

D4. Essential Collaboration Between Driving & Seating Specialists

Chris Maurer, MPT, ATP, Beth Anderson, OTR/L, CDRS,
Shepard Center, Atlanta, Georgia

D5. Transporting People in Wheelchairs in Vans & School Buses

Linda van Roosmalen, PhD, IDSA, Pittsburgh, Pennsylvania
Doug Hobson, Associate Professor, Co-Director, Rehabilitation Engineering Research Center, School of Health and Rehabilitation Sciences, University of Pittsburgh, Pittsburgh, Pennsylvania

D6. Selecting Specialty Controls for Power Wheelchairs

Elizabeth Cole, MSPT,
Director of Education, Sunrise Medical, Longmont, Colorado

The Power Evaluation Process - includes

Client evaluation includes the client interview and the mat evaluation and measuring
Choose appropriate seating

Choose appropriate electronics package, including type of input device (joystick or specialty controls) and appropriate interfacing electronics

Choose appropriate wheelchair base – (K0010 – K0014 or basic to high performance)

Choose appropriate drive wheel position - front wheel, mid wheel, rear wheel

Choose appropriate power dynamic seat functions - tilt, recline, both, power ELRs

Determine need for auxiliary devices - aug comm., computer, ECUs

What are specialty controls?
Numerous types of proportional and non-proportional input devices
Multiple access sites are possible - can tailor placement to match client's best function
Many sizes and shapes
Ability to use input device (now or in future) to:
Operate multiple dynamic seating systems
Operate auxiliary functions - ECUs, communication devices, computer
Can change from one type of input device to another to provide the most optimal device for current and future independent function
Require additional interface box/display to interface between controller and input device

Appropriate client has:
Strength, coordination, ROM that limit ability to safely access and operate a joystick
Limitations that interfere with control of proportional device, but can control non-proportional device

Progressive condition that in future will:
Require more sophisticated dynamic seating
Require use of auxiliary devices through the input device
Cause loss of UE function
Cause inability to control a proportional input

Choosing A Specialty Control Input Device

Determine the most appropriate type of control – proportional or non-proportional

Proportional input device

Deflecting the joystick causes chair to move at variable speed
The more deflection, the faster the speed
360° of directional control
Provides more fine-tuned control for steering and course correction
Arc of turn can be varied
Requires user coordination and motor control

Non-proportional input device (switched)
Operating a switch causes chair to move in single direction at pre-programmed speed
No variable speed control
Less fine-tuned control for steering and course correction unless latched or accessing 2 switches at once

Arc of turn is specific - determined by the programmed turning speed and acceleration
Requires less user coordination/motor control

Determine best access location for input device

Proportional – need to determine:
Location of best control - hand, head, foot, chin, lips

Non-proportional – need to determine:
Location(s) of best control - hand(s), head, feet, chin, finger(s), mouth, combination
# of switches that can be used effectively
Type of switch(s)

Types of switches
Mechanical - user physically pushes/pulls/deflects the switch to operate
Buddy button, ribbon, disc, micro light, wobble, plate, egg switches

Proximity – a sensor detects the relationship to a metal target without making physical contact, so the user does not need to actively touch the switch to activate it. User can activate it by moving to within ¼" to ½" inch of the switch

Pneumatic – and electronic transducer converts pneumatic pulses to electronic signals

Fiber optic - a "red dot" used with an interface transmits a digital signal on or off (~ the size of a pencil lead)

Infra-red - sends a beam of light at a specific radiated frequency to operate the switch

If considering a proportional control:
Does user have strength, coordination and endurance to use safely, effectively and consistently in all 4 directions

Do spasticity or reflexes compromise control

If considering non-proportional control:
Does environment require tight controlled turns
Can latch be used to increase control

Determine the most appropriate mode of driving

Momentary
Chair only drives when user is actively operating the input device
Turning is less controlled and less efficient when using switched systems

Appropriate client has adequate strength, ROM, coordination and endurance for continual activation and adequate postural control

Latched
Once user activates input device, chair drives without further activation until opposite or stop command is given

Right and left are still momentary. This allows course corrections with switched inputs and allows control of the arc of turn with switched inputs

Appropriate client has limited strength, endurance, ROM, but appropriate cognitive ability and response time

Choose the most appropriate input device

Proportional Controls

Joystick - Chin or Hand Control
Very small package mounted at the chin or hand
Attached to chair with S/A boom or armrest mount or to bib worn by client

Appropriate client:
Limited/no UE function and/or cannot operate a standard joystick
Has sufficient hand or head/neck control to operate a proportional control
Can operate a switch to access modes menu?
Might need forward and reverse commands swapped
Might need change in joystick throw - in one or all direction(s)
If chin control, can maintain control over rough terrain/obstacles, if appropriate

Joystick - Mini
Smallest package usually mounted at chin or hand
Very short throw requires minimal movement and minimal force to deflect (<10 gms)
Use at hand, chin, finger, lips

Appropriate client has:
Very limited strength, ROM and/or endurance at access point, but has…
Adequate control and coordination at access point
Can operate a switch to access modes menu?

Joystick - Touch Pad
Operated by gliding a finger on the pressure sensitive pad
Chair moves in direction the finger moves
Neutral is ~ center of the pad
The greater the displacement from neutral, the faster the speed
Extreme reverse location on pad acts as the mode switch to access modes menu

Appropriate client:
Does not have UE strength, ROM, endurance and control adequate to access a joystick and/or maintain contact or to move joystick thru required range even with short throw
Does have strength, ROM and control of 1 finger adequate to:
Move over small pad surface with minimal pressure, to navigate the pad smoothly/with control and to access/differentiate various areas of the pad

Joystick – Mushroom
Small package with rounded hand control
Transforms minimal force into peak response
Fits contour of hand, moves easily under the hand and hand moves easily over the surface

Appropriate client:
Has coordination to control proportional input but has limited strength and ROM
Needs rounded shape of mushroom to maintain hand contact and appropriate control
Needs input that requires minimal pressure to move

Joystick – Magitek Head Control
Operates via a 360° dual axis proportional tilt sensor mechanism
Senses tilt movements in the forward and reverse axis and right and left axis. A remote switch is used to access standby mode and modes menu
Usually positioned as a headband to sense forward, backward, right, left tilts of head, but can also be positioned at the foot, wrist, etc or can separate the sensors to two different locations
Null width adjustment – similar to joystick throw (increases/decreases the neutral zone)

Appropriate client:
Adequate head and neck control, strength and coordination through some range of flexion, extension and lateral tilting and can operate a separate remote switch

3-Axis Proportional System (3-directional)
Proportional control usually designed as a head control (joystick mounted behind head rest)
Variable speed and 360° directional control
Provides 4 directional commands (fwd, rev, right, left) using 3 directional displacements. Right and left are operated by pressing on right and left sides of headrest, while forward and reverse are operated by pressing on back of headrest
A separate switch has 2 functions – a single activation toggles the back of the headrest between fwd and rev, while a double activation accesses the modes menu

Appropriate client:
Has sufficient head control, strength, ROM and coordination to operate proportional control in 3 directions
If applicable, can maintain control during extensor spasms and mobility over rough terrain/obstacles

5 Switch Systems
5 non-proportional switches
4 individual switches for directional commands of fwd, rev, right, left, while 5th switch accesses modes menu
Very intuitive system to operate

Wafer board and starboard - 5 light touch switches connected in a plastic mold
Tray array – 5 proximity or fiber optic switches attached underneath the tray surface
Penta switch – 5 small mechanical switches arranged in a circle on a disc
CA-5 interface box – 5 ports for 5 single switches positioned at remote access points
Fiber optic array – 5 fiber optic switches in array mounted to armrest boom
5 Switch head array – 5 proximity switches in head array
5 Switch Head Array
1 proximity switch in back pad for forward
1 proximity switch in left pad for left
1 proximity switch in right pad for right
4th switch for reverse - could be a proximity switch located in right or left distal pad or any switch located remotely
5th switch accesses modes menu – could be a proximity switch located in right or left distal pad or any switch located remotely

Appropriate client for 5 switch systems:
Does not have coordination/strength to safely/functionally operate proportional control
Has spasticity that interferes with the operation of a proportional control
Has ROM, strength and gross motor control at one or several access points to independently access 5 different switches

3-Axis Switch Systems
Head Array with 4 Switches
3 proximity switches provide 4 directional commands, includes 1 switch in each side pad for right and left and 1 switch in posterior pad for both forward and reverse
4th switch has two functions- a single short activation toggles the fwd/rev switch between fwd and rev, while a double activation or single long activation accesses mode menu. The 4th switch could be another proximity switch located in the distal right or left pad, a beam switch mounted at the top of the headrest or any remote switch located at any access point

Appropriate client for any 3-axis head array has:
Adequate control, ROM, coordination, and strength in head/neck to access switches and the ability to differentiate between the switches in the head array
Adequate cognitive ability
Spasticity, coordination or environmental issues that preclude proportional head control

3-Axis Fiber Optic System With 3 Switches - ASL Optic Array (PASL 107)
3 fiber optic switches at end of tray
2 switches control directions - cover right switch for right, cover left switch for left and cover both together for fwd/rev
A 3rd switch is used for the fwd/rev toggle and for accessing the modes menu

3-Axis Fiber Optic System With 4 Switches - ASL Optic Array (PASL 108)
4 fiber optic switches in a tray
3 switches for directions - 1 for right, 1 for left, 1 for fwd and rev
4rd switch for fwd/rev toggle and accessing modes menu

Appropriate client for 3-axis fiber optic arrays has:
Limited but adequate control, ROM and strength in at least 2 fingers to access switches and the ability to differentiate between the switches in the array
Adequate cognitive ability

Single Switch Scanner
Single switch controls all functions
A moving display scans between arrows in a circle which represent the directional commands and the mode switch
User activates the switch when desired command lights up
Can adjust the speed of scanning to meets user's needs - slower for user with less coordination or faster for quick responses to environmental needs
Latch allows more functional operation, but user must be able to access and control a second switch for an emergency stop function

Appropriate client has:
Only one (or 2) point(s) of access and strength, coordination and ROM at access point inadequate to control any other proportional or non-proportional input
Sufficient cognitive ability, response time and coordination to operate safely/functionally
Does not have spasticity that would interfere with safe operation

Sip and Puff
Four pneumatic switches for 4 directional commands
Hard puff = fwd, hard sip = rev or stop, soft puff = right and soft sip = left
Can calibrate sensitivity of each command separately
Can be operated by vent-dependent user
Latch is a must to provide much easier course correction and turning control

Appropriate client has:
No functional use in UEs/LEs and inadequate head/neck strength for chin/head control
Spasticity and/or rough terrain/obstacles that might make chin or head control unsafe (unable to maintain contact or control)
Preference for the tubing vs the chin control box

Sip and Puff Head Array
Combination of sip and puff and head switches programmed as a 5-switch system
Provides 4 directions through 2 different types of switches
2 pneumatic switches for fwd and rev are activated with any puff and sip

3 proximity switches in a head array for right, left and mode are located in the side pads of headrest

Appropriate client:
Has difficulty differentiating between hard and soft inputs
Cannot access and/or differentiate all switches within the head array
Has cognitive or physical issues that limit ability to use separate switch to toggle fwd and rev functions and access modes menu on switched head array

2 Different Input Devices
Interface box that allows 2 different devices to be used on the same chair
Could be one proportional and one non-proportional - i.e., a joystick and a non-proportional specialty control
Use a switch on the box or a remote switch to control which input is currently active
Provides battery charging port
Switch-It Attendant Joystick Connector (ATD-QTARS)
ASL Multi Input Switch Box

Appropriate client:
Has condition that causes variable function, strength, endurance throughout the day

INTEGRATING AUXILIARY DEVICES

Augmentative communication devices, computers and/or environmental control units (ECU)

Can operate auxiliary devices through the drive input device (either a remote joystick or specialty controls)

Auxiliary Functions With Specialty Controls
ACM Interface Box
Interfaces between the controller and the auxiliary device(s) and provides control of 1 or 2 devices through the input device
2 channels (ports) provide 4 switch closures in each channel with 4 commands in each channel (fwd, rev, left and right)
Two types of cables connect the ACM to the auxiliary device - 9-pin to 9-pin or 9-pin to 4-mono plugs

Auxiliary Functions With a Qtronix Joystick

Switch-It Echo Tek
Provides 4 switch closures for auxiliary functions
Requires the use of the ALM as it utilizes the ports for tilt or recline on the ALM. The 9-pin port on the EchoTek connects a cable to the auxiliary device
To operate aux devices push the joystick toggle up twice to access the actuator display on the joystick, then use right/left commands to access the "actuators" that correspond to the ports used in the ALM for the Echo Tek. Use fwd/rev to operate the actuators

Switch-It SWECU
Interfaces between joystick and controller without any other interfacing box

8 potential switch closures for auxiliary functions provided by 2 cable types – a 25-pin to two 9-pin connectors or a 25-pin to one 25-pin connector and 4-mono plug connectors A single remote switch toggles the joystick between drive and the 2 auxiliary devices and indicates with auditory beeps (short, medium, long) which mode the user is in. If only one auxiliary device is being used, the other "mode" can be used as standby mode

OTHER
Link Selector
Allows use of more than one device for evaluation purposes. Both input devices must be programmed as the same type (i.e. both as joysticks or both as 5 switches, etc)
Can turn individual sensors on and off as needed
For example, plug a proximity switch tray array with 3 switches and a head array with 2 switches into the two 9-pin ports. Flip both top toggles to "On". Flip the lower toggles for right and left to headrest (HD) and the lower toggles for fwd, rev and toggle to tray (LP). The client uses headrest for right and left and tray switches for fwd, rev and mode

Remote Stop
Receiver - plugs into controller or ALM/ACM and mounts on the chair
Transmitter (like a garage door opener) activates the remote stop. It operates by a 9-volt battery and functions to ~ 50 ft. The red light indicates that the switch is active. If switch is activated while chair is in motion, the red light comes on and chair stops. To start chair in motion, wait ~ 5 seconds, then activate the white switch a second time

Mouse Mover
Provides the ability to move a computer mouse with the joystick

A transmitter interfaces between chair controller and joystick and a receiver plugs into computer mouse port

A separate switch toggles the joystick between driving the chair or controlling the computer mouse.

IN SUMMARY - SOME QUESTIONS TO ASK:

Does client have a progressive or improving condition?

What is the most functional way for them to control the chair? Now? In the future?

Are they likely to lose/gain function

What might they require to remain functional and independent?

Will upgraded electronics be necessary (i.e. joystick to alternative input device)?

Will additions to electronics be necessary?

Integrating boxes for other input devices or auxiliary devices?
What would need to be added?

How expensive and complex would it be?

Are there additional programming features in the specialty controls that would add function or independence

Might the client need more than one input device due to variable needs through the day
Does client require sophisticated tilt/recline/power ELR functions now or in the

Notes:

Simultaneous Paper Sessions Group 1

Effect of Seat Inclination on Seating Pressures of Individuals with Spinal Cord Injury

Chris Maurer, MPT, ATP, Stephen Sprigle, Ph.D., PT

Background and Purpose
Manual wheelchair configurations commonly include "squeezing" the wheelchair frame to improve balance for users with spinal cord injuries. This squeezing is achieved by lowering the rear portion of the seat relative to the front of the seat while maintaining the same back angle. The study's purpose was to examine the effect of increasing posterior seat inclination on buttock interface pressures.

Subjects. Nine male and 5 female subjects (mean age=37 years, SD=11.2, range=19-55) with complete thoracic or lumbar spinal cord injury were tested.

Methods. Subjects sat on a pressure mat placed over a foam cushion. Pressure readings were taken at seat angles reflecting seat height decreases of 0, 5.1, 7.6, and 10.2 cm (0, 2, 3, and 4 in) of the rear of the seat relative to the front of the seat. An analysis of variance and Duncan multiple range test were used for data analysis.

Results. No meaningful differences were found in measurements of interface pressure (dispersion index, contact area and seat pressure index), total force on seat, or peak pressure index with posterior seat inclination.

Discussion and Conclusion. The data indicate no meaningful evidence that squeezing a wheelchair frame increases seat interface pressures.

Notes:

Relationship Between Cushion Type, Backrest Height, Seated Posture and Reach

Stephen Sprigle, Ph.D., PT,
Director, Center for Assistive Technology & Environmental Access,
Georgia Institute of Technology, Atlanta, Georgia

Background: Seated posture and trunk control are important factors affecting upper extremity function of wheelchair users. A stable pelvis and trunk are required to provide a base from which upper extremity movement occurs, but, conversely, the ability to move one's trunk and pelvis can increase functional ranges of motion. For wheelchair users, balancing sufficient trunk support with adequate trunk mobility has important functional and medical consequences.

Objective: To determine the effect of cushion and backrest height on posture and reach and to determine the relationship between postures and upper extremity (UE) reach using a randomized 2X3 repeated measures factorial design.

Methods: Twenty-two subjects with spinal cord injury sat on three types of cushions – segmented air, contoured viscous fluid/foam, and air/foam and with two of three backrest heights – referenced T12, inferior scapular angle and scapular spina- while performing unilateral and bilateral reaching tasks – Seated posture (pelvic tilt and torso angle) and ASIA score were also measured.

Results: Pelvic tilt and ASIA score were significant predictors of reach. No evidence was found indicating cushion type or backrest height affected reach or posture. No consistent patterns of postures were found across cushion types or backrest heights.

Conclusions: The posture adopted by wheelchair users is a more important influence on UE reach than the cushion or backrest height used. Sitting with increased posterior pelvic tilt enhanced stability and permitted greater reach. Since subjects adopt different postures when using different cushions and backrest heights. Clinicians should monitor posture while assessing seating and function of wheelchair users.

Notes:

Development of Reliable Measures of Postural Stability

Stephen Sprigle, Ph.D., PT,
Director, Center for Assistive Technology & Environmental Access,
Georgia Institute of Technology, Atlanta, Georgia
Chris Maurer, Chris Maurer, MPT, ATP,
Shepard Center, Atlanta, Georgia

Background and Purpose: For wheelchair users, balancing the need for trunk stability with adequate trunk mobility has important functional consequences. ADL activities require instances of stability while others – such as reach – benefit from trunk mobility Clinicians routinely attempt to measure postural control as they evaluate clients for wheelchairs and cushions. However, clinical tests than measure trunk control of wheelchair users have not been well defined. The objective of this study was to determine the relationships between clinical measures of reach/stability/and performance of ADLs. Quick tests that can be performed in a clinic setting to determine postural stability and relate to performance of ADL's would be beneficial to clinicians evaluating clients for wheelchairs.

Subjects: two separate cohorts of wheelchair users with SCI: 1) 22 subjects who were at least 12 months post-injury and 2) 25 subjects who were <6 months post-injury.

Variables: 4 clinical measures of reach and balance from a seated position in the subjects own wheelchairs and 22 ADL activities. The four clinical measures are functional reach, sitting balance (unsupported), unilateral reach area and bilateral reach.

Results: All clinical measures demonstrated good test-retest reliability. Tow measures, bilateral reach and reach area, explained the most variance across the ADL activity performances.

Conclusion: The data indicate that clinicians may use clinical measures of reach to help determine the postural stability of their clients and that the results can be related to ADL activity performance.

Notes:

A Seating Interface Test Fixture Design To Simulate Asymmetric Anatomical Loads

Allen R. Siekman, BS; Alida Lindsley, BS
Beneficial Designs, Inc., Minden, Nevada

Abstract
The development of international standards for wheelchair seating is ongoing. One part of the current International Organization for Standardization (ISO) work on wheelchair seating standards includes the development of test methods and test fixtures to categorize the pressure distribution properties of wheelchair seat cushions. An adjustable Skeletal Loading Indenter (ASLI) test fixture was designed to include skeletal and soft tissue components that represent the anatomy of various categories of seated people with symmetrical and asymmetrical pelvis orientation. The adjustable pelvis components are encased in a gel material to simulate soft tissue envelopment. The ASLI was then tested in different pelvic orientations using a load/deflection test fixture and pressure measurement system on 3 commercial wheelchair cushions.

Background
With the adoption of ISO standards for wheelchair seating, the use of standardized techniques and tools for wheelchair cushion testing will be possible. The ISO standards working groups have recognized the need to test cushions for pressure distribution characteristics. To date, this work is in its preliminary stages, and will be integrated as a new section of the standard.

Anatomical indenters with soft tissue and skeletal substructure have been included as part of the planned work activities. Previous work has been done on symmetrical soft tissue indenter designs but this work did not include the ability to test cushions with the type of pelvic asymmetry commonly found in clinical application. In addition to pelvis asymmetry, previous indenter designs do not allow adjustment for the differences found in normal male/female anatomy.

Design
The ASLI test fixture was designed to simulate a symmetrical pelvis/femur orientation as well as incorporating adjustments that would allow asymmetrical orientation. These adjustments include the ability to simulate pelvic obliquity (10°), posterior pelvic tilt (15°), and pelvic rotation (10°) or any combination of these postures. In addition, the ASLI is designed to allow adjustment for male/female pelvic width differences.

Discussion
In previous soft tissue indenter designs, the pelvis and femur structures were purchased from anatomical model manufacturers. While these components work well, they require extensive modification for use, and are not readily available worldwide. To eliminate this problem surrogate pelvis components were designed that could be reproduced with simple tools anywhere in the world. The surrogate pelvis components consist of right and left ischial blocks, a sacrum/coccyx block and femur components that represent the key weight bearing areas of the skeleton in a sitting orientation.

Further testing and development of the ASLI test fixture will contribute to the development of international seating standards.

The Sub-ASIS belt: a New Concept In Pelvis Control

Allen R. Siekman, BS; Jamie H. Noon,
Beneficial Designs, Inc. Minden, Nevada USA

Abstract
One of the most common components used for pelvic control in wheelchair seating is the lap belt. Lap belts are available in numerous configurations and offer varying degrees of pelvis control. A much more aggressive control of pelvic movement can be achieved with the sub-ASIS bar. In clinical application, however, many wheelchair users are not able to tolerate the rigid Sub-ASIS bar due to discomfort or lower abdominal compression. When trying to control pelvic movement, the best results are often achieved when control can be applied over the bony pelvis structure instead of the soft tissue mass above and around the pelvis. Ideally, the controlling force should be applied to the anterior superior illiac spine or the sub-anterior superior illiac spine (sub-ASIS) areas of the pelvis. When applying an opposing force to these areas with a pelvic belt or sub-ASIS bar, the soft tissue mass that lies between the two ASIS contact points is compressed. The amount of compression varies with the body shape of the person, but a significant amount of compression is found even with very slender people.

Background
When trying to stabilize the pelvis and prevent unwanted pelvic movement, it is natural to apply the lap belt as tight as the user will allow. This approach can be very effective, but has low compliance outside the clinic setting. As the lap belt is tightened, or when the sub-ASIS bar is put into place, there can be significant compression of the soft tissue of the lower abdomen. This is quite obvious for individuals with a large body mass, but can also be problematic for people that are quite thin. The complications that arise when using a tight lap belt or sub-ASIS bar include discomfort and compression of the stomach and bladder.

Design
The sub-ASIS belt was designed to help maintain pelvic position while minimizing soft tissue compression of the lower abdomen. The design consists of two tapered pads that are attached to the user interface side of the lap belt and are adjusted to contact below the ASIS. These pads apply controlling force to the pelvis through the relatively shallow soft tissue covering in that area. Pressure is applied to the two ASIS contact points through the tapered pads. The section of lap belt between the two ASIS contact points is held away from the soft tissue by the padded sections, thus reducing soft tissue compression.

Discussion
The point of contact between the pad and the pelvis can be adjusted to provide rearward pull when used with a dynamic pelvic device such as the HipGrip, or the more standard 45 to 60 degree angle of pull that is common in general seating system use. The sub-ASIS belt design can be used with two-point or four-point lap belts. When used with a four-point belt, the position of the tapered pads can be maintained more accurately, especially when used with clients that have strong extensor thrust patterns. The sub-ASIS belt concept represents a new approach to providing pelvic control with a decreased degree of abdominal compression. Initial use of this belt design indicates that the degree of pelvic control is similar to the sub-ASIS bar or four-point lap belt.

The Anti-Thrust Seat: Proper Implementation and Use

Allen R. Siekman, Director of Seating and Design,
Beneficial Designs Inc. Minden, Nevada USA

Abstract
The Anti-Thrust Seat (ATS) cushion was first presented by the author at the International Seating Symposium in 1981. The ATS is designed to help control unwanted pelvic movement, primarily posterior pelvic tilt and forward pelvic movement due to extensor thrust. The Anti-Thrust seat cushion is offered as a standard cushion selection by nearly all of the commercial manufacturers of build-to-order seating systems. In the past few years, there has been a great deal of discussion on the advantages and disadvantages of pelvic movement within the seat system. Recent product development related to pelvic control has emphasized the value and role of the Anti-Thrust Seat in successful seating intervention.

Background
The most common method of maintaining pelvic stability in the wheelchair seating is by applying a postural control across the top of the pelvis, usually at or near the anterior superior illiac spine (ASIS). Lap belts in many different configurations as well as more rigid systems such as the sub-ASIS bar are commonly used. The application of a belt or other device at the ASIS may lock the top of the pelvis to the rear of the seating system or wheelchair, but does little to prevent the lower half of the pelvis from moving forward. It is not possible to prevent the lower pelvis from moving forward by applying controlling forces to the upper pelvis alone.

Design
In a seated posture, the ischial tuberosities (IT) extend below the trochanteric shelf and femur. In its simplest form, the ATS was designed to create a physical block in front of the ischial tuberosities. This block, when used in conjunction with a lap belt or other control mechanism at the ASIS, can limit the forward movement of the IT and provide improved pelvic stability. The basic ATS cushion is fabricated using three simple components: a plywood base, one layer of rigid foam (the anti-thrusts block), and one layer of softer foam. The anti-thrust block is typically fabricated from 1.8 – 2.2 pound density rigid polyethylene foam. To provide a physical barrier to ischial movement, the rear section of the anti-thrust block should be vertical or nearly vertical. Recent examination of commercial ATS cushions reveled that many were either constructed completely of soft foams or had a tapered anti-thrust block. A tapered rear edge at the anti-thrust block will not stop ischial movement, but will allow the IT to move. An ATS cushion fabricated entirely from soft foams will allow foam compression at the anti-thrust block and will not prevent ischial movement.

Discussion
In order to obtain maximum pelvic stability from the ATS, the anti-thrust block must be properly located. To determine the exact location of the ischials, have the client sit on a sample piece of visco-elastic foam while the optimal posture and pelvic alignment is determined. After sitting for 10-15 minutes, the clinician can either locate the ischials by palpation or have the person transfer and then mark the IT indentations on the foam. The rigid foam anti-thrust block will be approximately 3 inches forward of the IT marks (prior to adding the outer foam layer). Many variables such as body mass, pelvic orientation, other orthopedic complications and the thickness

of the outer foam layer can alter these general guidelines. When properly fabricated and fitted, the ATS cushion can provide improved pelvic control and stability.

Notes:

Simultaneous Paper Sessions Group 2

Pressure Management in Positioning Clients with Severe Pelvic Obliquity using Pressure Mapping Technology

Michael Banks, M.A., CRTS, ATS Director, Walla Wall HomeMedical Inc.,
Walla Walla Washington,
Eva K. Ma, OTR, ATP, PC Private Practice Portland, Oregon

Summary

Two individuals with severe fixed scoliosis were evaluated. The primary goal for the client was to achieve better head and shoulder orientation while allowing the pelvis to adopt an oblique position. When compromising pelvic position for head and shoulder position, the buttocks may no longer evenly bear most of the weight of the client. Assessment tools should be employed to evaluate the potential consequences of aggressive postural manipulation. Pressure mapping was employed for this purpose.

The information obtained for the clinician was 1) identification of high risk areas (using pressure mapping) when allowing a pelvic obliquity, and 2) assessing the effectiveness of different interface materials (using pressure mapping) in mitigating potential increases in pressure on bony prominences while allowing an oblique pelvis. Pressure mapping information was used directly in the design of custom contoured cushions. Four comparisons were made with each individual, using different material interfaces. Increased interface pressure was observed on ischial tuberosities and/or trochanter on both clients while tilted laterally in their existing seating systems.

Clients were molded using the Pindot Contour U (Invacare Corp.) molding bag system. Pressure mapping was conducted using the Xsensor system (Crown Therapeutics) during the molding process. Each of the four cushions was made from the same cast of the clients. One cushion was manufactured "as molded" and the other three were modified with one of three materials in a recessed area determined by the pressure map. The materials were the Pindot "***Soft Spot***", a custom sized single valve **Roho**, and a custom-cut piece of ***Pudgee*** foam.

The comparisons between materials was done within the context of the individual client, and no generalizations are made as to the respective ranking of materials across a population of clients.

One client appeared to show the best distribution of pressure with the Pindot Soft Spot, and the other with the Roho insert.

Our results suggest that pressure mapping provides useful information that can be used in the design of custom contoured cushions. We have also shown that the respective materials give significantly different results within the context of the individual client, and that one material is not necessarily better than another between clients.

Our results also suggest that laterally tilting a client in a seating system designed in a level orientation in space may place bony prominences at higher risk for skin breakdown than a custom contoured system. Molding a client in the orientation-in-space in which they will ultimately be in a finished system appears to mitigate the effects of the center of mass moving more over the oblique side of the pelvis.

Pilot Study to Detect Blanche Response

Jean Zanca, MPT, Ph.D (candidate),
Research Associate, Department of Rehabilitation Science and Technology,
University of Pittsburgh, Pittsburgh, Pennsylvania

Abstract: Wheelchair users are often at high risk for pressure ulcer development. Early stage pressure ulcers are often difficult to diagnose in dark skin because the skin's pigment masks color changes associated with early pressure damage. This study will use visible and near-infrared spectroscopy, a technique in which light reflected from the skin is analyzed to identify tissue constituents, to identify the blanch response in light and dark skin over bony prominences. Information from this study may contribute to the development of clinical devices to facilitate diagnosis of early stage pressure ulcers.

Notes:

Customized Back Prosthesis Fitting to provide trunk stability Following High Level Cord Injury. A Modular Concept Of Stabilisation

Peter Jung, CPO
Swiss Paraplegic Center Nottwil Orthotec
Nottwil AG, CH-6207 Switzerland

The following lecture describes the development and manufacture of modulare backrest orthosis by means of a stabilisation systems for patients following high level spinal cord injury.

Because of absent or insufficient trunk stability, patients with high level spinal cord injury are no longer able to independently stabilise their upper body in the wheelchair.

Standard marketed systems seldom provide adequate pressure sore prophylaxis where simultaneous stabilisation, straightening and correction of the upper body is concerned. In co-operation with occupational therapy and physiotherapy departments of the Swiss Paraplegic Centre Nottwil, customised backrest orthosis modelled from a plaster casts are manufactured by Orthotec Nottwil AG, by means of a modular system which offer optimal precision in fitting, are cosmetically inconspicuous and may easily be removed at any time to facilitate wheelchair transport.

The physiological properties are presented in preconsultation.

Notes:

Corrective Seating and Pain: A Role for Intramuscular Stimulation

Daryl Caves, B.Sc.; Grant Huston,B.Sc., PT;
Ian Denison, PT ATP, GF Strong Rehab Centre, Vancouver, British Columbia

Clients who have been utilizing a wheelchair for locomotion for a number of years invariably change over time due to the sequelae of aging. They usually come to us for intervention because they want pain relief and want to gain back their previous level of function. Myofascial pain predominates in this population and has a potentially wide-ranging influence on the clients' postural alignment and function. Intramuscular Stimulation (IMS), a dry needling technique using acupuncture needles, is a proven modality for treating musculoskeletal pain secondary to peripheral neuropathy. This pain modality, through its neuromuscular system modulatory effects, reduces contracture, which allows for corrective seating changes.

Clinicians need to be careful when assessing a contracture as a fixed deformity in this population. A thorough assessment of the soft tissues must first be made. A trained IMS practitioner will look for subtle cues regarding the underlying pathology of the musculoskeletal system. These signs can be detected during a comprehensive musculoskeletal assessment.

Musculoskeletal or myofascial pain is the most common form of persistent pain. This pain has many different proposed etiologies, pathophysiologies and treatments. When primary nociceptive and psychological causes for pain have been ruled out, a common source is from supersensitive structures secondary to peripheral neuropathy. Neuropathic pain is a term introduced by Gunn in 1978, utilizing Cannon's law of denervation supersensitivity to describe pain associated with peripheral neuropathy, and has expanded to include any pain which is sustained by aberrant somatosensory processing in the peripheral and central nervous systems. Damage to a peripheral nerve produces post-injury hypersensitivity due to peripheral and central sensitization.

After more than 20 years of clinical trials, observation and careful research, Gunn has proposed a radiculopathy model for this neurogenic cause of myofascial pain. He found that often, supersensitivity of musculoskeletal structures causing persistent pain occurs after damage to a peripheral nerve at the nerve root. The most common cause of this is from spondylosis, where the nerve root is subjected to irritation from pressure, stretch, angulation, and friction. Spondylosis is a normal degenerative sequel to aging and exists within the population in all gradations. Peripheral neuropathy of this nature is often found in a significant number of apparently normal, young (under 30 years old), pain free individuals. Neuropathy from spondylotic changes are accelerated in the wheelchair using population.

Neuropathy is most commonly seen at the nerve root level (radiculopathy). The signs and symptoms being looked for in the IMS assessment reflect this. There will be mixed sensory, motor and autonomic disturbances that will present in the dermatomal, myotomal, and sclerotomal target structures supplied by a segmental nerve. Sensory manifestations of peripheral neuropathy include allodynia (mild stimulus causing extreme pain), and hyperpathia (heightened sensitivity to sensation). Autonomic manifestations include vasoconstriction (affected parts are colder), heightened sudomotor (sweating) and pilomotor (goosebumps) activity, and trophic changes (trophedema). The motor manifestations, because of the large diameter of motoneurons and primary afferents, are usually the first to appear.

Muscle shortening is an early and regular feature of radiculopathy, with tight muscle knots being felt in most individuals. Supersensitive skeletal muscle fibers overreact to a wide variety of chemical and physical inputs, including stretch and pressure, and they have a lowered threshold to acetylcholine. These changes upset the normal properties and responses of skeletal muscle. Instead of muscles contracting and relaxing properly, with all muscle fibers acting in unison as in a "contraction" different fibers contract individually and without coordination. In the early stages, there may be twitches, cramps and spasms. Later, the condition becomes a "contracture" when there is a chronic shortened state, and parts of the muscle may be felt as tender, ropey strands.

IMS involves using acupuncture needles to specifically target injured muscles, which have contracted and become shortened from distress. These shortened muscles cause pain not only in the affected muscle itself, but also from the resulting stress on surrounding tendons and joints. IMS treatment causes the muscle to "grasp" the needle, which in turn forces the shortened muscle to release, providing relief from pain, and of special importance to the clinician looking at posture and seating, reduces contracture.

Seating specialists are experts in assessing posture and alignment based on bony anatomy and assessing ROM. They are also experts in determining the causes of pressure and shear. A comprehensive seating assessment is becoming a fixture in the seating specialist's repertoire. As a result, we are better at assessing whether limitations in movement are fixed or flexible and how to position the client for better outcomes in terms of fewer complications of soft tissue breakdown and orthopedic deformities. The addition of a comprehensive soft tissue assessment to the predominantly bony and range assessment (seen in most current physical seating assessments) is a necessary part of determining the potential for positive change in our client's neuromuscular systems, and more globally, in their posture and seating. An IMS assessment can pick-up subtle problems in the neuromuscular system that can be treatable, and when timed properly in the scope of a progressive seating plan, can create the chance for corrective seating changes instead of accommodative seating changes.

Accommodative seating changes are often necessary with many of our clients, but should always be the last resort. If there is the potential for positive change in our client's bodies it must be explored. IMS is primarily a pain modality, but can reduce contracture in soft tissue that allows better seating and positioning of our clients, and a greater chance for improved function and comfort.

Notes:

Effects of Camber on Energy Cost in the Experienced and Inexperienced Wheelchair User

Angie Perdios, M.Sc, School of Human Kinetics, UBC; Bonita Sawatzky, PhD, Assistant Professor, Department of Orthopaedics, UBC

Abstract:

Background: Wheelchair camber is the inclination of the rear wheels from vertical when viewed from the front. The proven benefits of rear-wheel camber are varied. In terms of energy cost and manoeuvrability, camber may appear to influence wheeling efficiency to a large extent. The few studies that have examined the energy cost of camber during wheeling have had differing results with most studies reporting an improvement in wheeling efficiency and overall ease of mobility.

To date, this is the only study that has examined the effects of rear-wheel camber on energy cost in the experienced disabled individual during over ground steady state wheeling. Purpose: The purpose is to determine if there is a difference in energy cost between 0°, 3° and 6° of camber in disabled experienced wheelchair users during over ground wheeling. A secondary purpose was to determine if these differences were consistent across all three groups.

Method: Three groups of subjects were examined: experienced disabled wheelchair users (T6 lesion and below) (DIS), able-bodied individuals with experience at manual wheeling (EXP), and able-bodied individuals with no experience at manual wheeling (IN). Subjects were tested using 0°, 3° and 6° of camber during steady state manual wheeling in slalom over a smooth hard surface. Data on heart rate, rating of perceived exertion (RPE), the visual analog scale for comfort (VAS) and a user preference questionnaire were collected for subjects in all three groups. Expired gas analysis and heart rate variability (HRV) were also collected for the DIS group.

Results: No significant difference in measures of energy cost, RPE, or VAS was shown for camber angle or group. Six degrees of camber emerged as the angle most preferred in terms of stability on a side-slope, hand comfort on the pushrim, manoeuvrability and overall preference. Discussion: All subjects, regardless of wheeling ability or injury status, showed no physiological preference for either 0°, 3° and 6° of camber. Specific questions about camber and stability, comfort and manoeuvrability showed there was a preference for 6° of camber across all groups.

Notes:

Simultaneous Paper Sessions Group 3

Lateral Tilt-in-Space: Innovative Design for a Unique Problem

Kevin Clements Manager/Orthotist, Seating and Mobility Department, Regency Park Rehabilitation Engineering; Jan Geddes, Physiotherapist, Intellectually Disabled Services Council (IDSC); Michael Bebb, Senior Speech Therapist, Adult Therapy Services, Independent Living Centre South Australia ; John Reeves, Senior Seating Technician, Regency Park Rehabilitation Engineering, South Australia

Abstract

This paper will detail the assessment, design, development and application of two different custom lateral tilt-in-space transit wheelchairs for two clients with profound physical disabilities.

Both clients presented with standard tilt-in-space transit wheelchairs with custom foam-in-place seating inserts.

Both have a 90 degree scoliosis, one in the Lumber region and the other Thoraco-Lumbar, one convex left and the other convex right.

Client “A” has no hip flexion and little or no knee flexion and client “B” has one hundred and ten degrees of hip flexion in her left and zero in her right and adequate range in both knees.

They are non-verbal, however both are able to communicate slightly with facial expressions, but reliability is questionable, but client “B” quickly becomes agitated when uncomfortable.

The client’s speech therapist has indicated that both have swallowing and feeding issues and need a set head position for feeding.

The lateral tilt-in-space system was designed to help alleviate chronic pressure areas and provide a change in position. The chairs were built from the ground up in the department using standard transit wheels, castors, brakes, etc, but the frame was fully custom made in-house.

Client “A” has, in the past, pressure areas on his left trochanter, which is where he weight-bears, and more recently on a bony prominence on the distal sternum. It is this pressure area we hope the lateral tilt-in-space will be most effective in relieving.

Client “B” has pressure on her right trochanter and has problems with reflux when pressure is applied to her abdomen. The ability to tilt the chair and seating laterally will alleviate some of the abdominal pressure.

We feel that having the ability to tilt the seating system laterally will provide added comfort, change of position and pressure management where standard tilt-in-space in the past has not.

Both chairs are on trial with the clients in their community houses with, so far, promising feedback. A full evaluation of the completed chairs will occur over the next six months.

A Retrospective of Three Years of Lateral Tilt-in-Space

Dave Cooper, M.Sc. Kines, Rehabilitation Technologist,
Sunny Hill Health Centre for Children, and,
Priority Posture Systems, Vancouver

INTRODUCTION

Lateral tilt-in-space is not a new concept. In 1989 Jody Whitmyer reported on a dual axis tilt adaptation to a Fortress Scientific power base. As well there have been lateral tilt-in-space systems provided in various custom applications for some time. Permobile has a powered lateral tilt option that enables the wheelchair user to tilt 15 to 20 degrees in both directions and Gunnell has a manual lateral tilt system.

The objective of this paper is to present the results of the clinical application of 17 lateral tilt-in-space systems that were provided by Sunny Hill Health Centre and Priority Posture Systems. All these systems were custom devices provided as part of the equipment provision process of these two services providers.

BACKGROUND

All but two of the lateral tilt-in-space systems provided were of the same style, (figure 1). They consisted of a large rotational bearing mounted vertically to the wheelchair frame. The back of the client's seating system was attached to front side of the bearing. The bearing was positioned at approximately the center of gravity of the client and seating system combined. This put the pivoting axis through the frontal plane somewhere in the lower abdomen. If stops to the lateral tilt were not used the client could be rotated until his or her shoulder would come in contact with the wheelchair seat rail. The footrests and armrests were attached to the seating system so they rotate with the seat. The first system provided was a dual pivot system with one pivot point behind the small of her back plus one at right angles to it under her pelvis. Including the standard wheelchair tilt, she had 3 pivoting axis'.

Figure 1: The lateral tilt-in-space systems for clients number 15 (left) and 7 (right).

Each system required the seat to be raised approximately 2 inches above the wheelchair seat rails to give clearance to rotate. This varied depending on the amount of tilt required and the configuration of the wheelchair. The weight of the lateral tilt hardware ranged from the small manual systems at 11 pounds to the heavier powered systems at 30 pounds. The manual lateral tilt systems cost $1,600 and powered systems were $2,400.

The other 2 of the 17 lateral tilt systems were manufactured by Ranger Wheelchairs in Surrey B.C.. They were powered systems that enabled about 15 degrees of lateral tilt in both directions and were integral to the custom power wheelchairs being provided.

A brief description of the clients and why they were thought to be candidates for lateral tilt is provided in table 1. All the clients except one required custom contoured seating of which the majority required considerable extra attention to ensure appropriateness. The exception was client 12 who was on a Roho cushion with an old CPSC back support. All the clients in manual wheelchairs were dependent for mobility.

Table 2 shows the type of wheelchair each client had and features of the lateral tilt system. All the wheelchairs had conventional anterior/posterior tilt systems.

RESULTS

The clinical goals of the lateral tilt systems were varied. The one consistent goal was to increase sitting tolerance. This may have been related directly to comfort or pressure, or specific issues that would make sitting prohibitive such as inability to manage saliva. The increased sitting tolerance was achieved in all instances. Keep in mind that at the same time as receiving the lateral tilt system most of the clients were receiving adjustments to their seating systems or receiving new seating systems. This puts into question the source of the positive results but there were specific instances when the results were entirely attributed to the lateral tilt. For example, client 2 prior to getting his custom seating system could only sit for 5 to 10 minutes, after receiving his custom contoured seat he could sit for 1 to 2 hours. But, after receiving his lateral tilt he could sit all day. Another example is client 5, a young fellow with advanced Duchenne's Muscular Dystrophy. He required his mother to reposition him every 10 to 15 minutes. With his powered lateral tilt in conjunction with his existing anterior/posterior tilt he was able to reposition himself and only required his mother's assistance every hour or so.

In several instances there were orthopaedic goals such as reducing the overlap between the lower ribs and the iliac crest or to stretch tight neck musculature. These goals were achieved. For specified periods of time the seat would be tilted to use gravity to provide the elongation of the trunk or stretch of the neck. Though there were positive results as the lateral tilts continue to be used there is no evidence that there would be lasting effects. Client 3 was in the situation of requiring spinal instrumentation but needing more complete growth before the surgery. The lateral tilt has been credited for allowing the surgery to be postponed without an increase in his scoliosis.

For some of the functional goals the lateral tilts had immediate and obvious benefits. This includes assisting with head positioning or head balance and assisting with positional shifts. This was very apparent with the MD and SMA-2 clients. The lateral tilt enabled them to get some balance through their trunk and consequently improve shoulder/arm function. Client 11 with SMA-2 successfully met his own goal of being able to use his Nintendo again.

Four clients had improved gastric emptying and/or reduced gastroesophageal reflux for their goals. Anecdotal evidence suggests that these were improved. A follow-up barium study on client 16 showed that a posterior tilt of 30 degrees with the lateral tilt had dramatic improvement to gastric emptying.

The primary goal for client 7 was to improve her management of oral secretions. Saliva would pool in her mouth causing her to choke and gag. By tilting her slightly to the right the saliva would drain out or she would swallow it. The amount of tilt required to accomplish this varied, likely dependent in some part on her positioning in her seating system and internal factors such as tone and her ability to control her swallowing. Initially, 5 degrees of tilt were sufficient to alleviate the problem but recently 25 degrees has been reported as necessary.

Pressure relief was measured in one instance. Using a FSA pressure mat pressures were shown to be dramatically reduced on the non-weight bearing side of the trunk when tilted away from that side. It was also observed clinically that contact in the axilla from high trunk laterals could also be removed by tilting away from that side. This also suggests an elongation of the concave side of a scoliosis. Client 5, a thin client with Muscular Dystophy, used the lateral tilt to remove pain from his left hip. Before receiving the lateral tilt he would lean to the right within his back support to reduce the pain. With the lateral tilt he would tilt back and to the left and take more weight through his trunk, thus relieving the pain.

Use of 5 of the 17 lateral tilt systems were discontinued.

- Client 2 received a new TLSO and caregivers were finding that they were not using the lateral tilt. He used the system for 19 months
- Following spinal surgery, client 3 no longer required the lateral tilt
- Client 5 passed away. He used the lateral tilt for approximately 1 year.
- There were technical difficulties with client 12's system. He weighed approximately 150 pounds. When driving his wheelchair over uneven terrain the seating system would bounce. This was due to the cantilevered nature of the system and his weight. Also the increased height of the seating system was detrimental. He decided to have the lateral tilt removed after 18 months of use.
- With the introduction of a J tube, client 16 no longer required the lateral tilt after only 4 months of use.

The systems that were no longer required were removed and recycled for other clients.

SUMMARY / RECOMMENDATIONS

It is difficult to draw these results into a cohesive summary of when and how to use lateral tilt. Each client presents his or her own case study in which the details are important factors concerning the appropriateness and usefulness of such a tool. We have had very good results using lateral tilts, but these are just 17 clients out of approximately 1,000 seating systems that we provided over those 4 years. Also, for each of the 17 clients there was careful simulation before deciding on the use of a lateral tilt.

No.	Age	Diagnosis	Sitting Complexity	Reason for Lateral Tilt
1	31	CP, spastic quad	Severe	increase sitting tolerance reduce overlapping of pelvis and ribs
2	17	CP, spastic quad	severe	increase sitting tolerance reduce risk of skin breakdown reduce reflux, improve gastric emptying
3	14	spastic quad as result of encephalitis	Severe	allow him to hold head in midline reduce effect of gravity on scoliosis prevent skin breakdown under left arm
4	11	spastic quad sec to intrauterine cytomegalovirus	Severe	reduce pressure on side stretch tight neck musculature saliva management
5	14	Duchenne MD	Severe	reduce constant need for repositioning increase comfort and sitting tolerance reduce overlapping of pelvis and ribs
6	29	CP, spastic quad	Severe	increase comfort and sitting tolerance
7	16	Leigh's disease	moderate	saliva management reduce support required from headrest reduce overlapping of pelvis and ribs
8	17	metatrophic dwarfism and torticollos	Severe	increase sitting tolerance and decrease pain
9	17	metatrophic dwarfism and torticollos	Severe	increase sitting tolerance and decrease pain
10	37	CP, spastic quad	Severe	improve gastric emptying reduce overlapping of pelvis and ribs
11	12	SMA -2	moderate	head balance allow to slouch to side to get head up
12	17	Duchenne MD	Mild	allow him to hold head in midline which helped keep trunk straight
13	37	CP, spastic quad	Severe	increase sitting tolerance by allowing weight shifts and head positioning
14	14	Duchenne MD	Severe	pressure relief
15	5	SMA-2	moderate	head balance
16	6	CP, spastic quad	Severe	improve gastric emptying
17	15	CP, spastic quad	Severe	improve gastric emptying increase sitting tolerance through tone management

Table 1. Clients that received lateral tilt-in-space systems.
Note that clients 8 and 9 are twins. The "Sitting Complexity" column indicates the degree of difficulty clinically and technically to produce appropriate seating.

No.	Date Received	Lateral Tilt Type	Required Tilt	Wheelchair
1	Jan 00	manual, dual pivot	left & right 30°	Action AT
2	May00	Manual	right 30°	Solara
3	May 00	Manual	right 20°	Solara
4	July 00	Manual	right 60°	Solara
5	Aug 00	powered	15°, mainly left	Action Storm
6	Jan 01	manual	right 25°	Quickie TS
7	Feb 01	manual	right 5°	Solara
8	Apr 01	powered	left & right 15°	Ranger 904 custom
9	Apr 01	powered	left & right 15°	Ranger 904 custom
10	July 01	manual	right 30°	Quickie TS
11	July 01	powered	left 15°	Action Storm
12	Aug 01	powered	left & right 20°	Action Storm
13	Dec 01	powered, single switch	right 20°	Action Storm
14	July 02	powered	right 20°	Action Storm
15	Oct 02	manual	right 10°	Action Orbit
16	Apr 03	manual	right 30°	Action Orbit
17	Sept 03	manual	right 30°	Quickie TS

Table 2. Date each client received their lateral tilt-in-space, tilt particulars and wheelchair model.

REFERENCES

Jody Whitmyer – (1989). A Dual Axis Positioning in Space System to Reduce the Effect of Gravity on Spinal Curves. In RESNA proceedings, New Orleans, p167-168.
Gunnell Inc – www.gunnell-inc.com
Permobile – www.permobilusa.com
Ranger Wheelchairs – www.sur-biz.com/rangerwheelchairs/

ACKNOWLEDGEMENTS

I wish to acknowledge the contribution of the therapists that have worked with the children and adults presented. They have the foresight to recognize the need for options that are not currently available and the willingness to try new ideas: Elaine Antoniuk, Janice Evans, Jennifer Law, Catherine Ellens, Chris Smerdon, Jo-Anne Chisholm and Katie Elder. I would also like to thank Catherine Ellens who assisted in gathering the information presented in this paper.

Lessons Learned: The TOTWalker Grant Project

Christine Wright-Ott, MPA, OTR/L
Richard J. Escobar, BS, ATP
Mobility for Discovery
(Formerly Rehab Technology Research Projects,
Lucile Packard Children's Hospital at Stanford)
San Jose, California

The TOTWalker Grant was a field-initiated, 3 year research and development project funded through the U.S. Department of Education, NIDRR, OSERS, PR/Award H133G990103. The Project team designed a hands-free, highly maneuverable, support walker for very young children with disabilities. The TOTWalker prototype and the rational for its design will be discussed. Clinically relevant data, information and observations obtained during the project will be shared.

Notes:

Interface Pressure Mapping Feet: Weight Bearing and Non-weight Bearing Applications

Jillian Swaine, B.Sc. (O.T.) and Shannon McGrath, B.Sc. (O.T.)
Occupational Therapy Services, Calgary, Alberta

Abstract

Interface pressure mapping (IPM) is used as a clinical assessment and educational tool for clients who are at high risk for foot ulceration and amputation. IPM enables both static and dynamic plantar pressure measurements to be determined. Both weight-bearing during ambulation (e.g. diabetic) and non-ambulatory (e.g. spinal cord injury) clients have interface pressure mapping of their feet (IPM-F). There are three types of interface pressure mapping devices for feet: high resolution mini map designed for punctuate areas of the foot during stationary and dynamic mapping; full-foot map designed for stationary and dynamic ambulation assessments; and a stationary full-foot for stationary (stance phase).

For non-ambulatory clients (e.g. spinal cord injuries) or clients who walk minimally during their daily routines, foot wounds are common on surfaces other than plantar. For example, lateral mallioli wounds are common due to inadequately fitted shoes, lymphodema or side lying in bed. The angle on the angle adjustable footplates can increase pressures in the heels and cause skin breakdown.

The mini map is used to determine if pressures are present on the wound site in a variety of shoes and positions. The goal is to use the IPM-F early in rehabilitation to prevent foot wounds by identifying well-fitting shoes, managing lymphodema and identifying offloading devices (e.g. bed).

Case Study

Mr. D sustained a C6 spinal cord injury (complete) 2 years ago. He has dependent edema in lower legs with pitting in the feet. He has no muscle tone in lower extremities. His legs abduct when sitting and lying and his left foot everts. He has a Stage III wound on lateral aspect of left foot. (See Photo 1)

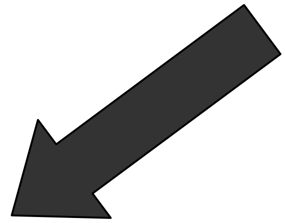


Photo 1. Mr. D has a Stage III that is healing on the lateral aspect of his left foot.

Assessment Phase

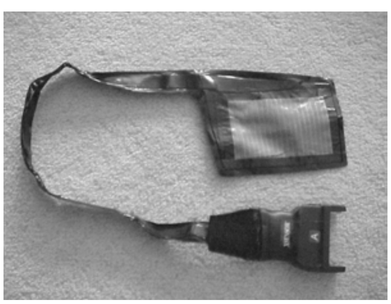
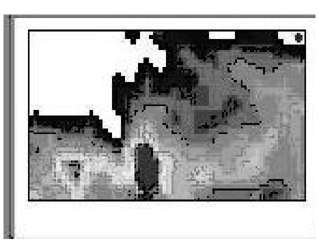
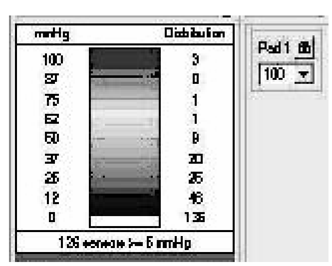
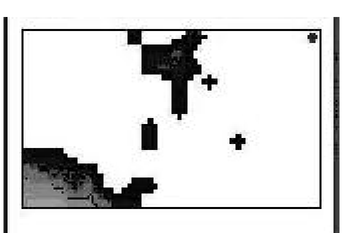


Photo 2 & 4. The mini map is shown on the left. It is taped over the wound site and shown in the running shoe on the right.





IPM 1. Mr. D. wearing a different pair of running shoes.



Note the high pressure (black area) in the middle of the IPM. This high pressure matches where the wound is located.

IPM 2. Mr. D. wearing the Darco® boots with the custom insert. There is no pressure over the wound site.

Treatment Phase

- Discontinue use of shoe on left foot;
- Fitted with a Darco boot with Plastazote custom insert;
- Velcro strap around thighs to maintain optimal leg/foot alignment;
- Compression stockings;
- Duoderm CGF with Aquacel.

Maintenance Phase

- Baseline lower leg assessment including Doppler, PPG
- Continue to wear pressure stockings;
- Footwear that has a wider sole and toebox;
- New wheelchair with a larger footplate and less front end tapering.

References

8. Bates-Jensen BM, Vredevoe, DL, Brecht, ML. (1992). Validity and reliability of the Pressure Sore Status Tool. Decubitus Nov;5(6):20-8

9. U.S. Department of Health and Human Services, Agency for Health Care Policy and Research. Public Health Service, May 1992. Pressure ulcers in adults: Prediction and prevention. Clinical Practice Guideline, Number 3. Rockville, MD: AHCPR. Publication No. 92-0047

10. U.S. Department of Health and Human Services, Agency for Health Care Policy and Research. Public Health Service, December 1994. Pressure ulcer treatment: Prediction and prevention. Clinical Practice Guideline, Number 15. Rockville, MD: AHCPR. Publication No. 95-0653

11. Inlow, S., Orsted, H., & Sibbald, R. G. (2000). Best practices for the prevention, diagnosis, and treatment of diabetic foot ulcers. Ostomy/Wound Management, 46(11), 55-67.

Notes:

Reducing The Risk Of Whole-Body Vibration Injury In A Car Seat Using A New Seating Design

Mohsen Makhsous, Crowther, Z., Lin, F., Taylor, E., Patel, J., Taylor, S., Pedersen, J.
Rehabilitation Institute of Chicago, Northwestern University, Chicago, Illinois

Whole-body vibration (WBV) is caused by machinery vibration [1] passing through the ischial tuberosities (ITs) and supporting areas on back of seated people [1]. The most widely reported WBV injury is low back pain and soreness [1]. Prolonged exposure may lead to adverse health effects that are divided into effects on health, activities, comfort and motion sickness. It can lead to considerable pain and time off work. Truckers, farm workers, mass transit operators, and others whose occupations involve long periods of sitting in moving vehicles are at especially high risks for injury due to WBV.

A new seat design, of which the back part of seat (BPS) can be tilted downward with respect to the front part of the seat and equipped with back support adjustable both in height and volume, introduces a new concept in more ergonomic sitting. The new seat design has been implemented into an office chair and a wheelchair. This mechanism introduces a novel concept in controlled sitting. In preliminary studies[2] on healthy subjects, we found that sitting with the lowered BPS and lumbar support in place, defined as **WO-BPS** posture, induced a significantly reduced interface pressure on the subject's ischium, an increased total and segmental lumbar lordosis, a forwardly rotated sacrum, and larger lumbar intervertebral heights. We hypothesized that a car seat implemented with the same mechanism will reduce the whole body vibration and segmental vibration (head, shoulders, elbows, knees) exposures associated with sitting due to the less rigid contact surfaces under ITs and increased softer contact surfaces under thighs and at the back, which will increase vibration isolation and the overall damping effect on the body. The primary objective of this study was to evaluate biomechanical benefit of this new car seat design in reducing WBV exposure during driving.

Twelve healthy drivers (23.0±7.8 years old (mean±SD); 73.3±13.3 kg in weight, and 180.0±6.7 cm in height) were tested. Ten tri-axial accelerometers were secured to the subjects and the car to measure vibration as the subjects drove down two different stretches of road. The subjects were asked to drive at a constant speed (40 mph) down both stretches of road with the seat in either the **Normal** (with the BPS level and flat lumbar support) or **WO-BPS** posture. The vibration collected during **Normal** and **WO-BPS** trials were then weighted according to ISO 2631-1 and the fourth power vibration dose method (VDV) was calculated and compared between **Normal** and **WO-BPS** postures.

Results showed that the new car seat design significantly decreased vibrations in the ITs and lumbar spine regions, by 62 ± 20% (P=0.001) and 60 ± 24% (P=0.003), respectively. Furthermore, no harmful levels of vibrations were found at any of the other locations on the body where accelerometers were placed. Also found was that by alternating the sitting postures between the **Normal** and **WO-BPS** increased the seating comfort. We conclude that this new car seat design has the good potential to largely reduce the exposure of WBV in drivers, especially those with professions involving long period driving.

1. **Mabbott N, Foster G, McPhee B.** Heavy vehicle seat vibration and driver fatique. Dept. of Transport and Regional services Australian Transport safety Bureau. 2002
2. **Makhsous M, Lin AF, Hendrix RW, Hepler M, Zhang L-Q.** Sitting with adjustable ischial and back supports: Biomechanical changes. Spine. 2003;28:1113-21.

Pelvic Positioning Evaluations for Wheelchair Selection: A Comparison between In Person and Video Conferencing

Ana Allegretti, OTR/L, Shirley Fitzgerald PhD, Mark Schmeler, M.S., OTR/L, ATP, Rory Cooper PhD, Michael Boninger MD, Nigel Shapcott M.Sc., ATP.
Human Engineering Research Laboratories- Va Pittsburgh, Pennsylvania

Purpose

The purpose of this study is to assess the feasibility of using Plain Old Telephone System (POTS) teleconferencing to compare the pelvic and trunk positioning portion of the physical motor/mat assessment between therapists conducting in-person (IP) assessments and through telerehabilitation (TR).

Methods

Four licensed therapists with experience in seating and mobility evaluations conducted assessments on a group of 20 wheelchair users. The group consisted of ten females and ten males with a mean age of 42.4 years ($\pm$ 13.1years) with a variety of common disorders warranting the need for a wheelchair. Two assessments were done one week apart in person by two different therapists followed by two assessments completed via TR by two additional therapists using POTS telecommunication and a non-therapist assistant. The two IP assessments and the IP and TR assessments were compared using Kappa statistics. A Kappa value of > .75 was interpreted as excellent agreement. The analyzed items are described in the tables below.

Results

This table shows the Kappa and p-values for IP x IP comparison. Of the 7 variables examined, all but one showed agreement with anterior-posterior pelvic tilt, pelvic obliquity, and anterior pelvic tilt having excellent agreement, hip flexion and knee flexion having good agreement and trunk deformity having fair agreement.

Anterior–Posterior Pelvic Tilt	Pelvic Obliquity	Hip Flexion	Knee Flexion	Anterior Pelvic Tilt	Posterior Pelvic Tilt	Trunk Deformity
***Kappa= 0.667 p= 0.006**	***Kappa= 0.81 p= 0.001**	***Kappa= 0.44 p= 0.04**	***Kappa= 0.58 p=0.03**	***Kappa=0.612 p= 0.004**	***Kappa=0.83 p= 0.000**	**Kappa=0.100 p= 0.53**

The next table shows the Kappa and p-values for IP x TR comparison. Of the 7 variables examined, all but one showed agreement with the posterior pelvic tilt and anterior pelvic tilt variables having excellent agreement, trunk deformity and pelvic obliquity having good agreement. The other variables only had fair agreement.

Anterior-Posterior Pelvic Tilt	Pelvic Obliquity	Hip Flexion	Knee Flexion	Anterior Pelvic Tilt	Posterior Pelvic Tilt	Trunk Deformity
Kappa= 0.429 p= 0.86	***Kappa= 0.46 p= 0.05**	**Kappa= 0.42 p= 0.09**	**Kappa= 0.45 p=0.64**	***Kappa= 0.77 p=0.001**	***Kappa= 0.6 p= 0.008**	***Kappa=\ 0.48 p=0.04**

Discussion

The results showed that in a population of model patients, even IP to IP assessments do not have perfect agreement. Possible reasons included limitations in the study design as well as the technology. Within the study design, although the TR assistants were trained, they were not therapists. Therefore it does not appear appropriate that the remote portion of a mat assessment be carried out by anyone other than a trained therapist. There is a possible flaw in the assessment protocol including the form design, which may have contributed to the therapist not completing items correctly or consistently. There were also limitations with the technology. The POTS system perhaps did not provide enough visual and auditory feedback to the hub clinician.

For further information contact Ana Allegretti- ala15@pitt.edu Phone: 412-365-4850

Notes:

Plenary Sessions

Notes:

Manual Wheelchair Skills: Past, Present and Future

R. Lee Kirby, MD, FRCPC, Division of Physical Medicine and Rehabilitation, Dalhousie University, c/o Nova Scotia Rehabilitation Centre, Halifax, Nova Scotia

Presentation Summary:
During this session, the background and growing body of research evidence supporting the use of a more formalized approach to the testing and training of manual wheelchair skills will be presented. The case will be made that the Wheelchair Skills Program (WSP), consisting of the Wheelchair Skills Test (WST) and the Wheelchair Skills Training Program (WSTP), represents the current gold standard for such testing and training. Future directions for clinical practice and the need for further research evidence will also be discussed.

Notes:

Seating via Telehealth: Benefits and Challenges

Angela Sekulic, BScOT; Ingrid Barlow MScOT,
Glenrose Rehabilitation Hospital; Edmonton, Alberta

Introduction

Telehealth (videoconferencing) is increasingly being promoted as a means for delivering cost-effective outreach for specialized health services. Given the very specialized nature of seating, it appears to be a prime candidate for utilizing Telehealth. Since 2000, the Glenrose Seating Service has been using Telehealth to deliver services to clients in rural and remote communities where travel to a main center is either too costly or the client is medically fragile. Despite the obvious benefits and great potential of Telehealth it also presents significant challenges for our seating team, which has led us to ask *"Is it possible to have successful results/outcomes across a room on a two-dimensional screen when seating is a three-dimensional and hands-on Service?"*

What does the Literature say?

1. Vesmarovich (1999) –8 SCI patients being followed in an outpatient wound care clinic in Atlanta, GA.
   - states that using still photos sent over a videophone from the patient's home, wound care specialists were able to assess the status of the wound and provide recommendations for cleansing/dressings. The results of this exploratory study *"demonstrated that pressure ulcers can be successfully managed via telerehabilitation."*

2. Dreyer (2001) –4 residents of a rural North Carolina community
   - states that while one OT administered either a KELS or COPM, another OT observed over a low-bandwidth Telemedicine link (less expensive but known for diminished video quality). They simultaneously scored and results revealed that they scored the same on 3 of the 4 administered evaluations. The report concludes, *"select occupational therapy evaluation data can be accurately scored using low-bandwidth telemedicine systems."*

3. Guilfoyle (2003) –12 high dependency residents in a care facility in Brisbane, AUS.
   - states that 5 allied health therapists (dietetics, OT, PT, podiatry, Speech Pathology) conducted their initial assessments face-to-face and by videoconferencing. In 35 out of the 60 assessments, two independent raters agreed that the care plans set out by the therapists were the same. They concluded that although the therapists' preferred face-to-face contact for initial assessments, the care plans were similar and *"assessments carried out by videoconferencing would therefore seem to be feasible."*

4. Allegretti, A. (2003) – assessed pelvic positioning of 20 model patients with a variety of physical disabilities (Pittsburg)
   - 4 therapists experienced in seating, completed both in-person (IP) and telerehab (TR) mat assessments. The telerehab assessment was carried out by an assistant (a non PT/OT student) monitored by an onsite licensed therapist and supervised by one of the 4 therapists from the remote location. The assessment findings were compared (Kappa statistics) between in-person assessments and between in-person and telerehab assessments. Results showed that *"IP to IP were for the most part*

comparable; IP to TR were not as comparable." The authors acknowledge that even the in-person assessments were not in perfect agreement. As well, the lack of expertise of the assistants and limitations of camera angle could contribute to the reduced comparability between the in-person and telerehab assessments.

TELEHEALTH IN ALBERTA

The Telehealth network in Alberta, a division of Alberta we//net (wellnet) was established in 1999 with the help of a 14 million private donation and other provincial and federal funding. The network started with 26 sites and has since grown to 236 sites. The objectives set out by the Telehealth Project are to:

1. Improve access to health services for people in remote and rural communities,
2. Support rural doctors and health providers to use technology to access peer information and education, and
3. Improve the efficiency of specialized health services.

TELEHEALTH AT THE GLENROSE REHABILITATION HOSPITAL

As seating is considered to be a specialized, tertiary service, our participation in Telehealth was initiated in 2000. The Glenrose Seating Clinic was already involved in providing Outreach services and was well aware of the need for seating services in the rural areas for those clients unable to travel to a seating clinic due to physical, mental or financial limitations. The challenges of Outreach seating are:

- it requires extra travel and preparation time for the seating team (the team being comprised of an OT, PT and Seating Technician),
- not all health regions have sufficient funding to pay for the team to travel or to pay for their overtime, and
- regardless of the extent of pre-screening to determine which seating are required, upon arrival at the site it is inevitable that additional components are needed.

Telehealth appeared to be an excellent solution to these problems.

Discussions with the Occupational and Physical Therapy regulatory bodies determined that a licensed therapist must be present at the outreach site to carry out the assessment. The Alberta Aids to Daily Living (AADL) program, the primary funding source for medical equipment, added an additional requirement that the therapist at the Outreach site should also have taken the Seating Education Workshop. This 1.5 day workshop with a formalized curriculum, is run two times a year by various Seating Clinics across the Province. AADL has specified that all persons involved in the assessment/authorization of adaptive seating equipment (including commercial and custom vendors) must take this workshop to ensure a uniform standard of seating assessment in Alberta.

These requirements help to ensure the quality of seating service provided to the client via Telehealth is "as good" as if it had been delivered in-person.

Prior to our inaugural Telehealth seating assessment, members of the seating team observed a demonstration of Telehealth at the University of Alberta Hospital. Two trial assessments were carried out with two clients from Cold Lake. The local therapist was very familiar with seating. Based on these two assessments, existing procedures were refined and adapted specifically for the Telehealth environment.

Presently, 2-3 Telehealth assessments are done each month which accounts for ~6% of all seating assessments done through the Glenrose in a year. We have the Telehealth equipment pre-booked for a ½ day each month and assign therapists to these assessments as if it was a regular clinic.

HOW MUCH DOES TELEHEALTH COST?

Start-up costs:

- Telehealth equipment ranges from:
  - Desk top system: $10,000.00
  - HS2000Vtel: $40,000.00
  - HCS III Clinical cart: $60,000.00
- One-time only charges:
  - $500-$1000.00 ISDN line install
  - $100.00 fee to activate ISDN line

Operational Costs:
- $20/hr long distance charges
- $60/hr for videoconferencing bridge (free in Alberta until April 2005)
- $210/mth for ISDN line in the facility
- Telehealth technician time (optional for frequent users who are familiar with the equipment)

IS TELEHEALTH COST-EFFECTIVE?

The Cost of Seating (Using an example of a client from a community 1.5hrs by car from Edmonton)

Expense	**Standard Commercial Clinic** (client and seating team meet at commercial vendor location)	**Outreach** (seating team travels to outreach site; commercial vendor brings the equipment that the seating coordinator predicts will be most appropriate)	**Telehealth** (seating team at Glenrose; commercial vendor at outreach site or at Glenrose to do Equipment demo)
Client Travel	~$1000 Ambulance (sometimes a portion is covered by extended health benefits)	$0 or handibus fee	$0 or handibus fee
Team Travel (round	40 minutes	3 hrs	0

trip)			
Coordinator prep time (assuming all required info is in place)	~30 minutes	~1 hr	~45 min
Outreach Therapist prep time	(time spent arranging/coordinating payment of transport) ~30min	(time spent setting up room, organizing staff and equipment) ~1hr	(time spent setting up room and liaising with Telehealth Technician) ~1hr

SUMMARY

In answer to the presenting question: *"Is it possible to have successful results/outcomes across a room on a two-dimensional screen when seating is a three-dimensional and hands-on Service?"*

YES!!

In general, we have found that Telehealth can be very useful for:

- <u>screening</u> prior to a clinic or outreach assessment
    - determines which equipment to have available for the clinic/outreach assessment
    - funding rationale for equipment (i.e. wheelchairs) can be submitted before to ensure prior approval, and to have it present when the client comes for the clinic assessment
- <u>consultation</u> – with other therapists or other seating clinics
- <u>equipment demonstration</u> - for rural families to become familiar with equipment choices
- <u>follow-up</u> to see how the client is positioned in their seating system, do minor adjustments if required
- <u>minor modifications</u> such as growing backs/bases, headrest/lateral adjustment.
- <u>education</u> (see workshop "Seating Education for Caregivers and Colleagues – Is it Worth the Effort?" for more details)

It is a greater challenge to achieve success in Telehealth <u>assessments</u> and <u>fittings</u> that require more of the "hands-on" feel of the client and their position. However, we have identified many factors that contribute to a greater likelihood of success. These factors include:

- accurate seating clinic referral information
- the Outreach therapist's comfort level with seating assessment procedures; (how frequently they do seating via telehealth and how recently they attended the Seating Education Workshop)
- the commercial technician is present at the outreach site
- the Outreach Therapist's or therapy assistant's familiarity with wheelchair and seating component adjustment (if the seating technician is not present)
- the Outreach site's ability and comfort in to utilizing telehealth equipment (i.e. camera angles, zoom, removal of camera for close-ups)
- the type of seating system required (commercial is easier to do than custom)
- the type of commercial seating required (Stroller based seating systems and planar systems tend to be more straightforward than other commercial components)
- the degree of deformity/spasticity present
- the Seating Therapist's comfort with Telehealth

How telehealth has helped:

- much less traveling for the seating team
- more timely seating intervention; (our procedure is that we won't book an outreach clinic until the facility had gathered clients to fully book our day)
- referring therapist, family, caregivers/staff can be present to get a complete picture of the client's needs
    - if a rural client comes to the Glenrose, the referring therapist usually can't afford the time to accompany the client. The client is accompanied by an aide or by family and often vital pieces of information can be missed

The challenges that still remain are:

- awareness and practice of appropriate telehealth communication skills
    - time delay when speaking
    - difficulty developing rapport with the client
- client confusion about the voices coming from the TV –occasionally leads to an increase in agitation and reduced assessment tolerance (i.e. refusal to get onto the plinth for the mat assessment)
- knowing when to say "this won't work – we must see the client face-to-face"
    - sometimes the follow-up can drag on and we end up having to see the client in person anyhow

References:

Allegretti, A.L., Fitzgerald, S.G., Boninger, M.L., Cooper, R.A. Cooper, R. Cohen, L., Shapcott, N. (2003). Pelvic positioning evaluation for wheelchair selection: A comparison between in person and videoconferencing. *RESNA 26th Annual Conference*. Atlanta, Georgia.

Dreyer, N.C., Dreyer, K.A., Shaw D.K., Wittman, P.P (2001). Efficacy of telemedicine in occupational therapy: a pilot study. *Journal of Allied Health*, 30(1), 39-42.

Guilfoyle, C. Wooten, R., Hassall, S., Offer, J., Warren, M., Smith, D. (2003). Preliminary experience of allied health assessments delivered face-to-face and by videoconference to a residential facility for elderly people. *Journal of Telemedicine and Telecare*, 9(4), 230-233.

Vesmarovich, S., Walker, T., Hauber, R.P., Temkin, A., Burns, R. (1999). Use of telerehabilitation to manage pressure ulcers in persons with spinal cord injuries. *Advanced Wound Care*, 12(5), 264-269.

Resources:

alberta we//net, found at: www.albertawellnet.org
Canadian Society of Telehealth, found at: www.cst-sct.org
National Initiative for Telehealth (NIFTE) Framework of Guidelines (2003).
This is a "structured set of statements designed to assist individuals and organizations in the development of policy, procedures, guidelines, and/or standards." found at www.nifte.ca
Office for the Advancement of Telehealth (US), found at: www.telehealth.hrsa.gov

Tele Rehabilitation for Seating and Wheeled Mobility, Evaluation and Service Delivery

Laura Cohen, PT, ATP, Research Associate, PhD Student,
Human Engineering Research Laboratories, Pittsburgh, Pennsylvania

"This House Believes that Responsible Clinicians Restrict Their Client Information Purely to the Solutions they can Provide."

Chair person: **Geoff Bardsley**

Notes:

Simultaneous Paper Sessions Group 1

Saturday, March 6th, 2004

Recovery Of Seated Postural Control In Children Following Traumatic Brain Injury

Beth Ott, M.Sc., PT,
Sunny Hill Health Centre for Children, Vancouver

ABSTRACT

Purpose: Seated postural control is important for children with and without disabilities and is a requirement for many occupational, functional, and recreational activities. Traumatic brain injury (TBI) is the most frequent diagnosis of all traumatic injuries reported in children and often results in multiple limitations in function, however, there have been no studies on the seated postural control in these children. The objectives of this study were to evaluate the (1) seated postural control of typically developing children, including the test-retest reliability of these measures, and (2) seated postural control of children with severe TBI during re-acquisition of independent sitting.

Methods: Ten typically developing children were assessed on two separate occasions and two children with TBI (6 and 15 year old males) were assessed longitudinally. For all tests, children sat on a force plate on top of a raised bench which could be translated forward or backward. Surface EMG electrodes recorded bilateral trunk and leg muscle activity. The static, volitional, and reactive postural control of the children was assessed during quiet sitting, self-paced maximal leans, and platform translations, respectively. Intraclass correlation coefficients were used to determine the test-retest reliability of the postural control in typically developing children. Correlations were calculated to determine the effects of age on the postural control of typically developing children. Analysis of the postural control data in the children with TBI was descriptive.

Results: There was moderate to high test-retest reliability for all measures of postural control in the typically developing children. A statistically significant correlation was found between age and the static postural measure in the typically developing children. Initially, the postural control of the children with TBI differed considerably from that of the typically developing children. Over time, the postural control of the children with TBI improved but still differed from that of the typically developing children.

Conclusions: Measures of seated postural control of typically developing children were reliable. The effects of age on these measures are dependent on the type of postural control. The recovery of seated postural control in children with TBI occurs in all three types of postural control concurrently.

Click it or Ticket: Seat Belt Usability Among Wheelchair Riders

L. van Roosmalen, PhD, University of Pittsburgh, Rehabilitation Science and Technology, Pittsburgh Pennsylvania ; M. Reed, PhD
University of Michigan Transportation Research Institute, Ann Arbor, Michigan

ABSTRACT- Individuals who ride motor vehicles while seated in their wheelchairs are often unable to reach for and use seat belts independently. This study investigated seat belt usability by people who sit in wheelchairs in motor vehicles. The findings of the study address guidelines for occupant restraint manufacturers to improve user independence, seat belt usage, belt comfort and safety among the wheelchair-seated population traveling in motor vehicles.

PROBLEM STATEMENT- Current practice for occupant protection during frontal vehicle impact consists of wheelchair occupant restraint systems (safety belts) that are attached to a fixed location on the vehicle structure. These safety belts are often difficult to use independently and properly because of wide variance in occupant and wheelchair sizes, and interference of the wheelchair structure with the belt system [2, 3]. Poor belt fit may result in pelvic belts crossing the soft tissue of the abdomen, creating the potential for abdominal injury in a crash. Shoulder belts crossing the occupant too close to the neck or too far from the neck may result in poor upper body restraint and the potential of occupant impact with the vehicle interior [4].

RESEARCH OBJECTIVE-This study investigated usability issues related to belt buckles, latch plates and reaching and grasping stowed safety belts.

METHOD-Ten study participants were recruited in the Pittsburgh area by word-of-mouth (IRB#021034). All individuals had impaired range of motion and/or limited strength in one or both upper extremities. Eight of the participants used power or power-assisted wheelchairs, one used a manual chair, and one used a scooter. A structure, simulating a safety belt system was developed and equipped with reconfigurable anchor points to present various seat belt scenarios to people seated in their own wheelchairs. The safety belt scenarios shown in Figure 1 were evaluated. Video and interview data were collected from four men and six women using the various restraint scenarios.

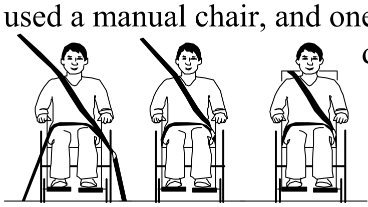


Figure 1: a) Vehicle mounted pelvic- and torso belt, b) Wheelchair-integrated pelvic belt and vehicle-mounted torso belt, c) Complete wheelchair-integrated pelvic and torso belt.

RESULTS-Subjects were unable to do one or all of the following: 1) reach for torso belt latch plates, 2) grasp hold of a latch plates, 3) don the torso belt over the torso and 4) connect/disconnect the latchplate into/from the buckle.

DISCUSSION AND CONCLUSION- The authors give the following recommendations for seat belt design for individuals with upper extremity limitations. (1) The stowed location of the latch plate should be located more forward of the wheelchair occupant's shoulder. (2) The latch plate should allow users to 'hook on' to the plate and don the belt without requiring a pinch or power grip. (3) Buckle design should allow for single-handed latch plate engagement and disengagement, and also allow flexibility to latch plate alignment during engagement. (5) The buckle should be visible to the user. Further research will be needed to develop restraint systems that combine improved ease of use with optimal crash protection.

REFERENCES

1. ANSI/RESNA, *ANSI/RESNA WC-19: Wheelchairs Used as Seats in Motor Vehicles*. 2001, ANSI/RESNA.
2. Van Roosmalen, L., G.E. Bertocci, D.A. Hobson, and P. Karg, *Preliminary evaluation of wheelchair occupant restraint system usage in motor vehicles.* Journal of Rehabilitation Research and Development, 2002. **39**(1).
3. Sprigle, S., B. Morris, G. Nowacek, and P. Karg, *Assessment of adaptive transportation technology: a survey of users and equipment vendors.* Assistive Tech. 1994. **6**: p. 111-119.
4. Bertocci, G.E., K. Digges, and D.A. Hobson, *Shoulder belt anchor location influences on wheelchair occupant crash protection.* Journal of Rehab Research and Development, 1996. **33**(3): p. 279-289.

ACKNOWLEDGEMENTS- This research was supported by the National Institute on Disability and Rehabilitation Research (Grant # 133E010302).
Linda van Roosmalen, PhD, IDSA. University of Pittsburgh - 5044 Forbes Tower - Pittsburgh PA 15260 - Phone (412) 3836794 - Email: Lvanroos@pitt.edu

Notes:

Seating Assessment / Prescription in a Rural Area

Joanna Rainer,
Vernon Jubilee Hospital, Vernon, B.C.

Providing a seating assessment and prescription service in the North Okanagan region of British Columbia, Canada has been a challenge for several reasons. This presentation will outline the problems community occupational therapists in Vernon, British Columbia have faced and the solutions they are implementing.

THE PROBLEMS

1. **The Occupational Therapists providing the service**
   - **Lack of experience and expertise in seating assessment and prescription**
     Seating assessment and prescription services in the Vernon area have historically been provided by occupational therapists from community rehabilitation services (i.e. Home care). In July 2001, the community occupational therapy staff increased from 0.5 FTE to 2.0 FTEs. The 2.0 FTEs are comprised of 1 FTE occupational therapist and two 0.5 FTE occupational therapist. These three new community O.T.s had limited experience and expertise in seating assessment and prescription nor did they have ready access to the local occupational therapist who did have experience in this area.
   - **Caseload diversity**
     Our caseload is very diverse. In 2002, only 13% of our referrals were for seating and wheelchair prescription. In 2003, 16% of our referrals were for seating and wheelchair prescription. In a smaller centre, you are not able to specialize in seating, so your learning curve is longer.
   - **Lack of local resources and educational opportunities in the B.C. interior.**
     Local courses for occupational therapists in the Okanagan are far and few between. Travel to the Lower Mainland, where more courses are offered, is expensive.

2. **The Dealers**
   - **Lack of experience and expertise in seating and wheelchair equipment**
     There has been a large turnover in medical equipment businesses and dealers in our area over the past two years. Some new employees had less knowledge than we did about the equipment. The remaining dealers who did have experience were spread very thin and were attempting to service huge geographic areas.

3. **Geography (Location, location, location)**
   - Our distance from large urban centres can result in long delays in obtaining equipment for trial, getting equipment serviced and having purchased equipment delivered to the client.
   - Our more fragile clients have difficulty either getting transportation to other seating services or tolerating the journey to get to services (e.g. the seating clinic in Kelowna, is a 120 km round trip from Vernon).

THE SOLUTIONS

1. **Organized a seating course in the Okanagan**
   - We submitted a proposal to the Interior Health Authority requesting funding for a seating course offered by Access Community Therapists. This was approved and a 3-day course was put on in Vernon in March 2003.

2. **Team up with another occupational therapist to do the seating assessment.**
   - Two O.T.s are better than one because:

   a) Two people are often needed to help clients with transfers.
   b) One person can record information while the other one does the hands-on assessment.
   c) One person can take photos while the other supports the client.
   d) Brainstorming with another O.T. is very useful for the more complex seating issues.

3. **Utilize existing resources to provide better service to clients with complex seating needs.**
   - We asked the Department of Veterans Affairs to hire a local O.T. with complex seating experience to work with one of our clients. DVA agreed to do this.

Notes:

Effects on Discomfort and Wheelchair Use

Barbara Crane, PhD, PT, ATP;
Douglas Hobson, PhD; Margo Holm, PhD, OTR/L, FAOTA, ABDA,
Department of Rehabilitation Science and Technology,
University of Pittsburgh, Pennsylvania

Wheelchair seating discomfort:
Research techniques and effects of user adjustable seating

Chronic sitting discomfort has been identified as a problem among many wheelchair users, but few researchers have attempted to directly study seat discomfort or seating systems that might mitigate discomfort. Our research study using a single subject research design examined the seating discomfort effects of two user-adjustable powered seating options. Traditional powered seat tilt and back recline systems were compared with a new powered-seat feature that allowed a wheelchair user to make adjustments to the seat and back support surfaces while sitting in the wheelchair. Outcome measures included the length of sitting time per day and the degree of seating discomfort, rated on the newly developed Wheelchair Seating Discomfort Assessment Tool (WcS-DAT). Selected results of this study will be presented in order to add to the body of clinical knowledge regarding wheelchair seating discomfort problems and the effectiveness of the explored interve

Notes:

Simultaneous Paper Sessions Group 2

Best Practices of OT & PT Performing Seating and Mobility Evaluations

Mary Issacson, Dr., MA, OTR/L, ATP
Principal, Adaptabilities and Assistant Professor, University of Oklahoma, Tulsa, Oklahoma

Scope and Method of Study: Most people take for granted the every day things they do in life. People with physical disabilities, however, cannot take these things for granted. Assistive technology such as the wheelchair is one resource that can make a positive difference on a person's life. However, if the wheelchair does not fit the individual appropriately, it can have a negative effect both functionally and medically. An occupational or physical therapists may be asked to complete the wheelchair evaluation, but because this is a constantly changing field of practice, they may not have the current skills or knowledge to complete the task well. The identification of best practices in a field is the initial step in the development of standards of practice. Therefore, the purpose of this study is to describe the perceptions of occupational and physical therapists who specialize in seating and mobility evaluations about the current best practices of the leaders in the field. The Delphi technique was utilized to collect the data via the internet from a panel of experts geographically dispersed across the United States.

Findings and Conclusions: As a result of the data elicited from this panel of expert practitioners in the area of seating and mobility, best practices can be defined as a multi-variant complex series of interactions in which the expert clinician uses experience, hands-on techniques, skills, technology, resources, self-directed learning, follow-up, and a relationship with the consumer in the provision of the services.

Established adult learning principles can add meaning and insight to the learning processes of occupational and physical therapists. These learning principles such as andragogy and self-directed learning, learning how to learn, critical reflection, and transformative learning are keys in the field of adult education. When these concepts are identified and recognized in the therapy field, they can be instrumental in assisting with the acquisition of best practices.

LEARNING OBJECTIVIES

Participants in this session will:

- Understand the concept of the Delphi technique and its application in research.
- Understand one method for data collection utilizing the internet.
- Learn about the concept of best practices and the application of the adult education principals in the application of best practices.

REFERENCES

Bogdan, R. C., & Biklen, S. K. (1982). *Qualitative research for education an introduction to theory and methods.* Boston, MA: Allyn and Bacon, Inc.
Brookfield, S. (1987). *Developing critical thinkers.* San Francisco: Jossey-Bass.
Byrnes, J. P. (1998). *The nature and development of decision making.* Mahwah, New Jersey: Lawrence Erlbaum Associates, Publishers.
Jenson, G. M., Gwyer, J., Shepard, K. F., & Hack, L. M. (2000). Expert practice in physical therapy. *Physical Therapy, 80,* 28-43.
Knolwles, M., Holton, III, E. F., & Swanson, R.A. (1998). *The adult learner: The definitive classic in adult education and human resource development.* Houston, TX: Gulf Publishing Company.
Patton, M. Q. (1987). *How to use qualitative methods in evaluation.* Newbury Park, CA: SAGE Publications, Inc.
Rogers, C. (1969). Freedom to learn. Columbus, OH: Merrill Publishing.
Schon, D. A. (1983). *The reflective practitioner.* USA: Basic Books, Inc.
Smith, R. M. (1982). *Learning how to learn applied theory for adults.* Chicago: Follett Publishing Company.
Sternberg, R. J. (1990). *Metaphors of mind: Conception of the nature of intelligence.* New York: Cambridge University Press.

Notes:

Current Practices for Providing Pediatric Powered Mobility

Jan Furumasu, BSPT, CART,
Rancho Los Amigos National Rehabilitation Centre, Downey, California

Summary: A national survey of pediatric powered mobility providers was conducted to determine current models for recommending powered mobility to young children.

'Models' of the assessment process used to evaluate young children for powered mobility frequently involve trial-and-error (i.e. placing a child in a powered wheelchair to determine readiness for driving). It is often the case that the outcome of the assessment, training, and recommendation process is quite dependent on the experience and service delivery practices of the clinician and/or assessment centre involved. While there is little formal research to describe existing models of practice in the provision of powered wheelchairs to young children, it is presumed that numerous factor are involved in the assessment process and may ultimately influence the provision of a powered wheelchair to a young child. In the present study, a national survey of providers of pediatric powered mobility was conducted to more objectively determine and more formally describe current pediatric powered mobility practices and models, and typical recommendations for children who are not recommended powered mobility. A survey was developed, pilot-tested, and mailed to approximately 450 providers nationally. A total of 140 surveys were received from clinicians and rehabilitation technology specialists (TRSs) in 6 states. Respondents were asked to complete the survey based on their experience evaluating two-to-six year old children for powered mobility during the past two years. These providers were asked to rate fifteen possible factors that might be included in a pediatric powered mobility evaluation in terms of frequency with which these were included as part of their evaluation process. Factors included such things as assessing the child's home environment, evaluating access sites, evaluating ability to uses remote control toys, conducting a formal assessment of a child's behaviour/temperament, and conducting a formal cognitive assessment. Responses were examined using a factor analysis. It was found that the fifteen items were described by six factors. These factors have been combined to form a descriptive "model" of the current practices in pediatric powered mobility. The current paper describes this model.

Notes:

Using a Scoring Guideline to Organize Scheduling of Wheelchair Evaluations

Judy Larson, OTR/L, Occupational Therapist,
Carrie Tingley Hospital, Alburquerque, New Mexico

CARRIE TINELGY HOSPITAL – SEATING CLINIC
SCORING GUIDELINE

Patient Name: **Referral Date:** month/year
Funding Source:
Type of Equipment Requested:

Complexity:

0 = **Low:** No anticipated problem with positioning. Need manual w/c or simple stroller.
2 = **Medium:** May require more in depth assessment of positioning needs. May need manual wheelchair or tilt-in-space wheelchair with mild to moderate positioning supports.
8 = **High:** Significant positioning issues. Will need tilt-in-space wheelchair with moderate to high level of seating support. Are requesting evaluation for power wheelchair.

Relevant Pressure Sores:
0 = skin intact, free of redness
2 = reddened area/decreased skin integrity or history of past (but healed) pressure areas.
4 = blister or long term reddened area of skin
6 = skin ulcer/decubitus or long term history of decubitus

Current Equipment Status:
2 = inadequate – does not meet needs, too small
4 = none – has never had equipment, equipment not available for use
6 = unsafe – damaged, needs major repair

Independent Mobility In Wheelchair:
0 = no change in anticipated distance traveled
2 = is independent for short distances, but would be able to go further with proper equipment
4 = currently has no independence with mobility, life would be highly impacted by ability to self-propel/self-mobilize (i.e.: power wheelchair)
NA = will always be dependent even with change of equipment

Positioning Issues:
0 = no change in functional skills anticipated with change in positional supports
4 = body posture/position currently impacted by postural support on wheelchair, functional skills will be impacted by change in postural supports
6 = significant change in body posture in wheelchair over past 6 months, change to postural supports will significantly affect comfort/posture/function. Significant change in weight of patient.

Health Change:

0 = stable health x 2 months
2 = gradual decline in functional abilities
4 = moderate decline in functional abilities
6 = recent change significantly affecting functional abilities

Total _________________________

Notes:

A New Database System for Seating and Mobility

Ajax Lau,
Seating Clinic, Prince of Wales Hospital, Physiotherapy Department, Hong Kong

Abstract:
A Database System was newly developed for clinical management of seating and mobility service in a local hospital. Unlike the traditional database system that mainly focused on client's medical and social information, this database has an electronic form, which included all relevant information for a complete seating and mobility assessment. Besides text format records; this database also collect multi-media recordings related to each specific client, which are important for documenting their seating postures and activities of daily living. These included still images, video clippings, x-ray films and pressure maps. With this integrated database, clinicians can perform easily retrieval of data for comparison and decision-making during client assessment and evaluation.

Another important feature about the new database is that evidence based seating and mobility interventions can be easily documented. For example, interventions provided to solve specific postural problem for client with specific diagnosis could be monitored in a longitudinal manner, so that outcomes of interventions can be easily evaluated. This could enhance the treatment quality for each individual client.

In the local setting, this database also serves to keep track of all loaned wheelchair and adaptive parts provided by the seating clinic. A barcode system was used to perform inventory control. In addition, the system also monitors the rate of change of the prescribed hardware for the pediatric clients. With the new features available in this new database, the information collected can be used to perform cost analysis; for conducting educational training and research, as well as for planning future development of the seating and wheelchair service. This presentation aims to share our experience in this area.

Notes:

Seating and Mobility Script Concordance Test (SMSCT) Validation

Laura Cohen, PT, ATP, Research Associate, PhD Student,
Human Engineering Research Laboratories, Pittsburgh, Pennsylvania

ABSTRACT

The Seating and Mobility Script Concordance Test (SMSCT) is a performance-based measure intended for use with professionals that recommend seating and mobility devices to individuals with spinal cord injuries. The SMSCT is proposed to evaluate the impact of educational experiences or clinical practice on the ability to make specialized clinical decisions about seating and mobility needs. The SMSCT consists of 67 items divided into two subtests: 33 assessment items and 34 intervention items. This study describes the development of the scoring system and appraisal of internal and external validity evidence. A convenience sample of 106 clinicians with varying levels of seating and mobility expertise participated in the study. Fifteen spinal cord injury experts contributed to the development of the SMSCT scoring system. The remaining 91 subjects provided validity evidence. All subjects completed a demographic questionnaire and 67-item SMSCT. Results suggest that the technical quality (internal structure) of the SMSCT may include evidence of reduced item performance but satisfactory convergent and discriminate evidence by construct definition. Proxy measures of clinical expertise were used to explore external validity, the extent to which scores converge or diverge with known qualities in the manner expected. The proxy measure of clinical expertise, seating and mobility hours/week was found to predict SMSCT intervention scores (F= 10.62, p= 0.002). Preliminary validation of the SMSCT suggests that the test may be a promising measure of clinical expertise. Further item development, revision and pilot testing are needed. Future SMSCT development and validation are planned.

AUTHORS: Laura J. Cohen PT, PhD, ATP; Shirley Fitzgerald PhD; Michael L. Boninger MD

Instructional Sessions – Group E

E1. The Evidence Basis of Using Gait Trainers

Virginia Paleg,
Pediatric Physical Therapist,
Silver Spring, Maryland

E2. How to do a Cost Analysis in Assistive Technology

Frances Harris, PhD, Center for Rehabilitation Technology, Helen Hayes Hospital, West Haverstram, New York; Stephen Sprigle, Ph.D., PT,
Director, Center for Assistive Technology & Environmental Access,
Georgia Institute of Technology, Atlanta, Georgia

This session introduces core concepts and tools needed to perform a cost analysis in assistive technology. A "cost analysis" is an integral part of economic evaluations, and a principal methodology within outcomes research. This type of analysis is useful, not only as a set of tools for researchers, but also to assist service providers to measure and evaluate those costs specific to their programs.

Through this course, we focus specifically on those cost variables unique to assistive technology across diverse service delivery programs/models/venues. Using examples from the professional literature and experiences in our own research, we will illustrate the complexities inherent in assessing a range of variables and the range of strategies available to those undertaking such analyses. Special attention will be given to examining the various trade-offs, choices, and challenges each cost analysis strategy poses for clinicians and researchers.

Course Goals

I. A common vocabulary covers definitions and basic types of economic evaluations. These include cost-minimization, cost-effectiveness, cost-utility, cost benefit, and cost-outcome. We also discuss how cost analyses, which were originally developed for use within a medical model, are being adapted for applications unique to rehabilitation specialists and assistive technologists.

Key concepts of cost analyses are discussed including the analytic perspective of the analysis and understanding the concept of "cost" from economist and accounting points of view.

II. In this section we discuss key terms and variables used in cost analyses. Basic cost terms include: direct and indirect costs, costs and charges, variable and fixed costs, marginal and incremental costs, and discounting. Variables specific to assistive technologists may include diagnostic equipment, billing, salaries, overhead, vendor costs and/or insurance costs, durable medical equipment, paid and unpaid personal assistance, and employment.

III. The final section of this course examines some of the perils and pitfalls of cost analysis tools as they have been applied within assistive technology. We examine published outcomes studies that include cost analyses, as well as examples from our own research to illustrate research issues unique to assistive technology.

Glossary

Economic Evaluations are defined as the comparative analysis of alternative health care strategies or programs in terms of both their costs and consequences (Drummond, O'Briend, Stoddart, and Torrance, 1997). All economic evaluations consist of both a 'cost side' and an 'outcome' or 'benefit' side. A 'cost analysis' represents the 'cost side' of an economic evaluation. Types of economic evaluations include: cost-minimization, cost-effectiveness, cost-utility, cost-benefit, and cost-outcome.

Cost-minimization evaluations are performed when the effectiveness of alternative interventions or devices is well established and roughly similar in value. When all other variables are approximately equal, the least expensive one is considered to be the most efficient, and therefore preferable.

Cost-effectiveness evaluations are a general type of economic evaluation in which the effects or outcomes of two treatments or devices or programs are compared. Effects are usually measured in natural units such as years of life saved or as a blood pressure measurement.

Cost-utility is a specific type of cost effectiveness evaluation. However, instead of the outcomes being measured in terms of natural units, they are measured as preferences, the most common being Quality of Life Years (QALY).

Cost-benefit evaluations are a type of analysis in which both the costs and outcomes are expressed in dollar amounts. The results are expressed by relating costs to benefits either as a ratio or a mathematical difference.

Cost-outcome studies are a partial economic evaluation in which the costs and outcomes of a *single* service program are described and partially analyzed. This differs from the above types of economic evaluation that *compare* alternative services or programs in order to facilitate choice between them.

Direct and Indirect Costs: *Direct* costs are those resources that can be directly linked to a health care intervention, e.g., personnel salaries, equipment, facility costs. *Indirect* costs are hidden or unintended costs within an evaluation. From a patient's perspective , indirect costs might include lost productivity or wages due to time spent in rehabilitation activities or doctor's appointments.

Costs and Charges: Costs are the actual resources consumed. Charges represent a specific monetary amount. For example, a charge may be the fee for a service performed. Costs must be measured and valued. For example, the actual costs of an AT intervention might include gathering data on patient out-of-pocket expenses, monies actually received by the facility, vendor, and or insurer. Costs are usually much more complicated to calculate than charges, therefore charges are more frequently used.

Opportunity Costs: Opportunity costs are a fundamental concept in economics. They can be defined as "the cost of using resources for some purpose, measured as their value in their next best alternative use" (CCOHTA, 1997, p65). For example, if you spend $10.00 to see a movie, you give up other uses of that money such as groceries or gasoline. Opportunity costs are the next best thing you could do with your limited resources.

Marginal/Incremental Costs: Both marginal and incremental costs attempt to gauge how much health we are getting from our health care resources. Marginal costs refer to the cost of producing one extra unit of output. Incremental costs refer to the difference between the cost of alternative services or programs.

Fixed and Variable Costs: Fixed costs are those costs that do not change in the short terms, such as salaried staff, rent, and equipment. Variable costs alter directly and proportionately with changes in the volume of services provided, such as the cost of office supplies.

Discounting: Discounting is a cost operation that is performed in long-term studies where the costs and consequences of a service or technology may accrue over time. For example, discounting takes those future costs of, let's say, a service delivery program and translates them into current monetary units.

References

General References on Economic Evaluations and Cost Analyses

Drummond, M., O'Brien, B., Stoddart, G., & Torrance, G. (1997). *Methods for the economic evaluation of health care programmes* (2nd edition ed.). New York: Oxford Medical Publications.

Johnston, K., Buxton, M., Jones, D., & Fitzpatrick, R. (1999). Assessing the costs of healthcare technologies in clinical trials. *Health Technology Assessment, 3*(6), 1-86.

Johnston, M. (1987). Cost-benefit methodologies in rehabilitation. In M. J. Fuhrer (Ed.), *Rehabilitation Outcomes Analysis and Measurement* (pp. 99--113). Baltimore: Paul H. Brookes Publishing Co.

Kee, J. E. (1994). Benefit-Cost Analysis in Program Evaluation. In J. Whaley, E. P. Hatry & K. E. Newcome (Eds.), *The handbook of practical program evaluation*. San Francisco, CA: Jossey-Bass.

Powe, N., & Griffiths, R. (1995). Clinical-Economic Trials: Background paper 5. In U.S. Congress Office of Technology Assessment (Ed.), *Tools for Evaluating Health Technologies: Five Background Papers, BP-I-I-142* (pp. 125-149). Washington, D.C.: U.S. Government Printing Office.

Torrance, G. (1996). Designing and conducting cost-utility analyses. In B. Spilker (Ed.), *Quality of Life and Pharmacoeconomics in Clinical Trials* (Second Edition ed., pp. 1105-1111). Philadelphia: Lippincott-Raven Publishers.

Watson, D. E. (2000). *Evaluating costs and outcomes: demonstrating the value of rehabilitation services*. Bethesda, MD: The American Occupational Therapy Association, Inc.

World Health Organization. (2000). *Workbook 8: Economic Evaluations*, 2002, from http:www.who.int/substance_abuse/PDFfiles/economicevaluation.pdf

Specific Examples of Cost Studies in AT Outcomes Research

Andrich, R., Ferrario, M., & Moi, M. (1998). A model of cost-outcome analysis for assistive technology. *Disability and Rehabilitation, 20*, 1-24.

Brodin, H., & Persson, J. (1995). Cost-utility analysis of assistive technologies in the European Commission's Tide Program. *International Journal of Technology Assessment in Health Care, 11*(2), 276-283.

Conine, T., & Hershler, C. (1991). Effectiveness: a neglected dimension in the assessment of rehabilitation devices and equipment. *International Journal of Rehabilitation Research, 14*, 117-122.

Haas, U., Andersson, A., Brodin, H., & Persson, J. (1997). Assessment of computer-aided assistive technology: Analysis of outcomes and costs. *AAC Augmentative and Alternative Communication, 13*, 125-135.

Palmer, C., Niparko, J., Wyatt, J., Rothman, M., & deLissovoy, G. (1999). A prospective study of the cost-utility of the multichannel cochlear implant. *Archives of Otolaryngology -- Head & Neck Surgery, 125*, 1221-1228.

Tolley, K., Leese, B., Wright, K., Hennessy, S., Rowley, C., Stowe, J., et al. (1995). Communication aids for the speech impaired: Cost and quality-of-life outcomes of assessment programs provided by specialist communication aids centers in the United Kingdom. *International Journal of Technology Assessment in Health Care, 11*(2), 196-213.

Wyatt, J., Niparko, J., Rothman, M., & deLissovoy, G. (1996). Cost utility of the multichannel cochlear implants in 258 profoundly deaf individuals. *The Laryngoscope, 106*(7), 816-821.

Notes:

E3. Modifications for Mobility

Richard Escobar, BS, ATP, Christine Wright-Ott, MPA, OTR/L
Mobility for Discovery
(Formerly Rehab Technology Research Projects,
Lucille Packard Children's Hospital at Stanford)
San Jose, California

Is straight from the factory good enough for everyone? Over the past 3 years, we have completed over 150 evaluations of clients for upright mobility through the use of support walkers. The majority of clients required a specific custom modification to provide comfort, increased endurance and function. This presentation will provide an overview of custom modifications of mobility devices, which primarily include support walkers and recreational equipment for children and adults. Features of support walkers that affect user performance and a feature matching method to select the most appropriate support walker, options or modifications for an individual will be included

PERSPECTIVES ON USING SUPPORT WALKERS

We define walkers which are hands free and provide a seat, pelvic and trunk pads to support the user, as *support walkers.* Our belief is that it is imperative for young, mobility impaired children, to use a mobility device like a support walker for self-initiated mobility to interact with the environment as their peers do. This new upright position makes it possible for these children, for the first time, to use their upper body, shoulders, arms, hands and eyes to explore and discover things they couldn't otherwise do from a wheelchair, static stander, or stroller. Professionals are often reluctant to recommend support walkers for children with cerebral palsy, because they frequently assume that using a walker will increase an individual's spasticity due to resistive exercise. However, this belief is not supported by research**.** On the contrary, resistive exercise has improved physical function in individuals with cerebral palsy and has not increased spasticity(7,8,9,10). Static positioning equipment such as standing tables, corner chairs and braces are the standard methods of intervention for young children with disabilities, in spite of the fact that little research has been conducted which validates their use. The inability to access one's environment, depriving a child of early mobility experiences and exploration has been researched and determined to have a negative affect on the child's growth and development (1,2,3,4). Only through the use of a hands-free support walker do children even have a chance to experience the benefits of exploration and discovery in the indoor environment, where they spend 80% of their time. A support walker which is specifically and thoroughly assessed to meet the needs of an individual, and is modified to improve performance, can provide endless opportunities for mobility and discovery and positively contributes to growth and development.

OBSERVATIONS OF CHILDREN USING WALKERS

- Care provider of a young 10 year old girl with athetoid cerebral palsy reported more verbalizing, enjoyment and excitement when using the walker, and sleeping through the night for the first time.
- A 6 year old boy with spastic cerebral palsy received his walker and Mother reports he cannot wait to get home from school to use his walker.
- A 9 year old boy with visual impairment takes his walker on the bus to school where he uses it everyday. Previous to using his walker, he had minimal interaction with other children on the playground.

- Fernando, a 2 year old boy with developmental delay, trachea, feeding tube, endurance reported by Mother to be 15 minutes, visually impaired, did not stop exploring when placed in 2 types of walkers during an evaluation, walked for 1 ½ hrs. He walked independently within 8 months of receiving his walker, and had no means for mobility prior to the walker.

SELECTING A WALKER

A support walker should be selected first based on the purpose for using the device and the goals the individual hopes to achieve with it. The purpose may vary according to the child's needs and activity level. The environment must then be considered, and it is most ideal to assess the walker in the child's natural environment where it will actually be used. Once the purpose and environment are considered, the child's physical abilities are matched to the features and options of the walker that best meet the user's needs.

DEFINING THE PURPOSE & GOALS:

Achieving Exploration & Developmental Activities

Several studies have demonstrated the importance of self-initiated mobility and exploration on the development of children. Children, particularly ages 1-5 years, need self-initiated mobility to access their home environment to develop spatial relations, visual perceptual mechanisms, eye hand motor coordination, and social-peer interaction. The primary purpose of a walker is to explore by accessing the environment. It's OK at this stage to use the walker in just one room for exploring, like the kitchen or family room.

Walker features that meet the need for exploration:

- Hands free
- No hardware in front of the user which is deeper than the arm of the child
- All swivel casters may be easier to move in a small, linoleum area like kitchen
- All swivel casters may encourage a young child to work on "cruising," or side steps

Daily Home Tasks: Children between 5-12 years benefit from helping with home activities: Carrying objects, reaching faucets, self care, food preparation, peer interaction.

Walker Features that are more appropriate for achieving daily home activities:

- Hands free walker
- May need a small, flip down tray to carry objects
- All swivel wheels are easier to use on linoleum surfaces in small areas like kitchens.
- Walkers with the ability to remove or lower the upper body support may allow the child to bend and reach during activities.

Sports and Peer Interaction: 10-18 yr old may desire to participate in competitive or friendly sports like little league, soccer or playground games:

Walker Features that work for sports:

- Need walker with stability and no hardware between or in front of the legs
- Wheels at least 6" are more ideal for outdoor use.

Physical Function/Exercise: Daily exercise is important for all individuals. Too often we "containerize" our children in static equipment (5,6).

Walker features that promote physical function:

- Stable base, larger wheels, fixed rear wheels for sidewalks, no hardware between the legs

ENVIRONMENTAL CONSIDERATIONS:

Smooth hard surfaces indoors:
- All swivel wheels, any size wheels, good maneuverability, small base

Carpeted surfaces
- Wheels at least 5" diameter with rear wheel anti-swivel or fixed
- Change threshold shapes to broader, flatter
- Remove throw rugs

Outdoors on uneven surfaces
- Larger base walkers or those with extended frame option
- Wheels at least 5" diameter

PHYSICAL FUNCTION OF THE USER:

Leg adduction (scissoring) interferes with ability to separate legs and reciprocate
- Consider walkers without hardware between the legs
- Modify the seat with a long seat extended from the seat to the knees

Hip abduction is wide and leg placement is not consistent
- Consider walkers with a base frame under the seat rather than around the legs
- Modify seat to extend further down legs and add a flexible leg strap around thighs

Child has low tone or is very weak
- Consider front leaning type of walker, but do not tilt it forward or maintaining the head upright will be difficult
- Use a walker with a well padded seat which can fully support the child's weight
- Use a walker that is lightweight with good bearings in the wheels

Child extends and arches when placed in standing
- Consider positioning the child closer to the ground with knee flexion
- Provide more surface area of support, possibly around the trunk (barrier free vest)
- Head and neck rests may be encouraging an asymmetrical posture. Use a walker with no contact behind the cervical area and neck.

NEEDS OF USERS
- Most children need a minimal to moderate degree of weight relief and support during movement. Walking takes a lot of energy, particularly if the child often "sinks" into a squat position.
- Children who are diagnosed as developmentally delayed, who do not willingly put weight on their legs, need maximum weight relief through the pelvis. They can benefit from gently moving the walker on a smooth hard surface and will eventually take more weight over their legs.
- Seats need to be well padded and protected from hardware. Subjects in our project did not respond well to the standard seats on the walkers, citing discomfort in the groin area (especially boys) and the thighs when rubbing against seat hardware.
- Children, especially those with spastic cerebral palsy, assume undesirable postures when first using a walker. This seems to be due to inexperience in the upright mobility position and postural insecurity. With proper support and possibly more surface contact on their trunk and or pelvis, they typically will improve postural performance within 30 minutes of use.

RECOMMENDATIONS FOR THERAPY TEAM

- The team must first decide what goals the child will accomplish with the device: exploration; developmental activities like pushing, pulling; exercise; stretching; dynamic weight bearing; improved digestive function; sports.
- It is important to evaluate several walkers with a child in side-by-side trials in the environment where it will be used.
- It is most ideal to have modifications which improve performance available on the walkers during the evaluation.
- Test the wheels for spinning capability before using the walker
- Make certain the brakes are not on unintentionally.
- Small adjustments in height and tilt can make a big difference in performance.
- Don't worry about the "perfect gait" or achieving full weight bearing.
- Most children can demonstrate some ability to move a support walker within 10 minutes, if motivated. If not, they may need "motoring" or pushing of the walker by the adult for 30 minutes (similar to treadmill intervention.)
- Bracing: During initial use of a support walker, braces are not recommended, particularly braces that are rigid or have no dynamic component. Some children appear to have an increase in muscle tone when wearing ankle foot orthoses and are not able to reciprocate with the braces on in standing.
- Some children may first walk up on their toes, but most will increase foot contact with the floor (unless there are non-flexible contractures) after using the walker for about 15 minutes.
- The equipment should be reassessed every 4-6 months for adjustments to accommodate growth and developmental abilities.

RECOMMENDATIONS TO MANUFACTURERS:

- Include simple directions for DME providers for assembling walker.
- Consider wheels with good bearings and test the wheels (with weight) over various surfaces, before making final wheel selection.
- Include the option of having all wheels swivel with an anti-swivel mechanism.
- Make the base as small as physically possible for indoor use with options for expanding the frame for outdoor use.
- Manufacturers should measure functional turning radius as measured by the ability for a user to turn in a 38" hallway.
- If a seat is included with the walker, the manufacturer has to assume it will be used as a weight bearing surface and therefore, it needs to be well padded.
- Mobility devices should be designed to reflect the needs of users in various environments and be tested for performance under similar user conditions. New models of support walkers that are only replications of existing walkers face the risk of not meeting the functional needs of users. Substantial research and development to discover new solutions to enhance mobility function is required for new devices to be successful. Without this level of research and development, users may quickly abandon walkers due to poor performance and third party payers will not continue to fund them.

HARDWARE PROBLEMS, SOLUTIONS, MODIFICATIONS
SEATS
Seat is used as a weight bearing area:
- Replace seat with a custom sized, well padded, upholstered seat

Seat does not offer leg alignment for individual who crosses the legs or adducts.
- Replace seat with a custom sized, longer (6-12" in length) seat about 2" wide.

Seat does not offer leg alignment for individual with too much leg separation (abduction)
- Replace seat with a custom sized, longer seat with wide stretch fabric straps that wrap over the thighs and fasten to the inside of the seat.

Seat may have hard edges and hardware which causes discomfort during ambulation.
- Replace seat with soft foam and gel seat.

TRUNK SUPPORTS
Trunk support pads have hard edges or seams that cause discomfort.
- Replace with softer pads that don't have seams or hard edges.

Trunk supports with straps may allow upper body to hang or sag over them.
- Replace strap with firm support if child has difficulty maintaining upright
- Add large, firm, chest support pad to strap.
- Add component to keep strap from sagging.

PELVIC PADS
Some walkers don't give enough anterior support at the pelvis and child's feet get in front of the pelvis, causing the child to only move backwards.
- Add wedge-shaped anterior pelvic pad about 1 ½" wide.
- Add angle adjustable front pelvic wedge
- Hip guides that replaces pelvic strap.

WHEELS:
- Higher quality & larger diameter
- All swivel wheels may be easier to use on linoleum and in small places like kitchens, because the child can move sideways rather than turning the entire walker.
- Walkers with rear fixed wheels are easier to turn on carpet, but functional turning radius may increase.
- Larger diameter wheels are generally easier to move straight on carpet and over thresholds
- Wheels should have good bearings
- Ideal wheel may be an omni-directional wheel, if design improves

ARM SUPPORTS FOR IMPROVING UPPER BODY/HEAD MOVEMENTS
- Trays should be clear
- Keep support minimal so as not to interfere with reaching

MOBILITY DEVICES/MODIFICATIONS FOR INTERVENTION & RECREATION
- **Weight relieving modified teeter totter** The seat on one side is removed and replaced with a modification to hold slide-on weights. A positioning unit with seat and trunk support is made and attached to the other end.
- **Toys for mobility interaction** Various toys can be adapted to encourage children using support walkers to interact with activities similar to their peers.

- **Joystick controlled Go-Carts.** Go-Carts can be made from old power wheelchairs by repositioning the electrical system and joystick. The frame is cut and lengthened, a lightweight plastic seat is added and a roll bar is included for safety.
- **Hand-powered tricycles –** Made by using the client's old wheelchair. Set wheels at lowest frame level. Parts from two old bicycles are used to construct the rest of the bike.
- **Adapted Tricycle** Made by adding a child's bicycle seat, cutting off the bottom part and using it for the foot restraints on the pedals.
- **Stroller Seat Modification** is an inexpensive device made from foldable stroller and a child's bicycle seat.
- **Adapted Scooters** Modified with a seat and small wheels under the footplate for balance.

References

1. Raine A et al. Stimulation Seeking and Intelligence: A Prospective Longitudinal Study. *J Pers Soc Psych*. 2002; 82(4): 663-674.

2.Foreman N, Foreman D, Cummings A, Owens S. Locomotion active choice and spatial memory in children. J Gen Psychol 1990, Jul: 117(3) 354-5.

3.Foreman N, Gillett R, Jones S. Choice autonomy and memory for spatial locations in six-year-old children. Br J Psychol. 1994, Feb: 85 (pt 1): 17-27.

4.Stanton D, Wilson PN, Foreman N. Effects of early mobility on shortcut performance in a simulated maze. Behav Brain Res. 2002, Oct 17; 136 (1): 61-6.

5. National Association for Sports and Physical Education Early Childhood Physical Activity Guidelines & Press Release, NASPE 2002. Available at: http://www.aahperd.org/naspe/template.cfm?template=toddlers.html#.

6.Carnegie Corporation Report. *Starting Points: Meeting the Needs of Our Youngest Children*. Available at: www.carnegie.org/starting_points/startpt1.html. April 30, 2002

7.Andersson C, Grooten W, Hellsten M, Kaping K, Mattson E. Adults with cerebral palsy: walking ability after progressive strength training. Dev Med Child Neurol. 2003, Apr; 45 (4): 220-8.

8.Blundell SW, Shepherd RB, Dean CM, Adams RD, Cahill BM. Functional strength training in cerebral palsy: a pilot study of a group circuit training class for children aged 4-8 years. Clin Rehabil. 2003, Feb: 17 (1): 48-57.

9.Ross SA, Engsberg JR. Relation between spasticity and strength in individuals with spastic diplegic cerebral palsy. Dev Med Child Neurol. 2002, Mar: 44(3): 148-57.

10. Fowler EG, Ho TW, Nwigwe AI, Dorey FJ. The effect of quadripceps femoris muscle strengthening exercises on spasticity in children with cerebral palsy. Phs Ther 2001, Jun;81(6):1215-23.

Our Websites; www.mobilityfordiscovery.com www.rjedesigns.com

E4. Vertical Mobility: An Overlooked Necessity

Juliana Arva, M.S., ATP - Permobil, Inc., Chatham, New Jersey;
Mark R. Schmeler, M.S., OTR/L, ATP - University of Pittsburgh, Pennsylvania

Wheelchair mobility is often only considered from the perspective of people moving from one point to another on a two dimensional plane. However, movement in a vertical direction is necessary and natural in order for people to function and participate in a three dimensional world. Common interventions that provide vertical mobility within a wheelchair include seat elevators and passive standing devices. The interventions however are often denied for payment by third parties as being perceived as unnecessary convenience items of no therapeutic or medical value due to a lack of evidence demonstrating their need. The purpose of this paper is to review the existing level of evidence available that demonstrates need for these interventions from the perspective of standards of practice, functional needs, medical issues, accepted human development theory, and psycho-social values as well as review existing statutory language that governs and defines whether an intervention is a covered benefit. Finally, specific case examples will be presented to illustrate consumer evidence that demonstrates the need for vertical mobility. The findings of this review and analysis can serve as a basis to assist with the justification for seat elevation and standing features on wheelchairs to payers who continue to perceive them as unnecessary.

Professional Standards of Practice

Rehabilitation practitioners are required under their professional standards of practice and codes of ethics to promote a person's independent engagement in functional activities based on their individual preferences and needs through the application of accepted interventions including assistive devices. For example, in the United States the recently published *Occupational Therapy Framework* (1) requires that OT practitioners work towards the improvement of functional performance, support engagement in meaningful activities, and promote participation in home, school, work, and community routines. An OT practitioner's departure from this practice framework would constitute malpractice. Likewise, a physician would be in violation of the *Hippocratic Oath* of "do no harm". A payer source's denial of a claim for a vertical mobility intervention on the grounds that it is a convenience thus forcing a person with a disability to be less functional and more dependent on others could cause practitioners to depart from professional standards of practice.

Functional Considerations

Functionally, the world is set up in three dimensions. Objects and surfaces regularly encountered and necessary to engage in activities of daily living as part of a typical daily routine range from floor level to seven or eight feet high. Inside the home this might include kitchen cabinets, trash under a sink, table or counter heights, bookshelves, shoes on the floor, and electrical outlets. Health and safety can also be compromised without vertical mobility including placing medications out of the reach of children, reaching across a hot stove, or taking a hot bowl of soup out of a microwave oven as well as access to light switches, thermostats, door locks, and food in a refrigerator or freezer. The home environment can to some degree be modified or set-up to address limitations in vertical mobility however when outside the home the need for vertical mobility becomes more obvious even with current accessibility statutes.

Examples include access to high and low grocery store shelves, fire alarms/extinguishers, service counters, vending machines, payphones, elevator buttons, and public washroom toilets and sinks.

A seat elevating device including the possibility of anterior tilt may be needed to allow a person to conduct safe and independent transfers to various surfaces including a bed, toilet, or alternative seating system such as a vehicle seat. For people who have difficulty assuming a standing position for stand pivot transfers or do not possess the strength or coordination to transfer into a higher surface, a seat elevator may be indicated to be more independent, safe, and efficient in the transfer process especially for those use lateral transfer techniques as well as the use of sliding boards. Research on transfers has shown that forces are reduced in the upper extremities when an individual is making a level or downhill transfer (2). Upper extremity repetitive strain injuries are well documented amongst wheelchair users (3) and transfers that require strain to the upper extremities are a contributing factor to this epidemic that results in costly medical interventions and loss of function.

Human Development

Vertical mobility is especially important for children to allow for appropriate cognitive, perceptual, and social development. Many children with disabilities develop a sense of helplessness, which is a direct result of not being able to perform certain activities and participate with their peers, therefore become accustomed to relying on others. The more a child can perform on their own, the less likely they are of developing "learned helplessness", which tends to formalize by the age of four (4). Mobility in the third dimension allows for participation in typical play activities on the floor (seat to floor function), and access to different surface heights such as preschool tables, toy shelves, drawers, or standard dining room tables. Children develop by exploring and accessing objects in the environment that stimulate their curiosity and facilitate the development of cause/effect relations, language skills, and social interactions.

Medical & Physiological Necessity

Depending on the solution chosen for vertical mobility, it may also have many added direct physiological benefits. Passive wheelchair standers have innumerable direct medical benefits (5). Users may experience decreased rate of bone demineralization with the consequent reduced risk for fractures, improved bowel and bladder function, prevention/reduction of contractures due to frequent independent ranging of the lower extremities, less occurrence of pressure sores due to full pressure relief under the ischial tuberosities, reduction in spasticity, decreased risk for urinary tract infections, and improved respiratory and gastro-intestinal function. Research suggests that in order to obtain full prevention of osteoporosis, mechanical loading is necessary through the longitudinal axis of the bone, and this load needs to be dynamic (6). Wheelchair standers provide the opportunity to apply frequent loading of varying magnitudes to the long bones of the lower extremities. The literature on the medical benefits of standing is very extensive, and it is beyond the scope of this paper to provide a full list of references.

Psychosocial Issues & Societal Values

There are many general, psycho-social issues associated with vertical mobility. The *Collins English Dictionary* (7) defines vertical mobility as: "the movement of individuals or groups to positions in society that involve a change in class, status, and power.

Vertical mobility can raise society's expectation of wheelchair users and provide them with a more equal chance for success especially with children and young adults. Studies show taller people make more money and are more successful (8). Shorter children are more likely to be bullied than taller ones (9). Eye to eye conversations are more socially appropriate and improve a person's ability to participate in social activities.

Statutory Language

The challenge remains convincing third party payers that vertical mobility is medically necessary. This requires interpretation of the somewhat vague definition of medical necessity. According to the United States Social Security Act of 1965, section 1862(a)(1)(A) medical necessity is defined as: S*ervices and items found to be reasonable and necessary for the diagnosis or treatment of illness or injury or to improve the functioning of a malformed body member.* The issue lies in the language "improve the functioning of a malformed body part" however the intent rather than the letter of the law was most likely to also mean replace the function as prosthetic devices are covered benefits under the law. Therefore, for example, if a power seat elevator is prescribed to improve or replace a person's ability to reach or conduct a more independent transfer due to decreased strength, quality of movement, or range of motion in the extremities due to underlying pathology or disease (malformed body member), it could readily be interpreted as medically necessary in the same manner that a prosthetic device replaces the functioning of an amputated limb. Likewise the standing feature on a wheelchair could also be needed for reaching and transfers but can also be justified based on the physiological benefits.

Consumer Evidence

A 53 year old male with Multiple Sclerosis who has been in a wheelchair for the last 5 years and recently started using a passive standing feature on his power wheelchair reports decreased constipation, decreased urinary frequency and increased quality of output, decreased edema in the lower extremities, decreased emotional stress associated with less incontinence, decreased spasms in the lower extremities, improved sitting posture, improved pain management through postural changes, and greater sense of well-being and control.

A 42 year old woman with osteogenesis imperfecta who uses a power wheelchair and recently added a power seat elevator to her system due to chronic shoulder degeneration reports the feature allows her to reach in her kitchen to fix breakfast for her and her son, reach the thermostat to adjust the temperature, reach medicine stored out of reach of her son, transfer into and out of the driver's seat of her van, reach elevator buttons at work, reach the fax and copy machine at work, reach the counter at the bank and any fast food restaurants, reach food items while shopping, mail a letter, transfer on and off the toilet at work or in any public restroom, pump gas, reach a pay phone, and be able to engage in and hear conversations at eye level.

A 12 year old girl with spastic quadriplegic cerebral palsy recently started using a power standing wheelchair. This enables her to wash her hands independently, get a glass of water, open the backyard door, and accept duties at school which require opening drawers at different heights and obtaining different files and folders. She can now fix lunch for herself by independently taking food out of the refrigerator, putting it into the microwave, using the controls, reaching into utensil drawers, and taking a plate out of the cabinets.

A 5 year old boy with a rare form of dwarfism, who is able to scoot around on the ground independently, recently received a power wheelchair which enables him to get down onto the floor independently. When he plays basketball, he can now pick the ball from the ground without having to ask for help. He reaches shelves at different heights to get his toys. He can lower himself to the level of a toy piano and play music like the other children. At school he can be part of all activities, by lowering himself to the floor when the other children play. He can transfer himself in and out if his wheelchair, elevate himself up to higher surfaces, and keep up with his peers when moving about.

Summary

In the United States the Centers for Medicare and Medicaid Services (CMS) recently issued procedure codes for both seat elevators and standing features on wheelchairs with clear language that these are not covered benefits under the Medicare program. This coverage policy does not appear to be based on any scientific or clinical knowledge but rather an arbitrary perception they are convenience items. Therefore practitioners need to prescribe these interventions when they are needed and appeal the policy on a case by case basis and petition policy makers on a national level using the available scientific literature, professional evidence, and the evidence provided by specific consumers. As demonstrated in this paper, consumers benefit on many levels from such devices; their quality of life, participation, and full independence may well depend on having the third dimension of mobility. More research studies should also be conducted to further demonstrate and quantify the benefits of standing and seat elevation features for wheelchair users.

References

1. Occupational Therapy Practice Framework: domain and process. *Am J Occup Ther* 2002, 56(6): 609-639.
2. Wang YT, Kim CK, Ford HT, Ford HT, Jr. Reaction force and EMG analyses of wheelchair transfers. *Perceptual & Motor Skills* 1994; 79(2):763-766.
3. Sie IH, Waters RL, Adkins RH, Gellman H. Upper extremity pain in the postrehabilitation spinal cord injured patient. *Arch Phys Med Rehabil* 1992; 73:44-48.
4. Safford PL, Arbitman DC: Developmental Intervention with Young Handicapped Children. Springfield, IL, Charles C. Thomas, 1975.
5. Dunn RB, Walter JS, et al. Follow-up assessment of standing mobility device users. *Assistive* Technology 1998: 10(2): 84-93.
6. Rubin CT. Lanyon LE. Regulation of bone formation by applied dynamic loads. *Journal of Bone & Joint Surgery - American Volume. 66(3):397-402, 1984 Mar.*
7. The Collins English Dictionary © 2000 HarperCollins Publishers
8. Harper B. Beauty, Stature and the Labour Marker: A British Cohort Study, *Oxford Bulletin of Economics and Statistics* 2000 62(Dec. Special Issue). 771-800.
9. Voss LD, Mulligan J: Bullying in school: are short pupils at risk? Questionnaire study in a cohort. BMJ. 2000 Mar 4;320(7235):612-613.

E5. "It's Just Like Riding a Bike" ... Seating Evaluation and Interventions for Handcycles

Kendra Betz, MS, PT
VA Puget Sound Health Care System, Seattle, Washington

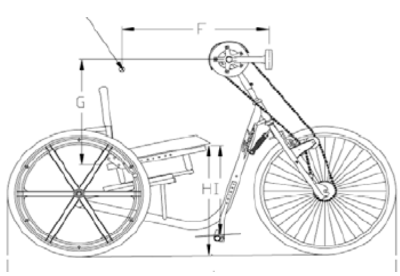
Handcycling as an adaptive sport
- Growing awareness and popularity for recreation and competition
- International Handcycling Federation: sanctioned competitive sport
- 2004 Paralympics in Athens

Handcycle Anatomy 101 and Terminology
- Upright: high sliding seat, easier transfers, short distance recreation
  Examples: Quickie Mach 2, Quickie Kidz bike, Top End Exclerator

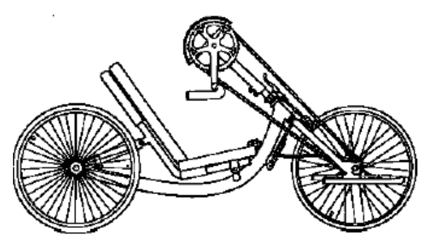
- Recumbent: low seat, advanced transfers, recreation & competition
  - Lean Steer: seat swings on frame with body lean to turn
    Examples: Freedom Ryder bikes, Lightning cycles

  - Pivot steer: hand crank pivots on frame to turn
    Examples: Top End Pro, Quickie Spirit 470

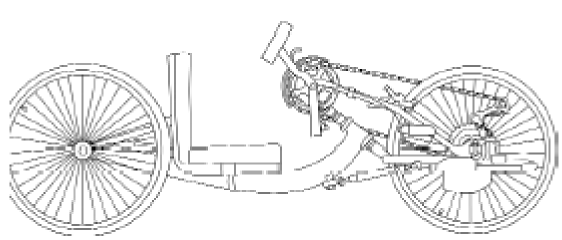
- Trunk Powered: low seat, forward trunk position, pivot steer, competition



Quickie Mach 2 Upright



Top End XLT Pro Recumbent



Top End XLT Gold Trunk Powered Bike

Handcycle Selection and Configuration

Requires a comprehensive assessment similar to that for high end manual chairs

- Thorough client background review with specific needs identified
- Seating/posture evaluation
- Equipment trials
- Customization of end product

Background/needs assessment

- Medical Background: age, disability, surgeries, current fitness level, etc.
- Identification of cycling goals:
  - Recreation, fitness, competition?
  - Distance and terrain anticipated?
- Functional skills: transfers, balance, UE function, chair stow
- Support systems for riding (clubs/teams, family, friends)
- Transportation & storage of the equipment

Seating/Posture Evaluation

- Anthropometrics: height, weight, physique
- Sitting in wheelchair: identifies posture presentation in usual seating system
- Short sitting on firm mat: removes influence of the chair
- Supine on firm mat: removes influence of gravity
- Sitting on bike: demonstrates influence of bike configuration

What are we looking for in the seating evaluation?

- Postural presentation/musculoskeletal alignment in frontal, sagital, transverse planes
  - Deviations from "normal"
  - Fixed or flexible? General rule is correct flexible, accommodate fixed
  - ROM: any limitations to accommodate?
- Neuromuscular coordination
  - Tone: extensor and/or flexor synergies, influence on position
  - Strength: trunk, extremities
  - Functional skills: balance, transfers, pressure release, adaptive strategies

Equipment Trials

- Need to know the options available and associated factors
  - Bike options for adults and children
  - Upright vs. Recumbent
  - Pivot steer vs. lean steer
  - Adjustable vs. custom configuration
  - Components available on various models

- Seat and back options
    - Seat/back sizes, designs, positions available
    - Specific adjustments possible
    - Ability to customize with alternative products
    - Cushions, backs, laterals, hip guides, cranks, pedals

Seating Interventions on Handcycle ----------Case Examples

A. Comfort

- Critical factor that must be considered/assessed with all modifications
- Sense of balance and equipment control may be the "comfort report"
- Sustained postures and repetitive motion for many hours

B. Skin protection

- Seat configuration: solid vs. sling seat, shape, size
- Cushion options: low profile needed for low COG and crank clearance
- Pressure releases: more difficult to do during prolonged rides
- Goal is to optimize pressure distribution, prevent skin breakdown

C. Postural support

- Utilize available adjustments for fine tuning
- Provide appropriate base of support based on posture eval findings/trials
- Consider after market products, creative interventions to optimize support

D. Joint preservation

- Prevention of repetitive strain injuries through proper bike configuration
    - Arm crank height and distance from trunk adjusted
    - Seat and back orientation optimized
    - Wrists maintained in neutral position
- Education for injury prevention
    - Transfers: avoid using crank housing or backrest for push
    - Straps: may exacerbate injuries in a rollover
    - Training: utilize appropriate endurance progression

E. Performance

- Recumbent: pivot or lean steer is rider preference based on trials
- Stable, lightweight, aerodynamic
- Adjustments in rider position/support to optimize power output
- Accessory options: cranks, pedals
- Postural support that is not inhibitory
- Consistent training

Other Handcycles of Interest

- One-Off Titanium All Terrain Handcycle: "truly a mountain bike"
- Angletech: propelled by both legs and arms
- Mobility Engineering: 2-wheeler with out-riggers

Handcycling Research

Published research limited (Janssen 2001, van der Woude 2000)

Recommendations for research

- Bike design and configuration for optimal performance
- Seating recommendations for skin protection, support
- Injuries associated with handcycling; prevention of injuries
- Handcycling as an aerobic exercise
- Long term compliance with cycling vs. other sports/exercise

"Handcycle Clinic" at VA Puget Sound Health Care System, Seattle

- Interdisciplinary approach: RT, PT, MD, OT, Equipment Tech
- Specific eligibility guidelines for sports equipment
- Comprehensive evaluation
- Equipment trials
- Prescription of bike, customization
- Support/encouragement for goal oriented cycling program

Resources & References

Published Research on Handcycles

Janssen TW, Dallmeijer AJ, van der Woude LH. Physical capacity and race performance of handcycle users. Journal of Rehabilitation Research and Development. 2001;38(1):33-40.

van der Woude LH, Bosmans I, Bervoets B, Veeger HE. Handcycling: Different Modes and Gear Ratios. Journal of Medical Engineering and Technology. 2000;24(6):242-9.

Published Research on Related Topics

Bressel E, Bressel M, Marquez M, Meise GD. The effect of handgrip position on upper extremity neuromuscular responses to arm cranking exercise. Journal of Electromyography & Kinesiology. 2001;11(4):291-8.

Price MJ, Campbell IG. Thermoregulatory responses of spinal cord injured and able-bodied athletes to prolonged upper body exercise and recovery. Spinal Cord. 1999;37(11):772-9.

Jeukendrup AE, Martin J. Improving cycling performance: how should we spend our money? Sports Medicine. 2001;31(7):559-69.

Gnehm P, Reichenbach S, Altpeter E, Widmer H, Hoppeler H. Influence of different racing positions on metabolic cost in elite athletes. Medicine & Science in Sports & Exercise. 1997;26(6):818-23.

Articles on Handcycling and Wheelchair Sports

Fleming, A. (2002, May/June). Getting a Handle on Handcycles. *Active Living*, 44-48.

Karp, G. (2001, October). How to Select the Right Handcycle. *Spinlife.com*.

Segedy, A. (1997, April). Sport Wheelchairs. *TeamRehab Report*, 33-34.

Vogel, B. (2002, March). Handcycling for Everyday Users. *New Mobility*. 41-43.

Vogel, B. (1998, September). Training Camp: Cyclists Roll Out Disability Culture. *New Mobility.* (on-line).

Seating and Equipment Assessment Resources

Hastings JD. Seating Assessment and Planning. *In*: Physical Medicine and Rehabilitation Clinics of North America: Topics in Spinal Cord Injury Medicine. 2000;11(1):183-207.

Huss, D. Manual Wheelchair Evaluation. *In:* Wheelchair Selection: Seating and Positioning for Adults (course manual). 1994.

Handcycle Manufacturers' Websites

invacare.com
sunrisemedical.com
newhalls.com
varnahandcycles.com
freedomryder.com
greenspeedrecumbents.com
mobilityeng.com
handcycle.com (Lightning)
eaglesportschairs.com
angletechcycles.com
titaniumarts.com

Handcycle Informational Websites

ushf.org
handcycling.org.uk
bhsi.org
bike-on.com
spinlife.com
handcycling.com
remote-ability.com
bicycling.about.com
handcycleracing.com
handsportusa.com
quinntecentral.co

E6. Developing Client Centered Guidelines for Power Mobility: An International Perspective

William B. Mortenson, Clinical Practice Leader (OT), Vancouver Coastal Health , Jeanette Boily, Clinical Practice Leader (OT), Vancouver Coastal Health , William C. Miller, Assistant Professor, School of Rehabilitation Services,UBC

Workshop Goals

1. Participants will review a variety of approaches to power mobility safety.
2. Participants will discuss client-centered ways in which power mobility safety guidelines can be developed and implemented within the settings in which they are familiar.

Background

Power mobility has a strong impact on quality of life of its users. Power mobility facilitates participation in self-care, productivity and leisure occupations in adults [1,2,3] and children [4,5]. Psychosocial benefits may include improved affect, increased assertiveness and increased autonomy [6,7]. Despite the benefits of power mobility, there are risks associated with its use.

Although there are media [8] and other reports [9, 10] of power mobility incidents, the prevalence of accidents in Canada is difficult to ascertain, as neither Statistics Canada nor the Workers Compensation Board keep wheelchair accident statistics. Frank et al. [11] found that within four months of power mobility provision, 'mishaps,' which included tipping from chairs and falls during transfers, were reported by 13% of those surveyed (15 out of 113). The Vancouver Coastal Health (VCH) residential facility with the greatest prevalence of power mobility users (82 out of 142 residents) reported 16 incidents of property damage from July 1999 to July 2000 resulting from power wheelchair use. This report is likely conservative, as only serious accidents or a series of escalating incidents tend to be reported; and minor incidents were probably overlooked. Within VCH residential facilities, power wheelchair accidents have caused 1) personal injuries that have involved workers compensation claims, 2) damage to facility and private property, and 3) automobile accidents. In light of these types of incidents, it is perhaps not surprising that Reed, Yochum and Schloss [12] reported that 30% of long-term care residents they surveyed felt that other drivers within the facility drove unsafely.

Power wheelchair use is expected to increase as technological innovations enable more individuals to drive powered wheelchairs [13]; and more individuals, particularly the elderly who are by far the fastest growing [14] and largest demographic to use power mobility, have a need for power mobility. Increasing consumer knowledge and visibility of power wheelchair devices in the community and in facilities may also lead to an increase in demand for these devices [15]. Logically, an increased prevalence of power mobility use would likely lead to an increased number of accidents.

Assessing power wheelchair safety is a contentious and troubling issue for therapists and their clients. Although two standardized power wheelchair assessments have been developed, the Power-Mobility Indoor Driving Assessment (PIDA) [16] and the Power-Mobility Community Driving Assessment (PCDA) [17], both were designed to enhance mobility rather than "assist the health care professional in deciding whether or not someone should have access to power mobility" [18]. Because of the impact of loss of independent mobility, the decision to withdraw a person's power mobility for safety reasons can be controversial and ethically problematic.

The loss of power mobility represents a serious concern for users or as one remarked, "It's my legs!" The removal of a power mobility device often meant residents were dependent on others for mobility and, in the absence of adequate assistance, were extremely limited in their ability to participate in activities, which could create occupational deprivation [19]. On one hand, given occupational therapist's mandate of client-centered practice and focus on enabling occupation [20]), limiting participation in meaningful activities is discordant with a therapist's raison d'être. Most therapists see the "potential" to overcome or improve rather than the need to create a barrier towards doing. On the other hand,

> If client's goals appear to be unsafe or to place people at risk for injury or illness, occupational therapists need to exercise legal and ethical responsibilities for identifying potential harm if clients decide to engage in clearly dangerous or socially irresponsible actions. [21]

In the absence of a gold standard to assess when a client is safe with power mobility, therapists generally rely on their clinical reasoning to make a decision about whether to provide, limit or discontinue power mobility use. Several agencies have also developed guidelines to assist in decision making around such contentious issues (see appendix A).

Rather than unilaterally impose guidelines on power mobility users the authors of this workshop were involved in two-part research project that involved power mobility users and other residential facility stakeholders in the development of safety guidelines. In the first phase of the research, driver and non-driver perceptions of power mobility and power mobility safety were explored through the use of qualitative interviews with 19 individuals associated with residential facilities. In the second phase safety guidelines were developed using a modified Delphi technique [22], which involved 26 individuals from 8 stakeholder groups. The Delphi is a multiple stage decision making process in which participants who are unknown to one another are given successive questionnaires, which are formulated from information derived from previous ones [23]. During the three rounds of the Delphi process a power mobility assessment and safety flow chart (see appendix B) was developed and each step was operationalized. Although this syllabus submission does not permit room for the entire guidelines, some of the areas of controversy addressed during the Delphi process included questions of

- Who should be considered for power mobility?
- Should different standards be applied to those who owned their own chairs versus those who used facility chairs?
- When should assessment for power mobility be considered unsuccessful?
- What would be considered a reasonable limitation or intervention to promote safe mobility?
- How should an incident be defined? What assessment process should take place when there is an incident and what are some reasonable interventions that could occur?
- When is it appropriate to remove power mobility and for how long?
- How should appeals to such decisions be handled?

During this workshop participants will have the opportunity to explore some of these areas of controversy within the settings in which they work and explore the relationship between client-centered practice and power mobility safety.

Workshop Outline

1. Introduction
2. Summary of different approaches to power mobility safety
3. Breakout session:

   Working in small groups, participants will

   1) describe how problem situations (presented in vignette format) would currently be responded to within the settings where they work or live.

   2) discuss how problem situations could be dealt with in a more client-centered manner and how client-centered guidelines could be developed and implemented within the settings where they live or work.

5. Conclusion

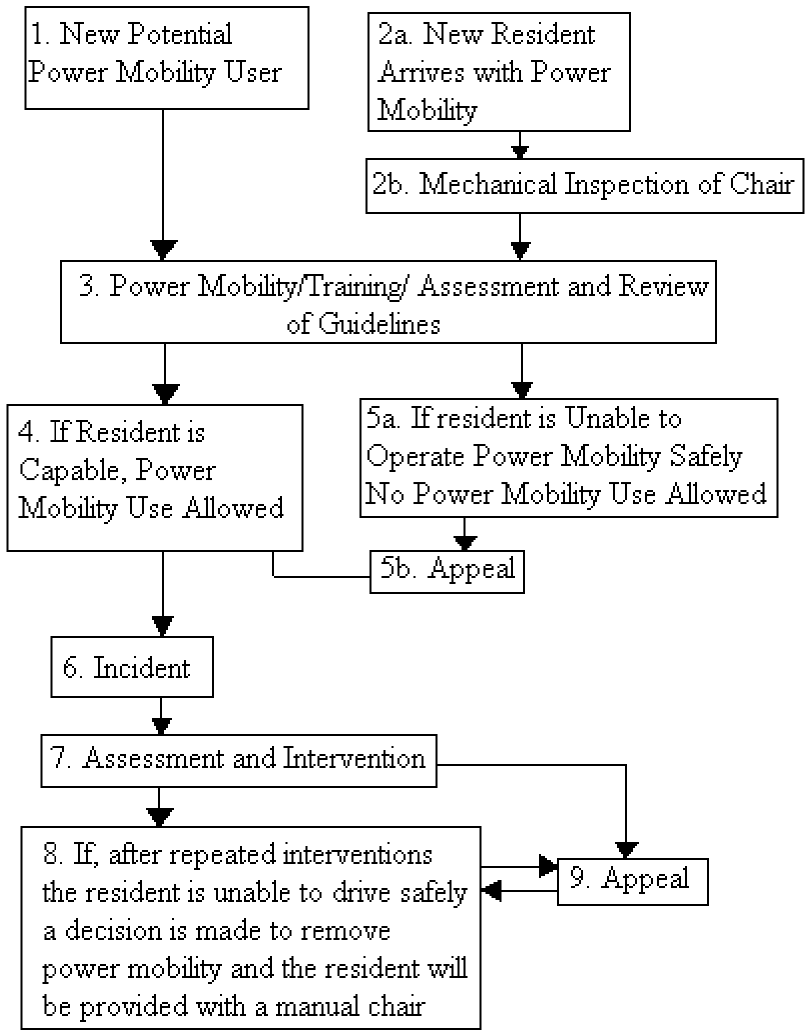
Participants who provide an address will receive a summary of the discussion during this workshop

Appendix A: Power Mobility Safety Matrix

Name	Brandon Regional Health Authority Power Mobility Program[24]	North Shore Health Power Mobility Assessment (PMAX)[25]	Powered Indoor Driving Assessment (PIDA)[26]	Powered Community Driving Assessment (PCDA)[27]
Features and Development	-Combined policy and assessment. -Policy reviewed via hospital administration and assessment reviewed by a variety of community and facility OTs within the region.	-Developed by the author with clinical trials by community occupational therapists -Emphasizes informed consent and driver competency - Ongoing revision and reliability validity studies planned	-Designed to enhance rather than prevent access to power mobility -Performance rather than capability oriented -Developed using feedback from 10 occupational therapists with additional feedback from occupational therapists from other facilities and wheelchair users	-Developed by five clinical experts and five power mobility users -Described in an article in the Canadian Journal of Rehabilitation -Not currently available
Component Assessments	Yes -Includes wide range of non-standardized physical and cognitive assessments	Yes - Includes wide range of non-standardized physical and cognitive assessments	No	Seems to assess power mobility related judgement with emergency scenario questions
Standardized Component Assessments	includes MVPT and Cognistat	includes ALSAR, MMSE, Clock Drawing Test, MVPT, Trail making A & B	N/A	No
Driving Test	Yes (no reliability validity data)	Yes (no reliability validity data)	Yes Intra rater ICC 0.67 Inter rater ICC 0.87	Yes (no data re-standardization)
Contract	Yes	Yes	Yes	?
Guidelines	Yes	Suggests interview with client to discuss findings	Suggested guidelines for wheelchair removal for increasing amounts of time with additional incidents	?

Appendix B

Power Mobility Assessment and Safety Flow Chart



References

1. Miles-Tapping, C. & MacDonald, L.J. (1994). Lifestyle implications of power mobility. *Physical and Occupational Therapy in Geriatrics*, 12(4), 31-49.
2. Evans, R. (2000). The effect of electrically powered indoor/outdoor wheelchairs on occupation: A study of users' views. *British Journal of Occupational Therapy*, *63* (11), 547-553.
3. Frank, A.O., Ward, J., Orwell, N.J., McCullagh, C. & Belcher, M. (2000). Introduction of a new NHS electric powered indoor/outdoor chair (EPIOC) service: benefits, risks and implications for prescribers. *Clinical Rehabilitation, 14* (6), 665-673.

. Butler, C. (1991). Augmentative mobility: Why do it? *Physical Medicine and Rehabilitation*

Clinics of North America, *2*, 801-815.

5. Bottos, M., Bolcati, C., Sciuto, L., Ruggeri, C. & Feliciangeli, A. (2001). Powered wheelchairs and independence in young children with tetraplegia. *Developmental Medicine & Child Neurology, 43* (11), 769-777.
6. Miles-Tapping & MacDonald (1994) (ibid)
7. Evans (2000) (ibid)
8. Bohn, G. (2000, December 13). Scooter-riding seniors a hazard in mall. *The Vancouver Sun,* pp. B1, B7)
9. Godfrey, C. (1996). Wheelchair drivers sidewalk menace? [letters] *Canadian Medical Association Journal, 154*, 6, 762.
10. Legal Eagle Eye Newsletter for the Nursing Profession (2001). Neighbour struck by motorized wheelchair: Court says home health aid not to blame. *Legal Eagle Eye Newsletter for the Nursing Profession, 9*, 6, 8.
11. Frank et al. (2000) (ibid)
12. Reed, R.L., Yochum, K., Schloss, M. (1993). Platform motorized wheelchairs in congregate care centers: A survey of usage and safety. *Archives of Physical Medicine and Rehabilitation*, 74, 101-103.
13. Dawson, D., Chan, R., & Kaiserman, E. (1994). Development of the power-mobility indoor driving assessment for residents of long-term care facilities: A preliminary report. Canadian Journal of Occupational Therapy, 61(5), 269-276.7.
14. Perreault, J. (1990). Population projections for Canada. Provinces and territories (1990). 1989-2011 (p. 107). Ottawa, ON: Statistics Canada.
15. Hendrickson, R.M. (1999). Use of personal-powered vehicles in a nursing facility. Annals of Long-Term Care, 7(4), 149-152.
16. Dawson, Chan, Kaiserman (1994) (ibid).
17. Letts, L., Dawson, D., Kaiserman-Goldenstein, E. (1998). Development of the power-mobility community driving assessment. *Canadian Journal of Rehabilitation*, 11(3), 123-129.9. Lloyd, S., Cormack, C.N., Blais, K., Messeri, G., McCallum, M.A., Spicer, K., & Morgan, S. (2001). Driving and dementia: A review of the literature. *Canadian Journal of Occupational Therapy, 68*, 3, 149-156.
18. Letts, L., Dawson, D., Kaiserman-Goldenstein, E. (1998), p. 124. (ibid)
19. Whiteford, G. (2000). Occupational deprivation: Global challenge in the new millennium. *British Journal of Occupational Therapy. 63* (5), 200-204.

20. Canadian Association of Occupational Therapists (CAOT) (1997). Enabling Occupation: An Occupational Therapy Perspective. Ottawa, Ontario: CAOT Publications ACE.
21. Ibid, pp. 54-55.
22. Hicks, C.N. (1999). The Delphi Technique. In C.N. Hicks Research Methods for Clinical Therapist. Applied Project Design and Analysis 3rd Ed., pp. 243-249. Toronto, ON: Churchill Livingstone
23. Sumsion, T. (1998). The Delphi technique: An adaptive research tool. British Journal of Occupational Therapy, 61 (4), pp. 153-156.
24. Laminman, K., Webber, K. (2003). A Region-wide power mobility program. *Preliminary Program. CAOT Conference*. (p. 24). CAOT: Ottawa, ON. (email: Kristal Laminman KLaminman@exchange.hsc.mb.ca or Shannon Webber webbers@brandonrha.mb.ca)
25. Brighton, C. (2003) Rules of the Road. *Rehab Management. The Interdisciplinary Journal of Rehabilitation, (April). email: Cathy Brighton,* cbrighton@shaw.ca
26. Dawson, D., Chan, R., & Kaiserman, E. (1994). Development of the power-mobility indoor driving assessment for residents of long-term care facilities: A preliminary report. *Canadian Journal of Occupational Therapy*, 61(5), 269-276.
27. Letts, L., Dawson, D., Kaiserman-Goldenstein, E. (1998). Development of the power-mobility community driving assessment. *Canadian Journal of Rehabilitation*, 11(3), 123-129.

Notes:

POSTER

Rapid Determination of the Front, Back and Side to Side Stability of an Occupied Mobility Aid in a Clinical Setting

Andrew Brulé, MASc, PEng
Sunny Hill Health Centre for Children, Vancouver, British Columbia

Currently at most clinical rehabilitation centers, the only method for determining the stability of a mobility aid after modifications is subjective; the technician lifts up and pushes down on the handles to test if it “feels” stable.[1] Studies have shown that this can lead to an inaccurate estimate of the mobility aid stability particularly with heavier wheelchairs.[2],[3] The Rehabilitation Engineering Department has developed a prototype computer controlled ramp designed to determine the centre of gravity and static stability of an occupied wheelchair in a clinical setting. The device uses a computer controlled ramp and a pressure mat to determine the centre of gravity. Currently the error generated by the measurements of the pressure sensing mat makes the clinical application of the device unsuitable. However, theoretical validation of the Excel model indicates that if accurate pressure readings were delivered to the model, the centre of gravity of the system could be determined with a ±1% error factor and in less than 5 minutes.

[1] Kirby R. Ashton BD. Ackroyd-Stolarz SA. MacLeod DA. Adding loads to occupied wheelchairs: effect on static rear and forward stability. [Journal Article] Archives of Physical Medicine & Rehabilitation. 77(2):186, 1996 Feb.
[2] Ibid, 77(2):185, 1996 Feb.
[3] Cooper RA. Stewart KJ. VanSickle DP. Evaluation of methods for determining rearward static stability of manual wheelchairs. [Journal Article] Journal of Rehabilitation Research & Development. 31(2):147, 1994.

POSTER

Reliability of a Method to Manage a Seating & Mobility Waitlist

Sandy Daughen, OT, Coordinator of Rehabilitation Services, The Lodge at Broadmead Tillicum and Veterans Care Society operating The Lodge at Broadmead and Veterans Health Centre

Summary:
The Lodge at Broadmead has developed a scale to assist in the management of a seating and mobility waitlist. The Broadmead Priority Assessment Scale for Seating or BPASS (see attached), is an 7 item clinical tool that uses chart review or interview with the resident, family or staff members, to evaluate resident status on a series of health-related measures. The measures include pressure sores, frequency of falls, current equipment status, eating, mobility and health change. This scale, which takes approximately 15 minutes to complete, is designed to determine waitlist priority placement for individuals who require a new wheelchair or seating device. The development of the BPASS was presented at the 19th Annual International Seating Symposium.

This presentation will present initial reliability data collected for the BPASS in August 2002. Data was collected by 2 occupational therapists at The Lodge at Broadmead using the BPASS and a non-practising occupational therapist assisted with the collection of demographic information, such as age, gender and veteran status. The process was repeated 2 weeks later to enable test-retest reliability while comparison of scores between the evaluators determined the inter-rater reliability of the BPASS. The presentation will also outline the initial development process of the BPASS and discuss the use of this new scale at The Lodge at Broadmead. Further areas for research and inquiry will also be highlighted.

POSTER
A Mobile Rocker Base to Provide Calming Sensory Input

Lynore McLean, B.Sc.P.T.Physiotherapist
Sunny Hill Health Centre for Children Vancouver, B.C., Canada

Josh was first assessed at 4 years old and he had no official diagnosis. He displayed global developmental delay, independent sitting, and normal range of motion. While Josh responded well to routine and a familiar environment, without these he became extremely agitated and vocal. When younger, Josh spent much of his time at home in a small commercially available rocking chair. The rocking motion was his only means of comforting himself, and as a result it was difficult to leave his home and participate in family or other meaningful activities. His parents and community therapists desired a way to bring Josh into the community that would provide him the means to calm and comfort himself.

The solution, devised by David Cooper, was to provide Josh with a basic custom postural control system (P.C.S.) mounted on a rocker base within a manual wheelchair. The rocker base consists of a pivot mounted low on the wheelchair frame that allows approximately 10° of forward movement and 22° of backward movement. A bungee cord resists the rocking motion, and there is a lock out mechanism to fix the seat position anywhere within the 30° of movement. The P.C.S. is mounted to a seat interface that sits above the seat rails. The footrest is mounted to the wheelchair to provide Josh with a solid surface to “push off” from. The anti-tippers are extended about 12.5 cm (5”) to prevent the chair from tipping backwards. The movement approximates that of a rocking chair.

After two months in use, Josh’s community P.T. reported that both Josh and his family were “pleased” with the new insert and wheelchair. Now the family is able to take Josh out into the community and he is able to calm himself in unfamiliar surroundings. Josh uses the rocking mechanism much of the time and it has helped to improve the whole family’s “quality of life”.

POSTER
Item analysis of the Seated Postural Control Measure (SPCM)

Lori Roxborough, MSc OT/PT Maureen Story, BSR PT
Sunny Hill Health Centre for Children (part of Children's and Women's Health Centre of British Columbia)

Introduction:
The SPCM is a 34 item criterion-referenced evaluative measure designed to measure postural control outcomes of adaptive seating intervention for children with neuromotor disabilities.

Objective: The purpose of this study is to analyze the item properties of the SPCM to assess item homogeneity, item difficulty and item discrimination.

Methods: This study involved secondary analysis of data from two previous repeated measures reliability studies[1,2] in which the SPCM was administered to 92 children with neuromotor disabilities using two raters and two seating conditions. Item homogeneity was assessed by calculating inter-item correlations for each of the items pairs. Item difficulty was the mean score for each item in the pre-seating condition. Berk's formula[3] was used to assess item discrimination. It is the proportion of participants whose scores increased from the pre-seating to the post-seating condition.

Results: - Item homogeneity - only one of the inter-item correlations exceeded .95
- Item difficulty - 31 of 34 items were within the accepted difficulty level (score < 3.5)
- Item discrimination - 30 of 34 items showed the capacity for change (Berk's index >.2)

Conclusion: Only minor changes to 3 items are required to achieve optimum item properties for this evaluative measure.

References:
1. Fife SE, Roxborough LA, Armstrong RW, Harris SR, Gregson JL, Field D (1991) Development of a clinical measure of postural control for assessment of adaptive seating in children with neuromotor disabilities. Physical Therapy, 71, 981-993.
2. Fife SE, Roxborough LA, Story M, Field D, Harris SR, Armstrong R (1993) Reliability of a measure to assess outcomes of adaptive seating in children with neuromotor disabilities. Canadian Journal of Rehabilitation, 7, 11-12.

Berk R (1984) Conducting the item analysis. In Berk RA (Ed), A Guide to Criterion-Referenced Test Construction. Baltimore MD: Johns Hopkins University Press

POSTER

Study on the Factors Affecting the Relationship between Independent Mobility and Modes of Daily Activities of Elderly Persons who Use Wheelchairs at Nursing Homes.

Yoshinori Saito, Takeshi Shigenari and Susumu Uehara.
Kawasaki University of Medical Welfare, Dept. of Medical Welfare Environmental Design

Summary:
The aim of this study is to clarify the factors that may affect the relationship between the independent mobility and ordinary daily activities of elderly persons who use wheelchairs in the environment of nursing homes.
Subjects for the study were from several nursing homes, and the observation and time-motion study were carried out for approximately three months on items described below:

* General scope of the capacity of independent mobility for elderly persons both with sample group who use wheelchairs and those not using them.
* The relationship between independent mobility and routine daily activities.
* Effects of varied types of nursing home environments on the daily activities of those who use wheelchairs.

Findings were as follows:

* Speed in the case of a wheelchair run by using the upper arms was as low as 20 to 30% of those walking with no aid at all.
* The daily activity behavior of elderly persons using wheelchairs tends to be affected by the speed of movement, and the distance that required for need of fundamental physiological request, time for staying in bed, also the feature of a semi-private-system. Additional findings revealed that aged persons who showed a skilful talent to manipulate their wheelchair seemed to yield more free time in a day outside their given schedule. Also, they showed a variety of moving activities. What initiated the moving action for a person with low movement ability was the need to meet their physiological requests, such as using the bathroom.
* Daily physical activities was affected greatly by their daily program schedule and utilization of the spaces available to them. We suggest that evaluation of wheelchairs for the future should contain factors related to their living environment.

POSTER
Adaptation and Evaluation on the SRC Walker for Children with Severe Disabilities through Cases in the Habilitation Center and the Special School

Takeshi SHIGENARI, Toshihiko TSUTSUMI, Shigeru OTA, Yoshinori SAITO Kinki Welfare University. Dept. of Welfare Business, Faculty of Social Welfare

Summary:

The SRC Walker was designed and developed by the authors in 1985 for children with severe disabilities. SRC stands for Spontaneous Reaction Control. The walker had been utilized to facilities and special schools in Japan. But this walker had not been evaluated for its ability at adaptation for special client needs and its effectiveness as a means of mobility. We chose two facilities in Himeji city as evaluation sites.

At these sites 72% of SRC Walker had Cerebral Palsy and their motor developmental level was estimated to generally be from 3 months to 6 months. A few children used the walker for seating system. At one site three users could move over 1000m within 45 minutes. In this investigation we confirmed that the SRC Walker is the effective mobility aid for the child with severe disabilities. We will now research on the criterions for adapting the walker to the special needs of each child.

POSTER
A Collaborative Project To Develop A Low-Cost, Low-Tech Air Loss Sensor System For Roho® Seat Cushions

Mikel J. Wheeler COTA, Tamara L. Vos OTR, Department of Physical Medicine and Rehabilitation, Mayo Clinic and Foundation, Rochester, Minnesota, 55905.

Summary:

ROHO® Seat cushions are successfully used to prevent pressure ulcers in wheelchair users. A problem with the cushions is air loss without the user being aware putting non-sensate users at risk for pressure sores. Adjusting the cushion to the proper air density is also difficult. We believe there is a low-cost, low-tech solution to these problems. We envision a device that can be built inexpensively in the clinic to alert the consumer when their cushion has lost air or is improperly inflated. The purpose of our presentation is to discuss the collaborative efforts between Minnesota high school science students, ROHO®, and Mayo Clinic seating specialists in developing such a device. Our presentation will describe the method we used for initiating the contest among high school students. We will be able to provide preliminary results and possible samples of devices created. The contest will begin Fall 2004. The devices will be tested for effectiveness at the end of the contest. Winning students will receive cash prizes and/or scholarship funds.

POSTER
Seating Simulator for Remote Access

David Jordan, BSc, BScOT Sunny Hill Health Centre for Children, Vancouver, BC