

The Right Technology at the Right Time: Considerations for Aging with SCI

Ginger Walls, PT, MS, NCS, ATP/SMS
Clinical Education Specialist
Permobil

Aging with a disability...

- ▶ Mobility does not get easier
- ▶ Challenges related to skin integrity, posture, pain, repetitive stress injury and fatigue become more difficult to manage
- ▶ Function becomes more difficult to maintain

- ▶ The right seating/mobility technology at the right time can play a critical role in "Adding Life to Years"!

Learning Objectives

1. Participants will be able to identify 3 impairments and/or functional limitations specific to clients aging with SCI that may be addressed by seating/mobility technology and signal a need to consider a change in technology.
2. Participants will be able to identify 3 seating/mobility technology applications that can be progressed to address impairments and/or functional limitations associated with aging with SCI.

Learning Objectives

3. Participants will be able to discuss 3 important social/environmental considerations for the therapist, clinician, assistive technology provider, and client to discuss when considering a change in assistive technology equipment.

Data from National Spinal Cord Injury Statistical Center Database – Groah, S: AJPMR, 2012.

- ▶ Most common age at SCI was 19 y/o – 2009
- ▶ 60% of the population surviving with SCI is < 45 y/o
- ▶ Therefore, most people with SCI have the potential to live most of their lives with SCI and have the potential for significant aging with SCI.

Bimodal Age Distribution in SCI

- ▶ Mean age at time of injury has increased from 28.7 years (1970s) to 40 years (2005–2009)
 - Bimodal age distribution – 2 peaks
 - Young adults (MVCs, sports, violence, etc)
 - Adults >65 y/o primarily due to falls
- ▶ Therefore, we need to address needs of 2 very different age groups: those younger who advance to old age with SCI and those who incur SCI as older adults

Accelerated Aging

- ▶ Altered aging trajectory where the rate and the effects of aging are accelerated
- ▶ Health conditions occur earlier and/or more frequently than would otherwise be observed, leading to a narrow margin of health.
 - Due to physiologic changes due to SCI and impairments that lead to immediate and long term effects on the body

Factors that Influence Altered Aging in People with SCI

- ▶ 1. Increased obesity and adipose tissue
- ▶ Lack of standing, ambulation, and w/b result in changes in body composition, including decreased muscle mass and increased adipose tissue.
- ▶ Up to 75% of those with chronic SCI are overweight or obese
- ▶ Need for prudent diet, physical activity and equipment considerations.

2. Increased Cardiovascular Disease Risk

- ▶ Increased adiposity in the abdominal region in SCI, positively correlates with increased risk for cardiovascular disease.
- ▶ Ischemic heart disease and other heart disease were the 3rd and 4th leading causes of death in people with SCI.

CASE STUDIES

- ▶ Illustrations of important considerations for the therapist or other health care provider, AT provider, and client to discuss when considering a change in seating/mobility technology to address clients' changing needs

Cannot leap to solution without first discussing implications of change

- ▶ Environment - home & work
- ▶ Transportation
- ▶ Functional Trade-offs
- ▶ Discussion on options and features important for function & activities
- ▶ Willingness to accept change or make changes
- ▶ Negotiables & Non-Negotiables
- ▶ Condition specific issues & priorities for client now & future



Synthesis of clinical and equipment knowledge bases

- Information gathered during evaluation
- Patient priorities
- Best practices
- Consideration of Equipment features/options and trade offs
- Determination of goals of the system
- Definitive equipment recommendations
- Fitting and training

Case Study – Eduardo

- › 27 y/o male with tetraplegia due to transverse myelitis.
- › PMHx: R femur fx; severe HO R hip resulting in 100 fixed R hip flexion contracture. LE edema.
- › Skin breakdown currently bilat fibular head areas, bilat greater trochanters with wound vac. All caused by rubbing on w/c parts.
- › Stage I sacral b/d due to poor postural support in w/c.
- › Dep transfers, pressure reliefs; requires assist with MRADLs. Lives with mother in accessible apt.

Case Study – Eduardo

- › Equipment Problems: Exceeded seat size capacity of present wheelchair. Patient weight now >285#.
- › Insufficient back angle to allow proper postural alignment
- › Wheelchair and seating system disrepair – tilt actuator not functioning fully
- › Results: insufficient pressure relief & positioning – skin breakdown buttocks and LEs

New equipment

- › Heavy Duty power w/c with fixed open back angle and larger seat size;
- › Permobil M300HD; Corpus 3G seating; power tilt; power center mount elevating leg rests;
- › ROHO High Profile cushion
- › meet patients size, positioning, skin breakdown, and LE edema needs.

3. Bone density complications

- ▶ Decreased muscle activity, standing, & amb, also contributes to decreased bone mineral density wit SCI
- ▶ Results in increased risk for fractures and accompanying reductions in function and independence
- ▶ Additionally, heterotopic ossification may also complicate ROM, function, and independence.

Case Study – Joe

- ▶ 34 y/o; T12 ASIA A SCI with HO bilat hips;
 - 2010: 35° left hip flex PROM and 90° right;
 - 2014: 15° left; 80° right; fixed with varus right lower leg deformity due to fx causing skin b/d.
 - H/o sacral flap surgery 2005.

Problem areas:

- ▶ Progressive postural problems
- ▶ Skin breakdown
- ▶ Shoulder, neck and low back pain
- ▶ Difficulty with transfers, MRADLs, pressure reliefs
- ▶ Wheelchair tipping over and disrepair

New Equipment – Transition to power

- ▶ Accomplishes the following goals:
 1. Improved postural support by improved accommodation for ROM restrictions
 2. Reduce RSI and pain
 3. Improve overall mobility & MRADL abilities
 4. Allow independent pressure reliefs and position changes
 5. Improve safety
 6. Increase overall w/c durability (decrease repairs)

New Equipment

- ▶ Permobil C300 power w/c with
- ▶ Corpus 3G seating with power tilt and power center mount elevating leg rests & head rest
- ▶ Jay 2 cushion

4. Increased Musculoskeletal Wear & Tear

- ▶ Manual w/c use can contribute to UE RSI injuries, including biceps and rotator cuff tendinitis, CTS, and other syndromes
- ▶ PVA CPGs on UE Preservation includes regular assessment of function, ergonomics, equipment, and pain

Application of PVA CPGs on Preservation of Upper Limb Function Following Spinal Cord Injury to wheelchair – seating recommendations

- ▶ **Preservation of Upper Limb Function Following Spinal Cord Injury: A Clinical Practice Guideline for Health-Care Professionals.** Consortium for Spinal Cord Medicine. Administrative and financial support provided by Paralyzed Veterans of America. © Copyright 2005, Paralyzed Veterans of America
- ▶ www.pva.org

Prevalence of UE Problems

- ▶ Wrist: CTS, Ulnar nerve entrapment, Tendonitis, and OA
- ▶ Elbow: Ulnar mononeuropathy, Lateral epicondylitis, Olecranon bursitis
- ▶ Shoulder: Impingement syndrome, Capsulitis, Dislocations, Rotator cuff tear, Bicipital tendonitis, Myofascial pain syndrome
- ▶ PAIN common to all these dx!

Summary of Recommendations

Initial Assessment of Acute SCI

1. Educate health-care providers and persons with SCI about the risk of upper limb pain and injury, the means of prevention, treatment options, and the need to maintain fitness.
2. Routinely assess the patient's function, ergonomics, equipment, and level of pain as part of a periodic health review.

Ergonomics

3. Minimize the frequency of repetitive upper limb tasks.
4. Minimize the force required to complete upper limb tasks.
5. Minimize extreme or potentially injurious positions at all joints.
 - Avoid extreme positions of the wrist.
 - Avoid positioning the hand above the shoulder.
 - Avoid potentially injurious or extreme positions at the shoulder, including extreme internal rotation and abduction.

Equipment Selection and Training

- 6. With high-risk patients, evaluate and discuss the pros and cons of changing to a power w/c system as a way to prevent repetitive injuries.
- 7. Provide manual wheelchair users with SCI a high strength, fully customizable manual wheelchair made of the lightest possible material.
- 8. Adjust the rear axle as far forward as possible without compromising the stability of the user.



Equipment Selection and Training

- 9. Position the rear axle so that when the hand is placed at the top dead-center position on the push-rim, the angle between the upper arm and forearm is between 100 and 120 degrees. Alternative method: fingertips should be at same level as the axle
- 10. Educate the patient to:
 - Use long, smooth strokes that limit high impacts on the push-rim. Utilize circular push pattern.
- 11. Promote an appropriate seated posture and stabilization relative to balance and stability needs.



High Risk Pts May Need Power

High risk pts may include: those who have a prior injury to the upper limb, are obese, are elderly, or live in a challenging environment, such as on a steep hill or very rough terrain.

The advantages of power wheelchairs include:

- Reduced propulsion-related repetitive strain.
- Conserved energy and therefore reduced fatigue.
- Increased speed.
- Increased ease of traversing uneven terrain and inclines.

The disadvantages include:

- Decreased transportability.
- Increased maintenance.
- Increased cost.
- Possible weight gain.
- Possible decreased fitness.

Appropriate seating/trunk support provide stable base for UE function

- ▶ Stabilize the pelvis first; then the lower extremities and the trunk.
- ▶ Stabilize the pelvis on a cushion that provides postural support as well as pressure distribution.
- ▶ Promote as neutral/midline position of pelvis and trunk as possible
- ▶ Accommodate fixed postures of the pelvis, lower extremities, and trunk to allow balance for performance of activities of daily living.

Appropriate seating/trunk support provide stable base for UE function

- ▶ Place trunk support as high as the client needs to feel stable and comfortable.
- ▶ Apply lateral and anterior trunk supports if the client is unable to maintain a stable posture while performing activities of daily living and other functional skills.
- ▶ Make special accommodations for individuals with tetraplegia, who may have a forward head posture that results in rounding of the shoulders and causes anterior instability and reliance on the upper extremities to maintain balance.

Equipment Selection

12. Provide support to the UE at all points when the pt has UE paralysis or pain.

13. Provide seat elevation or a standing position to individuals with SCI who use power wheelchairs and have UE function.

Equipment Selection and Training

- 14. Complete a thorough assessment of the patient's environment
- 15. Instruct individuals with SCI who complete independent transfers to:
 - Perform level transfers when possible.
 - Avoid positions of impingement when possible.
 - Avoid placing either hand on a flat surface when a handgrip is possible during transfers.
 - Vary the technique used and the arm that leads.
 - Consider a transfer assist device prn

Case Study – Bill

- ▶ 60 y/o male with C7/C8 ASIA A tetraplegia due to MVC in 1982.
- ▶ Bilateral shoulder pain. Received US guided prolotherapy injections into both biceps tendon sheath and supraspinatus due to partial tears in both muscles. Pain with propulsion, dressing, & car transfers. Pain with breaking down w/c for driving or raising arm overhead.

Bill cont.

- ▶ Tore left biceps tendon during transfer into hotel bed.
- ▶ Returned to PT for treatment. Tried E-Motion power assist wheels. Was able to propel without increased pain.
- ▶ Purchased van to facilitate transportation.
- ▶ 6'0" tall and 220 pounds
- ▶ Folding ultralight weight w/c; ROHO High Profile Cushion, J2 back; Emotion M15 Power Assist Wheels

5. Skin Breakdown

- ▶ Skin breakdown is very prevalent in people with SCI both during acute and rehab stays, as well as afterwards
- ▶ PVA CPGs on Pressure Ulcer Prevention
 - Monitoring for skin breakdown
 - Pressure reliefs
 - Proper equipment intervention

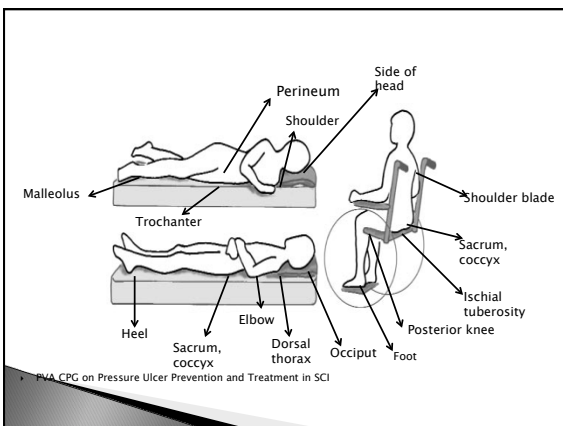
PVA CPGs ON PRESSURE ULCER PREVENTION AND TREATMENT FOLLOWING SCI TO WHEELCHAIR/SEATING RECOMMENDATIONS

▶ **Pressure Ulcer Prevention and Treatment Following Spinal Cord Injury: A Clinical Practice Guideline for Health-Care Professionals.** Consortium for Spinal Cord Medicine. Administrative and financial support provided by Paralyzed Veterans of America. © Copyright 2000, Paralyzed Veterans of America

▶ www.pva.org

PVA CPGs: Prevention: 1 oz = 1 lb cure

- ▶ Avoid prolonged immobilization
- ▶ Eliminate stretching or folding of tissues when individuals are re-positioned
- ▶ Evaluate the individual and his/her support environment for optimal maintenance of skin integrity.



Wheelchair Positioning

- ▶ Prescribe wheelchairs and seating systems according to individualized anthropometric, ergonomic, and functional principles.
- ▶ Obtain specific body measurements for optimal selection of seating system dimensions.
- ▶ Measure the effects of posture and deformity on interface pressure distribution.

Prevention

- ▶ Establish and initiate a specific pressure relief regimen within the individual's capability.
- ▶ Prescribe a power weight-shifting wheelchair system for individuals who are unable to independently perform an effective weight shift.
- ▶ Provide individuals with SCI, their families, significant others, and health-care professionals with specific information on effective strategies for the prevention and treatment of pressure ulcers.

Prevention

- ▶ Generally, a weight shift every 15 to 30 minutes is recommended to allow the skin to be replenished with oxygen (Bergstrom et al., 1992; Nixon, 1985).
- ▶ Frequency/Duration: 30 secs for every 15-30 min or 60 secs for every 60 min seated in w/c

Wheelchair Support Surfaces

- › Use appropriate wheelchair cushions with all individuals with SCI.
- › Inspect and maintain all wheelchair cushions at regularly scheduled intervals.
- › Assess full seating system support

Pressure Relief: FOLLOW UP TRAINING!

- › Since tilt/recline primarily used for comfort during day, the majority did not use sufficient angles to achieve pressure relief
- › Duration and frequency also likely insufficient
- › Tools to help with compliance: watch or smart phone timer; Virtual Seating Coach App from Permobil; Memory Seating or Indep. Repositioning Mode; Latch seat functions
- › Check switch access at end range

Power Seating to Improve Overall Seating Tolerance

- › Dynamic seating systems assist in promoting dynamic seating tolerance necessary for MRADLs and ergonomics throughout the day
- › Power w/c users stated that they primarily used their seating systems to promote comfort and reduce pain and fatigue
- › This combined with reducing higher pressures, also promotes longer seating tolerance.

Case Study - Henry

- ▶ 50 y/o male; C5 on right; T4 on left; ASIA A > 15 years. Also, right BKA due to osteomyelitis 6 years ago. Left LE distal edema. Scoliosis - sits asymmetrically due to asymmetrical strength.
- ▶ Dysreflexia sx by end of day, increased spasticity, sweating. Nightly redness of skin on sitting surface. Must lie prone after work. H/o left sided skin b/d. Sitting tolerance decreasing.
- ▶ Increasing right shoulder pain with propulsion and MRADLs.

Henry cont.

- ▶ Full time federal government employee in demanding job. Very active. Drives own van.
- ▶ 6'3" tall and 195 pounds
- ▶ Present Equipment: Quickie GPV with Emotion power assist push rim system. ROHO High Profile Quatro Cushion. Jay 3 back with LTSs.
- ▶ Recommended equipment: Permobil C300 Corpus 3G power w/c with power tilt, recline, and center mount ELRs. Seat elevator. LTSs. HR. Hip guides.

Mark - Tetraplegia - Posture, skin breakdown, obesity

- ▶ Pt is 45 y/o male with C5-6 ASIA A Tetraplegia and history of skin breakdown and scoliosis with right apex. Multiple aftermarket LTS and backs have been trialed w/o success in controlling posture. Pt is 6'2" and 260 pounds. BMI 33.4
- ▶ Using Roho cushion.
- ▶ Pt transfers to left, so needs custom molded seating system with BIG right LTS but not much on left to keep free for transfers.

Bowel, Bladder & Breathing

- ▶ 6. Repeated UTI due to need for catheterization. Septicemia is a significant cause of death in SCI, compared with general population.
- ▶ 7. Dysmotility of bowel
- ▶ 8. Pulmonary Insufficiency - People with tetraplegia and high paraplegia have ineffective cough leading to increased mucous retention and infection risk

9. Depression

- ▶ Depression rates for SCI are higher than general population, but they vary with age and time since injury.
- ▶ The risk of depression in SCI is highest in the first 2 decades after injury. In other words, those 21 years or more after injury had the lowest depression rates..... until function was compromised by other illness or impairments...

10. Function & Participation Impact

- ▶ With increasing age after SCI, there are declines in health status and functional independence, and a corresponding increase in medical systems utilization.
 - Also lifestyle, environmental, employment and income factors impact participation, aging and longevity
 - Low income is a primary predictor of early mortality in both general and SCI population

“Disparities in W/C Procurement by Payer Among People with SCI”

- ▶ Groah, S. Ljungberg, I, Lichy, A, Oyster, M, Boninger, M. American Academy of PM&R. Vol 1-6, 2013.
- ▶ Standard of Care based on PVA CPGs: ultra lightweight manual w/c or group 3, 4 power w/c
- ▶ Medicare beneficiaries and uninsured were least likely to have a manual or power w/c that met standard of care
 - Is technology being provided based on payer source vs end-user needs?
 - What does that mean for access to the optimal technology for people aging with disability?



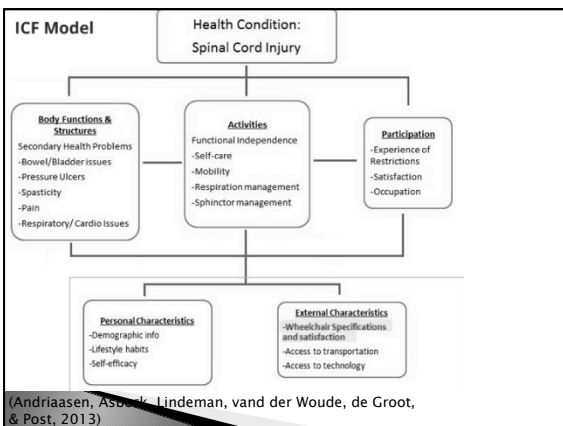
Case – Robert

- ▶ Injured at 14 y/o. C5 ASIA A. Now 32 y/o. Artist. Paints using his mouth. Does stand-up comedy.
- ▶ Equipment: Permobil Chairman Power w/c with power stander. Over 10 y/o w/c now.
- ▶ Results of equipment use: Reduced spasticity, increased bone density, improved breathing, improve bowel and bladder functioning, improved community participation and vocation with power stander.
- ▶ Trying currently to get replacement funded



Interactions Relevant to Aging with SCI

- ▶ 1. Current chronologic age
- ▶ 2. Age at injury
- ▶ 3. Duration of injury
- ▶ 4. *Age cohort* –social, economic, and medical context around an individual’s SCI
 - Medical advances; sociopolitical factors (disability awareness, i.e. ADA: 2015 = 25 years); IMPROVED equipment!
 - Time-lagged designs are beneficial for evaluating the overall effects of broader environmental changes on outcomes for persons with SCI



Ed Eckenhoff Case Study

- ▶ President Emiratis of Medstar National Rehab Network; founder of NRH.
- ▶ 70 y/o male, injured at 20 y/o in MVC
- ▶ T12 ASIA A. H/o fall with L hip fx & ORIF, 2012
- ▶ Changes in technology afterwards:
 - Revision to KAFOs/shoes to accommodate leg length change
 - 1" Lateral wedge with left side high under Roho pad on desk chair
 - 2 ultra lightweight manual wheelchairs that are kept in car (DC & FLA) in case he's too tired to walk after multiple rounds of golf.
 - Uses 4W POV at NRH and has one at home



Ed's Keys to Success

- ▶ Father was MD; Mother RN; supportive family
- ▶ Competitive athletic background – healthy prior to injury; pushed himself afterwards
- ▶ Longer acute and rehab stays taught vigilance on monitoring skin and focus on goals
- ▶ KAFOs were waiting for him when he arrived in rehab. Began brace walking then and has not stopped.
- ▶ Standing was expectation.

Ed's Keys to Success

- ▶ Financial resources to access equip & services
- ▶ Supportive wife, who is also an OT
- ▶ Activity - The desire to be active and the access to the opportunity to be active has kept him going. Loves to golf!
- ▶ Access to Rehab Professionals & equip which helped him continue to be as active possible
- ▶ Message: Do not fall in the trap of the health care professional who settles into a pattern of limitations of less than optimal mobility, activity, long term health and function for clients.

Instead... Adding Life to Years...

- ▶ ... with the right equipment at the right time for each individual, so end-users can be as active, functional and healthy as possible for as long as possible!!
- ▶ If you don't shoot for the 12th Hole at Augusta, you will never get there!!

