Spinal Cord Injury SIG: Problem-Solving Complex Seating and Mobility Technology Needs for Individuals with Spinal Cord Injury

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Objectives

1. Discuss the team approach to seating and mobility assessment.
2. Understand the considerations for home and environment issues and how they affect the mobility assessment.
3. Discuss the challenges for acute SCI clients versus chronic SCI clients with regards to seating and mobility.
4. Understand current technology and trade offs in complex seated mobility.
5. Participate in case discussion
The **TEAM** Approach

- **Who is the TEAM?**
  - Client
    - Family/Caregivers
  - Therapist(s)
  - Supplier
  - Physician/Nurse Practitioner
  - Case Manager?

- **Patient/client must be the quarterback**

- Same team needs to deliver/fit wheelchair
When Acute

• They don’t know what they don’t know

• We can’t know the future

• Their focus is on walking and recovery
When Chronic

• Know what they want-
  – Can they get it (funding, obsolescence, etc)
  – Is it really what they want/need

• Environment/life is set up for current equipment

• Change is hard- even when wanted/needed
  – Emotionally
    • Feel change is going backward
  – Physically
    • Requires adaptation........AGAIN!
Considerations for home/environment

• Home
  – Doorway widths
  – Hallway maneuverability
  – Floor surfaces and door trestles
  – Access in/out of home

• Bathrooms
Height Tradeoffs

• Knee height
  – access to tables/work surfaces
  – Ground clearance

• Transfer heights

• Propulsion efficiency

• Living in standing world, everything is overhead
Transportation Considerations

• How will they transport themselves and wheelchair
  – Will they have own vehicle
  – Will wheelchair be primary mode of transportation
    • What is terrain
    • What is social/community area accessibility like
  – What is mode of public transportation
Vehicle Considerations

• Loading method- behind seat, breaking down chair, ramp (side or back entry), lift, car-topper
• Type of securement system
• Passenger or Driver
Vehicle Considerations

• Loading
  – Can lift/ramp handle size of wheelchair
  – Can lift/ramp handle weight of wheelchair

• Maneuverability
  – Can wheelchair get into correct position in planned space
  – Can wheelchair maneuver into/out of position

• Lock down
  – Is chair compatible with securement system
  – Rare for lockdown bracket to work on new chair
Considerations for driving

• Driving from van seat
  • Are transfers safe and independent
  • Is it practical to do the number of transfers needed
  • Can you provide sufficient body stability

• Driving from wheelchair
  • Safe access to steering and controls
    • KneeHeight
    • Proximity
  • Good visual field
  • Body stability/securement
Posture

Posture occurs over time due to:

- Forces of gravity
- Search for good visual field, comfort, and stability
- Repetitive activities/habits

If we don’t provide stability, the body will find it

Not going to change overnight!
Posture

• Correct or support-
  – *fixed or flexible*
  – *Tightly flexible*..... if it can get worse over time, can it get better over time?

• What would you change?
  – Is it “the chair” or the parts and adjustments?

• It isn’t always about the equipment
  – Back to basics of PT
Lessons from Experiences (Mistakes?)

• This will not all be done in a one hour evaluation

• What works on paper doesn’t always work

• Adjustability is a good thing if you want change- and there will always be change

• You learn from seeing long term effect of interventions-
  – You want clients to come back!
  – Follow up is essential to success
Lessons from Experiences (Mistakes?)

• Change takes time, commitment, and purpose
• Never make assumptions
  – Accessible is relative
• You can “teach an old dog new tricks”, it just may take longer or require greater motivation
• Change may not always be best-
  • People are who/what/where they are for a reason
• Are you really listening-
Lessons from Experiences (Mistakes?)

• Everything is a trade-off, nothing is perfect

• Change one thing at a time

• Plant the seeds of change—**EARLY!!!**
  – Information is powerful
    • people don’t know what they don’t know
  – Sometimes change is about trust and “permission”
  – Look to future needs
    • Open doors, not close
TIMELINE OF MOBILITY, FUNCTION AND ASSISTIVE TECHNOLOGY ASSESSMENT FROM INITIAL INJURY TO 35 YEARS POST INJURY 1980-2014

Twala H. Maresh, PT, DPT, NCS, ATP
University of Central Arkansas
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MEDICAL AND FUNCTIONAL PRESENTATION

- MVA Dec 1, 1980, no other injuries at the time of the accident, 6’1” tall, initial weight was 160 lbs.
- SCI C5/6 incomplete, AIS C (right side stronger than left with sensation throughout, greater on right)
- 23 years old- male
- Workman’s comp insurance
- Employment as a water well driller in south Texas
- Initial care in Austin Texas with 3 months of bed traction, wt. of 120 lbs at discharge
- Transferred to Initial Rehab at small rehab center in Gonzales, Texas for 5 months
- Discharged to nursing home for 2 years due to family not feeling comfortable taking care of him at home.
JR’s Functional Presentation:
• Unable to push a manual w/c
• Dependent in Transfers
• Dependent in lower extremity dressing/ most bed mobility skills
• Assistance needed for LE dressing and bathing
• High risk for pressure sore development (Air cushion prescribed)
• Developed pressure sore in nursing home.
• Discharged from nursing home in 1982 to Rehab Hospital (pressure sore healed)
2ND REHAB ADMISSION

  - 3 months in transitional program
  - Began the use of manual mobility as well as power mobility
  - Independent in transfers with use of UE’s and RLE and independent in dressing by d/c
  - Required assistance for Bowel program only
  - Evaluated for driving
    - Full size van with six way power seat, w/c lift and hand controls was purchased.
- Began Junior College in south Texas in 1983 (lived on campus).
- Graduated in 1985 with an associate’s degree
  - Now using manual wheelchair as primary
1st CUSTOM MANUAL WHEELCHAIR

- Folding frame
- Sling seat and back rest
- Arm rests
- Swing away foot rests
- 8 inch front casters
- 24 inch rear wheels
- Pseudo fluid cushion replaced
  - Air cushion to increase independence in transfers and provide greater seating/posture support.
1st VEHICLE

- Full sized Ford van
- Side entry
- Wheelchair lift
- Six way power seat
- Hand controls with spinner knob
- Raised roof
FUNCTIONAL STATUS

• Independent in transfers, ADLS (except for bowel program)
• Married in 1985
• Enrolled at the University of Texas at Austin- Major-Mechanical Engineering
• Independent in driving a full size van with wheelchair lift and 6 way power seat.
• Used manual at home and power wheelchair at school.
Power wheelchair used more for outdoor activities such as mowing the lawn and for access at UT Austin due to hilly landscape etc.

- Molded backrest with minimal lateral support and a pseudo fluid cushion
- JR’s focus was on function and refused additional trunk support as he felt that it limited his ability to move in the power wheelchair.
FUNCTIONAL STATUS CHANGE

• Moved from Austin to Dallas to attend UT Arlington
• Began to use a manual wheelchair more than power at the university as campus due to primarily level terrain.
• Purchased new manual wheelchair
• Transportation changed from full size van to a small car
• No longer had a vehicle able to transport power wheelchair
• Able to transfer, load and unload manual wheelchair independently
Hybrid wheelchair, rigid frame that folded

Focus of this custom manual wheelchair was JR’s ability to independently load and unload wheelchair into a car and ease of transport in other vehicles.
1st car with hand controls

Independent in loading and unloading custom rigid frame manual wheelchair, hand controls with spinner knob.

Number of transfers per day ranged from 4 to 8.
FUNCTIONAL ABILITY AT THIS TIME INCLUDED INDEPENDENT TRANSFERS TO VARIOUS SURFACES

Able to transfer and dress independently on full bladder waterbed.
JR’s transfer ability continued to improve allowing him to transfer to various heights due to strength in RLE.
1990

- Graduated from UT Arlington with BS in Mechanical Engineering
  - Full-time employment in North Texas
  - Independent in all ADL’s (except for Bowel Program), Driving and wheelchair mobility on level ground with custom manual wheelchair.
FUNCTIONAL STATUS

- Independence in transfers increased allowing greater transfer heights, independence in ADL’S (except for Bowel Program) continued.
- Manual wheelchair was still primary.
- Power wheelchair used only for outdoor activities such as mowing the lawn, trimming trees etc.
- Moved to Arkansas in 1994.
- Began working as a Mechanical Engineer for the US government.
Custom rigid wheelchair

JR’s focus was on light weight frame- posture and positioning at this time was adequate. JR was able to propel over level and some sloped terrain however required assistance over unlevel.
1998

- Surgery for Colostomy due to increased Bowel complications
  - Allowed complete independence in ADL’s
  - Travel overnight independently

2000-2010
20 years post
• Beginning to have increased shoulder pain
• Increased weight gain
• Decreased endurance
• Transfer height of greater than 5 inches more difficult
• JR continued to work full time and some travel was required however fatigue began to be an issue.
• JR chose to Lower the suspension on his mid-sized truck to decrease transfer height.
• Continued to be able to load and unload manual wheelchair independently however he had begun to limit the number of transfers per day.
  • *Physician/ PT discussed the use of power mobility.*
  • *JR felt that returning to using a power wheelchair was a step back.*
DODGE DAKOTA WITH LOWERED SUSPENSION PACKAGE

Overall decreased transfer height by ~ 4 inches.
FUNCTIONAL STATUS CHANGE

• Continued increased shoulder pain
• Increased weight gain
• Transfer height of greater than 3 inches became increasingly difficult
  • Wheels removed from bed to level transfer heights
• Still worked full time with some travel however fatigue began to be a greater issue.
• JR decides to add an out-rider to the truck with lowered suspension. This decreased the need to lift wheelchair into and out of truck
  • Again Physician and PT discussed the use of power mobility and van
  • JR stated that he was not ready to go there!
Evaluation by PT and equipment specialist for custom manual wheelchair - Need for power wheelchair was discussed again - JR refused due to travel and job requirements.

Manual wheelchair required increased need for lateral support due to postural changes (possibly caused by colostomy, weight gain and fallen abdominal wall on left trunk). Increased weight bearing on left hip with pelvic obliquity, kyphosis with forward leaning neck.
2007

- SURGERY FOR ABDOMINAL HERNIA WITH ABDOMINAL MESH
  - Unclear if this procedure would hold and for how long
- In bed for 3 weeks – dependent in bed mobility, transfers, ADL’s.
- Used a hospital bed with low air loss mattress
- Mechanical lift for transfers with assistance
- Able to work from home after 1 month
- Use of power wheelchair when out of bed, unable to push manual wheelchair for 2 months, unable to transport power wheelchair.
- Limited strength and endurance to transfer to existing vehicle
- Slow progression to return to work full time after 3 months
- 3 months Post surgery Function: JR was not able to return to function prior to surgery- generalized weakness and limited strength and change in spasticity status in RLE
- Changed vehicle to full size truck with TAS seat and out-rider lift
- Transfers to bed required increased assistance.
  - Changed transfer system to ceiling lift
The body support system was chosen to allow JR to have the ability to transfer himself into and out of bed. JR wanted to continue with as much independence as possible for as long as possible.
VEHICLE CHANGE TO FULL SIZE TRUCK
(3rd)

TAS seat allowed for down hill transfers each way, Rubber mat on floor prevented slipping of JR’s feet during transfers and out-rider assisted in decreasing stress on UE’s. JR continued to transfer up to 8-10 transfers per day.
FUNCTIONAL STATUS CHANGE

- By 2012 JR’s transfers had become unsafe even when levels were positioned to make transfers easier.
  - Increased overuse, weight gain etc.
- Abdomen had begun to fall to left side again due to breakdown of the abdominal mesh. JR refused to have another surgery and chose to just deal with it.
- Full time employment continued however, JR changed to working one day a week at home.
- Travel for work limited to day trips only, JR became concerned about his ability to continue to work full time.
- Additional assistance needed for dressing, bathing and limited now to mobility on level surfaces only for manual wheelchair.
- Agreed to be assessed for a power wheelchair for full time use and to explore driving from power wheelchair in vehicle!
FINALLY A NEW POWER WHEELCHAIR FOR EVERYDAY USE!

• Evaluation of Power Wheelchair by PT and equipment specialist
  • Evaluated for both the mid wheel and front wheel drive
    • JR preferred the front wheel drive so that he would have greater access to outdoor activities
  • Power Tilt/recline/ELR’s
  • Power seat elevation
  • Lumbar/lateral and thigh supports
  • Air cushion

• Result:
MODIFIED MINI VAN TO ACCOMMODATE
POWER WHEELCHAIR

• Mini Van modified with hand controls, driver and passenger seats removal as needed, 14 inch lowered floors, and ramp. No transfers required!

• Client tried this system for 2 weeks however, did not like this system due to the inability to drive over anything other than level ground. Was able to sell this system back to the Van modification company and order a truck with lift system.
NEW CHEVY TRUCK

• SVM Mobility Package
  • Required change of Power bases from front wheel drive to mid wheel drive due to change in SVM design
  • Multiple adjustments required for independent driving from wheelchair
Summary of Major Equipment from 1980-2014

• Wheelchairs
  • Manual 6
  • Power 5

• Vehicles
  • Vans 2
  • Cars 1
  • SUV 2
  • Trucks 4

• Other (truck seats, vehicle lifts, ceiling lifts, beds, shower chairs etc) 11

• Total 31  Cost? $500,000 +
SUMMARY OF REASONS WHY JR WAS RELUCTANT TO RETURN TO POWER MOBILITY

• He felt that it was a regression in function
• He was concerned about the ability to have room for travel with family (typically traveled with up to 7 family members) or to visit various family members with steps.
• He was stated that a power wheelchair would limit his ability to travel to various job sites (some required him to be lifted up steps etc).
• He felt that a power wheelchair would promote his loss of strength in his UE’s.
• He did not want to drive from his wheelchair.
• He was concerned about how he would be perceived by his employer
• He stated that he would return to power mobility only when absolutely necessary.
FOLLOW-UP
FALL 2014

• Loves the new power wheelchair and truck system and wonders and why he did not make the change several years ago.

• Continues to work full time but is now considering retiring by the age of 60. (has worked full time for 24+ years post injury)
  • Does travel for work for one night only – sleeps in wheelchair??
• Plans to build a lakefront wheelchair accessible home and relax!
FUTURE ASSISTIVE TECHNOLOGY NEEDS

• JR is aware that he will most likely need additional care giving
• He feels that the Power wheelchair and the truck with SVM mobility has greatly improved his independence, endurance and decreased pain in his shoulders. But worries that the truck modifications may not be appropriate later and may require changing to the mini van again so that he will have the option to be a passenger on longer trips.
• Additional positioning issues will need to be addressed
• JR wants to continue to be as independent as possible for as long as possible.
Cindi Haslob
Case Study

Allison Fracchia PT,
ATP/SMS
Assistive Technology Clinic
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Jackson, MS
Background

1985 injured in a MVA resulting in T12 Paraplegia. Cindy was 19 years old.

From 1985-2013 she had multiple manual wheelchairs.

Cindy was fully independent and employed full time.

She married in 2003 and had a baby girl in 2004.
Medical and Life Complications

• 2006: husband diagnosed with Multiple Sclerosis. Reduced work schedule to assist with his care.

• 2008-2013: battled osteomyelitis in her right leg as a result of a toe infection.

• 2012: broke her left leg in multiple places. She then fell and broke the right leg.

• 2013: Became septic. Bilateral legs amputated.

Allison Fracchia PT,
ATP/SMS
2013 Evaluation

- Sometimes the therapist’s goals do not match up with the patient’s goals.

- I suggested power. She wanted manual.

- Compromises had to be made.
Problems with Current System

- Current chair was non-adjustable and too small.
- Cindy felt unstable.
- The thigh guides were cutting into her outer thighs.
Proper wheel placement was important for decreasing risk of overuse injuries and balance of the chair was an important safety consideration.

Cindy wanted to have a chair that was as lightweight as possible.
Sometimes you have to think outside of the box

Anti tip tubes--not typical for a long term wheelchair user that has paraplegia; however, in Cindy’s case her center of gravity with use of the chair had changed.

Counter weights on the front frame...this helped to provide more “balance” to the system due to the loss of limbs. Avoid backpacks/bags on the back of the chair- this can make the chair “tippy”.

Allison Fracchia PT,
ATP/SMS
I suggested Natural Fit hand rims due to Cindy’s history of carpal tunnel syndrome.

Cindy wanted standard hand rims—she trial used both but wasn’t willing to change.

Explained pros/cons--- documented my recommendations and Cindy’s decision.

Allison Fracchia PT,
ATP/SMS
Follow-up Appointment

Received her new manual wheelchair and was pleased with the outcome.

Spent time during the appointment working on advanced wheelchair skills to ensure that “set up” was safe.

Allison Fracchia PT,
ATP/SMS
Cindy revealed that in June of 2014 she had been diagnosed with Rheumatoid Arthritis.

- Every day activities had become more challenging:
  - Balance/endurance deficits
  - Upper extremity joint pain

Allison Fracchia PT,
ATP/SMS
Power wheelchair eval took place

- Several team members present
- Full mat eval performed. Never make assumptions!
Cindy’s Goals

• Began appointment by listening to her goals:
  • Requested low backrest
  • Requested low seat to floor height
  • Didn’t want it to look “rehab-y”
  • Wanted it to be “very simple”
• Discussed pros/cons of base configurations

• Chose FWD configuration--wanted to attend school activities with her daughter, enjoys being outdoors, preferred performance during equipment trial, preferred van accessibility/turning style.

• Initiated the equipment assessment with a basic set up. Started slowly.

Allison Fracchia PT, ATP/SMS
Power tilt

• Provides ease in weight shift for skin management.

• Improves trunk stability.

• Can move to 45°.

Allison Fracchia PT, ATP/SMS
• Considerations:
  
  • Weight shifts and repositioning challenges due to upper extremity joint pain and inflammation (dx RA).

  • Overall stability due to bilateral AKA.

  • Activity level due to family and work requirements.
Power seat elevate

• Assists in ease with transfers.

• Allows for improved reach.

• Allows for ease in ADL’s.
• Considerations:

• Decreasing upper extremity joint compression and strain when transferring.

• Her family responsibilities--cooking, cleaning, assisting her husband with his needs, being an active participant in her daughter’s activities.

• Work responsibilities.

• Eye level conversations to decrease cervical hyperextension.
Power Recline

- Allows for ease in weight shift.
- Allows for ease in repositioning.
- Allows for ease in bladder management.
• Considerations:
  • Repositioning/clothing management.
  • Bladder management.
  • Husbands high level of care needs.
Seating and Positioning Components

- Hip/thigh guides
- Pressure relieving cushion
- Contoured backrest
- Headrest
- Pelvic positioning strap
Hip/Thigh guides

• Allows for a more neutral position of Cindy’s thighs - very important to Cindy to sit in a more “lady-like” position.

• Helps with pressure redistribution and promotes a more neutral pelvic position.

Pressure relieving cushion

• Needed for skin protection due to absent sensation in the buttocks and thighs.
Contoured Backrest

- Provides Cindy with lateral trunk support for improved stability.
- Provides her with lumbar support to correct a flexible decreased lumbar lordosis.

Headrest

- Provides her with cervical and head support when in a tilted or reclined position.
- Important if she is ever transported in a bus or van while seated in her chair.
Considerations for work and home needs:

• Quad link retractable joystick mount
• Footplates
• Light package
Quad link retractable joystick mount

• Allows Cindy to pull up close to counter tops or tables for ADLs.

• Allows her to access desk at work.

• Improves safety while transferring.

Footplates

• Provides Cindy with a place to carry objects.

• Can flip them up to decrease footprint when not in use.
Light packages

• Helpful to light her pathway in the evening and night time hours - more visible to others.
Transportation considerations

• How will the person transport the wheelchair?

• Will the person drive from the chair or the vehicle seat?

• How will the chair be secured?
Final Outcome

• Regained independence

• Decreased effort needed to do a given activity

• Decreased effort/energy expenditure to go a given distance

• Preservation of joints

• Decreased risk of overuse injuries
REFERENCES


