SEATING CONSIDERATIONS FOR PEOPLE WITH SPINAL CORD INJURIES

WRITTEN BY: JILL MONGER, PT, MS, ATP

Spinal cord injury (SCI) and disease often result in devastating disabilities. However, people with SCI live life successfully and fully every day. For this to happen, clients with SCI who require a wheelchair and seating system need to be seen by a therapist and supplier who collaborate with the client toward common goals. Both the therapist and the supplier should be skilled, qualified professionals with specific training and experience in seating and mobility, and specifically in SCI, if possible. Once the therapist determines the motor level of function for the individual with SCI and educates the team as to potential functional outcomes, the patient and supplier can be more informed participants during the decision-making process. They will then be able to best determine the most effective products for clients to strive to meet their highest possible level of function.

The Anatomy and Function of the Spinal Cord

The actual spinal cord is about 18 inches in length and extends from the base of the brain (C1) to about the waist (T10/L1). The brain and spinal cord together make up the central nervous system (CNS). The nerves that are situated within the spinal cord are called upper motor neurons (UMNs), and their function is to carry the messages back and forth from the brain to the spinal nerves. The spinal nerves that branch out from the spinal cord to the other parts of the body are called lower motor neurons (LMNs). These spinal nerves exit and enter at each vertebral level and communicate with specific areas of the body. There are seven cervical vertebra, 12 thoracic vertebra (these have ribs attached) and five lumbar vertebra. The sacrum is fused, but also has LMN nerves exiting and entering between segments. Other important functions of the CNS include the sympathetic and parasympathetic nervous systems, which control involuntary functions such as blood pressure and temperature regulation.

It is important to perform a manual muscle test and general sensory review to determine the "functional" level of injury before determining functional outcome potentials.

Spinal Cord Injury Overview

A spinal cord injury (SCI) is damage or trauma to the spinal cord that results in a loss or impairment of function, causing reduced active movement and sensation, spasticity, neurogenic bowel and bladder and other complications. The most common causes of damage are trauma (car accident, gunshot, falls, sports injuries, etc.) or disease (transverse myelitis, polio, spina bifida, etc.).

Cervical SCIs usually cause loss of function in the arms and legs, resulting in quadriplegia. Injuries below the cervical spine usually cause paraplegia. The physical level of injury and the neurologic presentation can differ. After weeks or even years of healing, neurologic improvement can increase by a few levels.

It is important to perform a manual muscle test and general sensory review to determine the "functional" level of injury before determining functional outcome potentials. It is also important to know whether the injury is complete or incomplete and the level of ASIA (American Spinal Cord Injury Association) impairment scale. This information is critical to the Complex Rehab Technology (CRT) clinical specialty evaluation. Knowing the functional level of injury is very helpful in predicting what parts of the body might be affected by paralysis and, therefore, what functional outcome potentials can be expected. Remember that with incomplete injuries there will be some variation in these prognoses. This information is especially important when making recommendations for the newly injured individual.

Related Medical Complications and Considerations

There are many complications that can occur because of SCI, including amputations, orthopedic injuries, brain injury or interventions such as spinal fusions, removal of ischium or any part of the pelvis or femur, etc. Obviously other diagnoses can also complicate outcomes, such as diabetes and cardiac history. Funding, motivation and support system, as well as many other social factors can affect outcomes, also. When considering recommendations for CRT features and products, issues other than motor function and functional potential must be considered.

THESE CAN INCLUDE:

- Bladder management, including the need to extend at the trunk and hips to use a urinal or catheterize
- Transfer technique (if client uses a sling, it must be removed) and how the chair is utilized
- Physical pressure release technique and effectiveness
- Pressure sore/surgery history
- Any environments client plans to access
- Lifting: does the client need to physically lift a manual wheelchair?
- Transport: will the client drive from the chair? How will the chair be transported?
- Range of motion:
  - Cervical – can the client easily "look up" at someone who is standing?
  - Upper extremities – can the client push the wheels, access a joystick in standard position, and reach during daily functional activities?
  - Trunk – is the trunk flexible to a symmetrical position?
  - Hips, knees and ankles – what spasticity response occurs in sitting and during transitional movements and when rolling over uneven surfaces?
- Assistive Technology: other technology the client needs to access

Outcomes and Recommendations at Specific Levels of Injury

C-4 AND ABOVE

Cervical injuries usually result in quadriplegia. Complete injuries above the C-4 level can impact breathing, and the client may require a ventilator. These individuals will likely have no potential for active function beyond the use of their head and neck and shoulder shrugging. Power mobility will be required using alternative controls such as sip 'n puff, head array or chin joystick. Power seating is also required such as power tilt, recline and articulating elevating leg rests (AELR) for full pressure relief, bladder management in the chair, spasticity management, postural management, and prevention and management of LE dependent edema and circulatory issues. Memory seating (pre-programmed combinations of movement) is extremely helpful with this population, since they are using switches for access. Seating products must include excellent pressure relief for the coccyx, sacrum, trochanters and ischium as well as excellent distribution along the thigh to prevent peak pressures and resulting skin breakdown. Due to the spasticity response when transitioning between positions and when the chair is moving over any uneven surface, stability is also critical to prevent sheer and change of overall position. Since these individuals must use their head and neck to access driving, power seating, and other functions, the head and neck must remain in position at all times for access. If the pelvis, trunk and LEs are not stable, the head will move out of position. Depending on the spasticity response, snug-fitting lateral hip and thigh supports and/or medial knee supports are helpful. In most cases, lateral thoracic supports will also be necessary. Depending on the level of movement, varying levels of cervical and lateral head supports may be necessary. (See Picture 1)

C-5

At this level of function, injuries often result in preserved shoulder (deltoid) and elbow flexion (biceps) control, but no control of elbow extension (triceps) or of the wrist or hand. Some people may use a manual chair with push rim pegs or power assist for therapeutic purposes, but functionally, they will likely require power mobility. Most of these individuals will require the same power seating as a person with C2-4 level injuries. The client will usually need to access a mode change switch using their heads. Some individuals at this level may need to use head access for operation of the chair to reserve the strength and endurance available in their arms for other activities throughout the day. Depending on

(CONTINUED ON PAGE 40)

(CONTINUED FROM PAGE 39)

the stability of the cushion and the balance control of the client, lateral pelvic, thigh and trunk supports will also be necessary. (See Picture 2)

C-6

Injures resulting in the C6 level function generally preserve shoulder, bicep and wrist extension control, but not triceps, hand or finger function. This is a tricky level. Many people with C6 complete SCI are fully independent using a manual wheelchair. The client can learn to transfer, dress, bathe, drive and perform many other tasks independently. However, this level of function requires many months, even years, of intensive rehabilitation that many do not have the ability to complete. Newly injured people with C6 level function require a lot of education and peer counseling to determine their ultimate goals. One of the biggest challenges with seating in the manual wheelchair for these individuals is the active pressure relief. We can provide good pressure distribution with a cushion and back, but it takes months or even years for the person to be able to perform an effective physical pressure relief. So, manual mobility is a risky, albeit individual, choice.

The other difficult function to consider is transfers. Often, the set-up of the chair and seating necessary for stability for independent propulsion interferes with the ability to meet transfer goals, with or without a transfer board. Driving goals can also be problematic for people with C6 level injuries who choose manual mobility. Transferring to a six-way seat (common in many vehicles driver's seats) may not be possible, so they will need to drive from the chair (although not the safest form of driving). Lockdown systems tend to require a lower bar to mount the locking mechanism, and there are very few ultra-light configurable manual wheelchairs on the market today that have this lower bar feature. Of course, addition of this lockdown feature adds significant weight to the chair, further interfering with successful self-propulsion. If power is the client's choice for primary mobility, then at least power tilt should be used. Usually power tilt and recline with AELR provides better outcomes regarding bladder management, spasticity management, LE dependent edema prevention and management, access to complete pressure relief and positioning/repositioning tasks. The seating design should provide pressure relief, ability to transfer (in most cases) and stability. (See Picture 3)

C7, C8 AND T1

People with C7, C8 and T1 presentation will have tricep control, and those with only C8 and T1 nerve injury will demonstrate some hand function. These individuals now have a much better chance of using a manual wheelchair after a few months of rehabilitation. If they are able to learn to transfer independently, they can manage their bladders, spasticity and LE edema outside of the chair. These clients should be able to perform efficient, effective pressure relief. If they do not meet these goals, a power chair is required for mobility. Again, power tilt, recline and power legs may be necessary since the client cannot transfer easily throughout the day. High-level pressure relief cushions are still necessary and stability is critical at this level due to lack of trunk musculature control.

T2-T9

High level thoracic injuries (generally above T9) result in poor-to-no trunk control. In most cases, these individuals will use ultra-light, properly configured, manual chairs. Some will still need power assist or power wheelchairs, depending on their ultimate level of function. The seating in manual chairs must be very stable to prevent development of spinal deformities and collapsed spine. The cushion needs to provide a level and stable pelvis to prevent obliquity and severe posterior tilt, as well as provide pressure relief from bony prominences. The backrest needs to be low-to-mid-level height with excellent posterior pelvic support with allowance for thoracic extension and at least mild lateral contouring. In some cases, true lateral thoracic support through increased lateral back depth or actual LTS (lateral thoracic supports) will be necessary. (See Picture 4)

T10-12, LUMBAR AND SACRAL

Lower thoracic and lumbar/sacral injuries leave the client with good-to-excellent trunk control potential. Manual mobility is the choice for most of these individuals. They should be able to move away from and return to the back support without using their arms. If this is the case, these clients will not require as much back support, but will still require pressure relief and some stability from the seat.

Conclusion

When assisting an individual with a spinal cord injury in choosing a wheelchair, the focus must be on the

The client plays a vital role throughout the process and should be an active and involved member of the decision-making team...

individual client's goals, functional abilities and potential. For example, two people with the same injury may have very different body types and presentations, which must be considered when recommending equipment. In addition, an individual's motivation, access to rehabilitation, and support system will impact the decision-making process. It is critical that all tasks and environments in which activities will be performed be considered when recommending a device.

Finally, once the equipment arrives, a fitting and training session with the original team is important to assure goals are met and that team members learn from the process. Training in the use of power seating for full pressure relief is important and should include pressure mapping for biofeedback for the client if possible. When providing manual chairs, assurance of the most ergonomic set up for propulsion, as well as instruction in most effective propulsion method is critical to assist in prevention of UE injuries. For new users, instruction and practice of wheelchair skills and negotiation of the environment is also important.

The client plays a vital role throughout the process and should be an active and involved member of the decision-making team along with a knowledgeable clinician and supplier.

CONTACT THE AUTHOR

Jill may be reached at carterjm@musc.edu.

References

Arledge, S., Armstrong, W., Babinec, M., Dicianno, B. E., Digiovine, C., Dyson-Hudson, T., ... & Stogner, J. (2011, January). RESNA Wheelchair Service Provision Guide. In RESNA. RESNA. 1700 North Moore Street Suite 1540, Arlington, VA 22209.

Dicianno, B. E., Arva, J., Lieberman, J. M., Schmeler, M. R., Souza, A., Phillips, K., ... & Betz, K. L. (2009). RESNA position on the application of tilt, recline, and elevating legrests for wheelchairs. Assistive Technology, 21(1), 13-22.

Outcomes following traumatic spinal cord injury: clinical practice guidelines for health-care professionals. J Spinal Cord Med. 2000 Winter; 23(4):289-316.

The Application of Ultralight Manual Wheelchairs Position Paper, resna.org, accessed 2/4/14.

PICTURE 1 – *C3 COMPLETE, REQUIRES HEAD STABILIZATION TO CONSISTENTLY ACCESS PNEUMATIC SWITCHES*

PICTURE 2 – *C5 COMPLETE, REQUIRES CONTOURED BACKREST, CHEST STRAP AND LATERAL THIGH SUPPORTS*

PICTURE 3 – *WEAK C6 COMPLETE, REQUIRES WRAP AROUND BACKREST AND ORTHOTIC CUSHION WITH AIR INSERT FOR ABILITY TO BE STABILE TO SELF-PROPEL YET PREVENT PRESSURE SORES*

PICTURE 4 – *T3 COMPLETE REQUIRES LATERAL PELVIC SUPPORT LEFT AND LATERAL THORACIC SUPPORT RIGHT TO CORRECT LEFT PELVIC OBLIQUITY AND RIGHT SPINAL CURVE TENDENCY*