Creighton UNIVERSITY

School of Pharmacy and Health Professions
Department of Occupational Therapy

Assistive Technology and Wheelchair Seating/Positioning Considerations after SCI

Coleman Lay – Creighton University

Mentors: Dani Willey, OTR/L, Kristi Rocole, PT, ATP & Tabatha Sorenson, OTR/L, OTD

BACKGROUND

The number of new spinal cord injury (SCI) cases each year is approximately 17,810, most of which require custom seating and positioning systems as well as assistive technology (AT) intervention to support their occupational performance and mobility (National SCI Statistical Center, 2020). Individuals most likely to incur a SCI are often young, previously high functioning, and have the potential to achieve high levels of independence in their personal care and the workforce. With the help of knowledgeable clinicians a successful return to active community and occupational participation is often possible.

The focused of this Doctoral Capstone Project was to gain specialized experience in the area of SCI rehabilitation, specifically as it relates to the use of assistive technology and custom seating/positioning technologies to enable people living with SCI to return to living meaningful lives in the community. This experience occurred under the supervision of licensed physical and occupational therapists at Madonna Rehabilitation Hospital in Lincoln, Nebraska.

CLIENT HISTORY

The client depicted in this case study is a high school-aged male who was involved in a single-car accident while driving during the winter on slick road conditions. The client lost control of the vehicle before it rolled several times and came to rest, at which point he was pulled from the vehicle, and taken via ambulance to the ED. After several weeks of ICU and acute-level care the client came to Madonna Rehabilitation Hospital, Lincoln Campus to receive comprehensive rehabilitation for spinal cord injury classified at the ASIA level C5, A.

This indicates a complete SCI lesion. With this level of SCI, the patient presents with no sensory or motor function throughout his trunk, lower extremities, or bowel/bladder. In his upper extremities the patient has muscle activation in elbow extension/flexion, all shoulder movement planes, but no active wrist flexion/extension or hand/finger activation. Prior to his injury the client was independent with all ADL/IADLs, was a multisport high school athlete, and enjoyed video/computer gaming and recreating outdoors.

RESEARCH QUESTION

How can assistive technology and custom wheelchair seating/positioning systems be used to support this client's return to occupational roles and leisure activities?

METHODS

Over several-month rehabilitation course client was seen ongoingly for AT training/trial up to 1hr/week to trial/train with different technologies. Custom seating system with alternative drive controls trialed ongoingly during therapies, with final wheelchair evaluation and pressure mapping (1hr) prior to discharge.

As this client progressed through rehabilitation process, assistive technology devices helped him to become more independent with daily activities related to life roles and leisure activities, and a custom seating and mobility system provided him means accessing his environment. Equipment utilized is as follows:

Assistive Technology (AT)

Client's goals: return to life roles of being a student, interacting with his friends digitally, and to engage in videogames and computer access for leisure.

Return to computer use AT:
- Dragon Naturally Speaking (1)
- Sonocent Audio NoteTaker
- Adaptive mouse control: Glassouse digital head tracker (2), Bluetooth joystick control (integrated with power wheelchair) (3)

Return to cell phone use AT:
- Apple Voice Control, accessibility features
- Bluetooth joystick from power wheelchair
- Mounting systems (4)

Environmental control AT:
- Amazon Alexa synced with television, cell phone, room climate controls, lights, etc.
- Universal remote built into power wheelchair to control TV

Wheelchair Seating & Positioning

Permobil F3 front-wheel drive power wheelchair (5)

Custom seating options: H -strap for trunk support/positioning, padded trough-style arm rests with posterior elbow blocks, lateral trunk supports for stabilization, lateral thigh guides to prevent hip abduction, specialized backrest for positioning (Comfort Company Acta-Back), skin protection/positioning cushion (Jay Fusion).

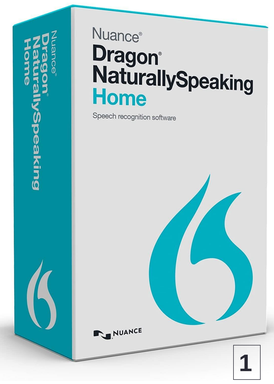
Power seat functions: tilt, backrest recline, leg elevate, seat elevate, and combination backrest recline/leg elevate; operated through adapted button switch positioned at head rest (6)

Drive control: Head array (7) vs. Joystick (3). Rehabilitation process involved a trial of multiple drive controls to allow patient to operate the chair in the least restrictive and most energy efficient manner.

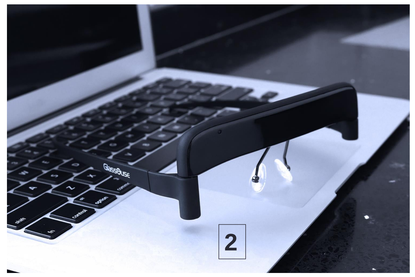
Trial wheelchair progression: front wheel drive vs. mid-wheel drive, Quantum vs. Permobil; pressure mapping for cushion selection, etc.

RESULTS

Despite having limited upper extremity function below the elbow bilaterally, the client was able to achieve independence with many aspects of his life with AT and custom seating/positioning equipment. Without these technologies and equipment, the client would be unable to participate independently in the following activities given his functional deficits:
- Independent phone use for gaming and to communicate with friends and family (messaging, calls, FaceTime, SnapChat, etc.)
- Independent computer use for leisure, and for academic purposes.
- Independent with mobility in power wheelchair to access environment, independence with pressure relief/weight shifts for skin integrity management.
- Environmental control of television, climate controls, Amazon Alexa



1


2


3


4

5


6


7

BOTTOM LINE FOR OT

With each new SCI case extensive amounts of patient education and wheelchair skills and AT training is necessary to help promote successful community re-integration. OT practitioners are uniquely positioned to make an impactful difference in the outcomes and lives of individuals following SCI because of their background in environmental and activity adaptations. It is often the case with SCI that not all functional movements of the upper and lower extremities are recoverable, but despite this it is possible for individuals to go on to lead successful and meaningful lives with the use of compensatory strategies and technologies.

OT practitioners are recommended to employ the use of AT and wheeled mobility intervention as early in the rehabilitation process as possible to increase competence with use, self-efficacy, and quality of life for individuals with SCI (Sakakibara, Miller, Eng, Backman & Routhier, 2014; Mortenson & Miller, 2008; Scherer & Cushman, 2001). In many cases, individuals with SCI have undergone significant emotional distress due to the nature of their injuries, thus a client-centered approach is recommended when employing AT and wheelchair equipment to increase environmental competence and subjective well-being (Migliorini, Callaway & New, 2013).

REFERENCES

Mortenson, W., & Miller, W. (2008). The wheelchair procurement process: Perspectives of clients and prescribers. *The Canadian Journal of Occupational Therapy, 75*(3), 167-75.

Migliorini, C., Callaway, L. & New, P. (2013) Preliminary investigation into subjective well-being, mental health, resilience, and spinal cord injury. *The Journal of Spinal Cord Medicine, 36*(6), 660-665.

National Spinal Cord Injury Statistical Center, University of Alabama at Birmingham. (2020). *Facts and Figures at a Glance*. Retrieved from: https://www.nscisc.uab.edu/Public/Facts%20and%20Figures%202020.pdf

Sakakibara, B., Miller, W., Eng, J., Backman, C., & Routhier, F. (2014). Influences of wheelchair-related efficacy on life-space mobility in adults who use a wheelchair and live in the community. *Physical Therapy, 94*(11), 1604-1613.

Scherer, M. J., Cushman, L.A. (2001) Measuring subjective quality of life following spinal cord injury: a validation study of the assistive technology device predisposition assessment. *Disability and Rehabilitation, 23*(9), 387-393.

[Dragon Naturally Speaking (1)] (n.d.) Retrieved from: https://www.amazon.com/Nuance-Dragon-K409A-G00-13-0-NaturallySpeaking-Home/dp/B00LX4BZAQ

[Glassouse Assistive Device (2)] (n.d.). Retrieved from:https://glassouse.com/wp-content/uploads/2020/04/003-1.jpg

[Adapted Joystick Control (3)] (n.d.). Retrieved from: https://www.bodypoint.com/ECommerce/site/images/thumbnails/b47f087466abcf75471de8a864415871/400x250.0/01_PCPT04.png?13089175922891866 7

[Cell Phone Mount (4)] (n.d.). Retrieved from: https://www.mobility-aids.com/assets/images/mdd403-delta-smart-phone-holder-demo-close-w.jpg

[Permobil Power Chair (5)] (n.d.). Retrieved from: http://permobilus.com/product/f3/

[Adapted Switch (6)] (n.d.). Retrieved from: https://images-na.ssl-images-amazon.com/images/I/71WZO9lVb-L._AC_SX425_.jpg

[ASL Head Array Drive Control (7)] (n.d.). Retrieved from: http://www.asl-inc.com/products/product_detail.php?prod=191