A "PROSTHOSIS"- INTEGRATING POWER MOBILITY AND PROSTHETICS

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Client Background

Jeff Sparks is a 32 year old man with a diagnosis of Spinal Muscle Atrophy Type II at C2-C3. He is an active man and is currently the national manager of Chapter Development for Muscular Dystrophy Canada. He owns and operates his own consultative practice as well, entitled Kaleidoscope Management Solutions Inc. where he specializes in Diversity and Human Resources consulting and training. As active as he is, Jeff is completely dependent for all of his activities of daily living tasks and has a full time 24-hour aid who assists him with personal care, mobility, work and leisure related tasks.

Current Issues

Jeff has been followed by the Adaptive Seating Service at the Stan Cassidy Centre for Rehabilitation for his seating and mobility needs for many years. His seating and positioning needs are complex and quite unique, and currently, Jeff is seated in a Contour U seat and back on an *Invacare* TDX 5 power wheelchair with power tilt and recline. He has a manual chair for backup. His sitting posture includes a heavy lean to the left side, which is one of the only positions that is comfortable to Jeff, and allows him to feel secure without fear of falling out of his chair. He is unable to weight shift or change positions independently. He has control over movements of his left thumb, particularly in antigravity positions, and some movements of the face, around the mouth.

His most recent power mobility assessment and prescription occurred over the course of 2 years. An ASL mini joystick was initially prescribed. When the equipment arrived, the challenge was to mount the mini joystick for independent driving. Jeff could control the mini joystick with either his thumb or his lip when the joystick was held in position by the therapist. When trying to mount the joystick, however, there were challenges. Because of the power positioning features on his chair, the joystick mount needed to move with Jeff. Also, the mini joystick is such a small point of control that if his thumb slipped off, he was unable to self-correct and would require assistance to regain independence with driving. Lip controls, with the joystick mounted on a head bracket, on a bib, or as part of the later/head rest were uncomfortable and fatiguing for Jeff. Listed here are some of the options explored and dismissed for independent driving:

- *Mini joystick* mounted under a custom built lap tray with hole cut to allow for thumb movements to control the chair - his positioning did not remain the same when reclined
- *Mini joystick* mounted within a wrist/forearm splint that allow for maximum freedom of movements of the thumb - Thermoplastic splinting materials that are available to OTs were not strong enough.
- Headset-style mount with mini joystick for lip access - too heavy, not aesthetically pleasing
- Bib mount with compact joystick - too fatiguing
- Bib mount with mini joystick - too fatiguing
- *Mini Joystick* mounted to the seat pan frame - too fatiguing, did not maintain position when reclined

After a number of months of frustration, we determined that the *mini joystick* was not the optimal method for independent driving. After further assessment, we explored non-proportional driving using a single switch scanner that Jeff would control by one of his fingers through a microlight switch that

was attached to his watch strap. Although non-proportional driving is a tedious way to drive, he was able to maneuver the chair himself and it seemed as though success had been achieved.

At a certain point, Jeff traveled to Vancouver to a conference and met a colleague that was using a *mini joystick* mounted onto a custom-built arm trough splint that was controlled with the tips of his fingers/thumb. Jeff took some photos and shared these with his OT upon his return. He was interested in returning to proportional driving and wanted to pursue a similar design. Knowing we needed heavy duty materials and specific custom manufacturing skills, Jeff was referred to the Institute of Biomedical Engineering to see if the clinical team could help.

Goals for Prescription

- To be an independent driver of his power chair, using thumb control of a mini joystick.

Equipment/Solution

The Institute of Biomedical Engineering (IBME) is a research and clinical prosthetics facility located at the University of New Brunswick in Fredericton. The Clinical team specializes in upper extremity prosthetics, particularly myoelectrics but has modified equipment and fabricated specialized and custom molded orthotics at special request.

Jeff was seen by the Prosthetist, the Prosthetic Technician and the Occupational Therapist at IBME. The OT from Adaptive Seating was there for the first appointment to assist in determining the needs for Jeff. Jeff's hand was molded using a geltrate mold in a position that was held by the therapist's hands. His hand was held in comfortable pronation with his thumb in an antigravity position that would allow him the most movement in a circumduction field so that forward/backward/side to side directionality of his chair could be controlled. The mold was then modified to remove the imprints of the therapist's hands and a custom molded spectralon and fiberglass 'prosthosis' was fabricated. Included within the fabrication/lamination process included the addition of a custom metal mounting bracket for the *mini joystick.* The 'prosthosis' (mix of prosthesis and orthotics) with the mounted *mini joystick* (which maintained the position of the joystick relative to his hand) was then mounted as part of Jeff's chairs armrest (so that it moves when Jeff travels within the range of his tilt) Collaboration between Stan Cassidy Rehabilitation Centre and the Institute of Biomedical Engineering was made throughout.

Outcomes

Jeff is now an independent driver of his power wheelchair. Positioning device allows correct alignment of his hand and thumb for accurate movement of his thumb. The prothosis maintains him in a comfortable seated position. There is limited opportunity for falling 'out' of position. A wider strap and increased padding was added as Jeff was finding some discomfort at the mounting position. The result of the consult/referral was a unique, one of kind, client centered approach to treatment that included collaboration of two of New Brunswick's highly regarded tertiary centres.

Speaker Bio

Krista Porter is an Occupational Therapist and the Coordinator of the Adaptive Seating Service at the Stan Cassidy Center for Rehabilitation in Fredericton. This is a tertiary level rehabilitation centre that serves the province of New Brunswick. There are two Occupational Therapists and two Industrial Mechanics/ Seating Technicians who work as part of the Adaptive Seating team. We do mostly complex seating and in the recent years have had to create some unique solutions for persons to continue driving.