MANAGEMENT OF HIGH LEVEL BILATERAL ARM AMPUTEES WHO USE WHEELCHAIRS FOR MOBILITY
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Management of the high-level bilateral arm amputee poses many challenges to the prosthetist and rehabilitation team. When the amputee is also in a wheelchair, use of arm prostheses becomes more difficult. Positioning of the prosthesis without the use of the lower extremities is remarkably difficult. The work envelop is further reduced when trunk motion and stability is compromised by paralysis.

Heckathorne and Uellendahl have recommended a framework for component and control strategy selection when designing prostheses for high level bilateral arm amputees.1-3 This strategy calls for use of dissimilar components on each side to enhance prosthesis usefulness and control schemes that provide dedicated control of as many components as possible allowing simultaneous control when functionally desired. Uellendahl has used this approach for over 15 years for clinical fittings. The long-term success of this fitting philosophy demonstrates the clinical efficacy of this approach. In fact, one of the amputees (MM) reported on in this paper has used prostheses of the same original design for more than a dozen years.3

The authors have experience fitting bilateral SD, TH, and unilateral TH with quadriplegia clients who are confined to wheelchairs for mobility. Case presentation of these fittings will illustrate the benefits of implementing the above-mentioned fitting philosophy. One on-going fitting will be discussed that uses an innovative control strategy using a mini joystick to control two components simultaneously on an x/y coordinate system. The joystick is from a Play StationTM control unit. The technical modification to prosthesis control were performed by Liberating Technologies of Holliston Maine.
Figure 1 shows a bilateral humeral neck amputee (MS) who also has bilateral transfemoral amputations. He uses an electric wheelchair controlled with chin activated joystick. The left prosthesis is fully electric using myoelectric 2 site control of wrist, TD, and elbow using a chin nudge for mode selection. The right dominant side uses FSR’s under the humeral remnant for control of TD and wrist with a chin operated mode select between these two devices. Both shoulders use electric locks operated by chin nudge.

Figure 2 shows the cable control of the elbow on the right prosthesis for patient MS.

Figure 3 shows a quadrimembral congenitally limb deficient boy (CG). In this case only one prosthesis was fitted to avoid gadget overload. The hand is myoelectrically controlled using 2 electrodes. The wrist is controlled by FSR’s located superior to the acromion.

Figure 4 shows the elbow control using linear transducer for patient CG.

Figure 5 shows a unilateral TH amputee (DB) with C7 quadriplegia. His left hand is minimally functional, it is used to control his electric wheelchair. The right prosthesis uses a single FSR for terminal device control using chin operation.

Figure 6 shows the harness used for cable operated elbow control for patient DB.

Figure 7 shows patient MM. He has bilateral humeral neck amputations, bilateral TT amputations, and paraplegia. He is fitted unilaterally. He uses FSR’s placed anterior and posterior to his shoulder for elbow control. The TD is controlled with a chin operated rocker switch. The T mount on the wheelchair is used to position humeral rotation as well as to activate the lock lever for wrist flexion.

Figure 8 shows a posterior view of MM. Forearm rotation is controlled by switch using scapula abduction.

References:

