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PROSTHETIC MANAGEMENT OF A BELOW-ELBOW AMPUTATION WITH BRACHIAL PLEXUS INJURY[1]

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Although amputation of an upper limb due to brachial plexus injury is common, it is usually performed above the elbow and a shoulder fusion is carried out at the same time. In a recent case, a young man who had sustained a brachial plexus injury at the C7-T1 level was amputated below the elbow. This presented an uncommon set of prosthetic fitting problems, which are described in this report, along with the solution achieved.

The C7 root was intact, and the biceps were functional at grade 4; triceps were "trace"; deltoid, grade 4; shoulder girdle, 3+ to 4; forearm and hand 0. The patient after consultation had elected to have a below-elbow amputation, but he did not wish to be fitted for a prosthesis at the time of surgery since he had been without the use of his hand for two or three years and felt at the time that a prosthesis would not be of value to him.

He returned to the clinic one year later, however, and asked to be fitted with a functional prosthesis. A standard below-elbow prosthesis was not appropriate because the absence of triceps function resulted in an elbow without stability. The line of force from a control cable passing anterior to the center of elbow rotation would result in flexion of the patient's elbow when he attempted to use the terminal device, and, thus, the only time he would be able to open the terminal device would be when his elbow was fully flexed. This problem was discussed with the clinic team, and since the patient wished to do repair work on his car we felt a mechanical elbow lock would be appropriate. Other design options would have been to have the control cable pass posterior to the patient's joint, negating the bending moment applied to the elbow joint by cable excursion. This was regarded as not being feasible since the patient's elbow would still be unstable in most activities of pushing or holding an object against a fixed surface.

The prosthesis of choice was a BE arm with a double wall, total-contact socket, half-cuff, and figure-of-eight harness (Fig. 1). By incorporating an E-2500 outside locking hinge joint for elbow-disarticulation amputations (Fig. 2), the required stability was provided throughout the full range of flexion and extension. The hinge was modified by cutting off the socket attachment strap and contouring the forearm straps to fit the shape of the BE socket. The prosthesis was laminated using standard procedures (*1*).

RESULTS

After initial fitting and harness adjustment, the patient was able to operate the prosthesis easily, except for the elbow lock. With a maximum of two rubber bands on a 555 Hosmer-Dorrance hook, the elbow lock was not necessary for full terminal device function since the weight of the prosthesis and terminal device prevented elbow flexion. However, as additional rubber bands were applied, he could not

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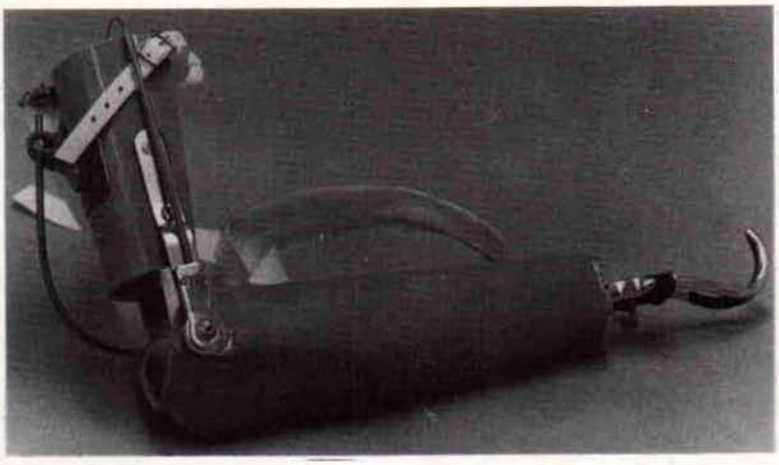

Fig. 1. The completed prosthesis.

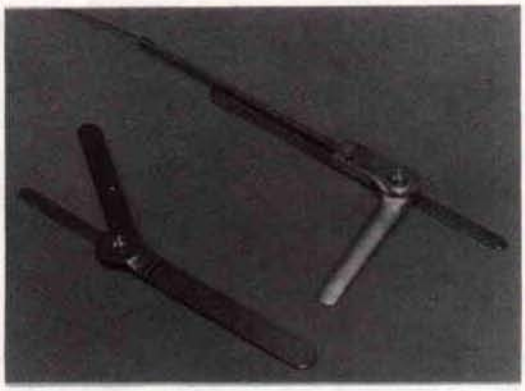

Fig. 2. The E-2500 outside locking elbow joints used in the prosthesis shown in Figure 1.

open the hook without inadvertant elbow flexion unless the lock was engaged.

Use of the elbow lock mechanism by the patient posed a slight training problem because the absence of triceps function limited his active humeral extension. The lock was finally activated by a combination of shoulder depression and abduction motions.

LITERATURE CITED

1. Santschi, William R., *Manual of upper extremity prosthetics,* Second Edition, University of California at Los Angeles Press, 1958, pp. 79–85.