

Technical Note

A Tri-Correctional Upper-Limb Orthosis

A 45-year-old, white female acquired a hairline fracture of the proximal third of the ulna. She was treated by the application of a full arm cast for six weeks. After removal of the cast, she had a flexion contraction of the elbow and both pronation and supination of hand were limited. The prescription was simply a request to fit the patient with an orthotic device for correction of the flexion contraction of elbow, pronation and supination of the hand.

At the onset, I would like to say that we have a very good working relationship with the Department of Physical Medicine at the Methodist Hospital in Memphis, and we often see patients with very difficult orthotic and prosthetic problems. Most problems are solved successfully, but a few are not. This case, to me, seemed to be one of the most difficult presented. During the 28 years of my practice, I had never been successful in designing an orthotic device that provided correction of pronation and supination.

In this case, our first concern was function. The second was ease of donning and doffing, the patient being able to change the correctional parts independently. A third concern was cosmesis. The end results were acceptable to all four members of the clinic: the patient, the orthotist-prosthetist, the occupational therapist, and the physician.

A turnbuckle type device (Fig. 1) with a band and cuff at the proximal end, a

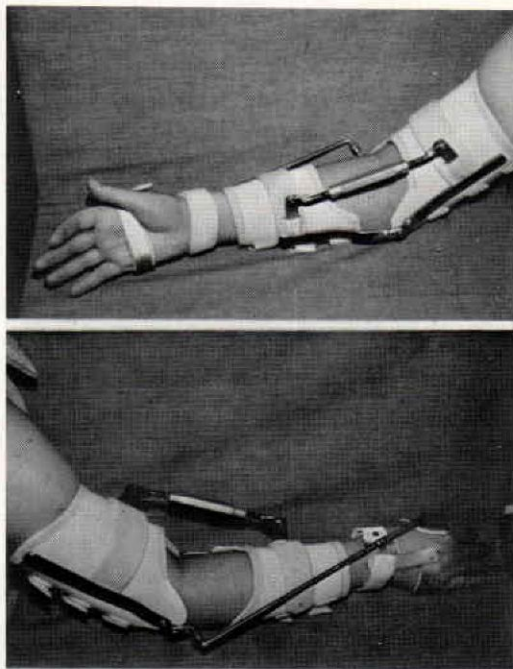


Fig. 1

free-motion elbow joint medially, a single bar, band and cuff on the distal portion, and a special elbow joint on the lateral side was provided. For the lateral side, I used a swivel ball joint from a "four-poster" cervical orthosis. The bottom portion of the ball joint was silver-soldered to the head of a metal joint 1 inch distal to the axis. The top part of the ball joint was welded to a 1/4-inch stainless steel rod that was long enough to reach from the ball joint to the distal end of the radius. The hand portion of the device is

a simple opponens splint extended to the wrist, with a piece of one-inch square, 1/16-inch-thick steel attached by rivets at the proximal end. The joint at the styloid of the radius is simply a 1/4-in. ID tube, 3/4 inches long with a 10-24 screw silver-soldered to the bottom and a 8-32 nut silver-soldered to the top to allow for an Allen-head set screw. On the plate at the radial styloid, I silver-soldered a 10-24 nut and tapped it out to allow the tubing to act as a swivel joint there.

This orthotic device works well in all three functions. The portion of the orthosis to correct flexion (turnbuckle) at the elbow, is simple and has worked many times. The portion of the orthosis that provides pronation and supination of the wrist is not quite as simple. The design is successful because of a combination of three factors. First, the distance from the axis of the elbow to the ball joint, 1 inch, allows the 1/4-inch rod to rise over the distal portion when pronation occurs. This arrangement also allows the rod to be in alignment with the swivel joint at

the wrist when the hand is in supination. Second, the ball joint at the elbow allows the rod to be in alignment with the tube at the wrist in all positions. Third, the 1/4-in. ID tube at the wrist allows the rod to elongate when the wrist is either pronated or supinated. The 10-24 screw on the tube is a simple way to have a swivel joint that allows two things: the tube stays in alignment with the rod and allows ulnar and radial deviation at the wrist during work and play.

In order to change position of the hand, the patient only has to loosen the ball joint nut at the elbow and the set screw at the wrist. The turnbuckle simply has to be screwed out to correct flexion. In the case of this patient, the changes only had to be made once a day.

A full arm cast is needed for fabrication of the orthosis. I believe fabrication time to be approximately six hours.

I would like to express my appreciation to Trudy Smith, O.T. and Dr. John D. Huffman for their help in providing this patient with a functional orthosis.

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