

A Prosthetic Thumb for the Partial Hand Amputee

ROBERT G. THOMPSON, M.D. and MICHAEL M. AMRICH, C.P.

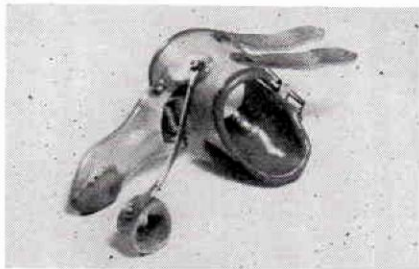
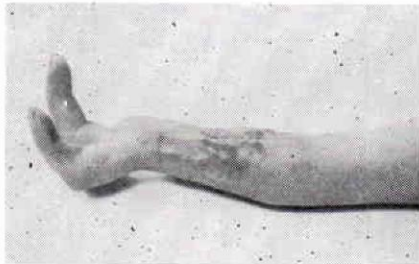
Prosthetist, Liberty Mutual Rehabilitation Center, Chicago

Modern prosthetic clinical teams are being confronted with a relative increase in the number of partial hand amputations especially among the group of industrially injured. This is partially because of the dictum of the modern surgeons to save all possible viable structures and also due to the widespread use of infection controlling anti-biotic drugs.

For the majority of partial hand amputees, the best we have had to offer them, from the field of prosthetic replacements, was a cosmetic glove, with a filler for the missing portions. However, the cosmetic glove does not meet the needs of an industrial amputee as an assistive appliance in future gainful employment.

The patient with a thumb or several fingers missing will be handicapped if he is not fitted with some type of assistive utility prosthesis. For the amputee with a thumb and several fingers amputated, some form of opposition to the remaining digits is required. Stationary posts or digits mounted on leather or plastic cuffs have been successful to some degree, for such activities as gross lifting or carrying of objects. However, the inability to selectively pinch, grasp and hold objects is somewhat discouraging and frustrating to this type of amputee.

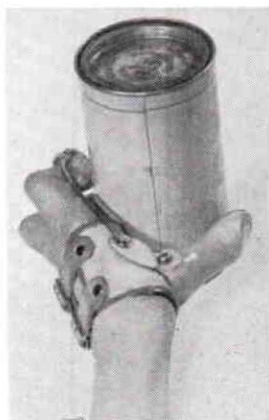
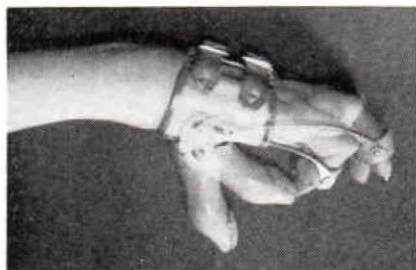
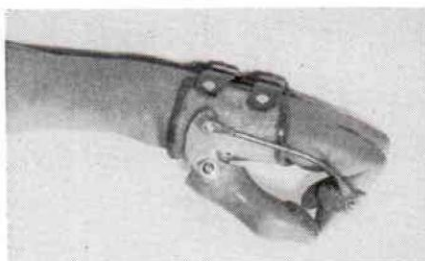
Recently, we were confronted with this type of partial hand amputee, at the Liberty Mutual Rehabilitation Center in Chicago. The patient's hand (Figure 1) showed a complete loss of the thumb, fourth and fifth fingers. In addition, the musculature and tendons of the palmar surface had been damaged, resulting in con-



Figures 1 and 2

tractures of the metacarpal-phalangeal and interphalangeal joints of the remaining second and third fingers. After extensive physical therapy treatment the maximum active range of motion attained was 40 degrees in the metacarpal-phalangeal joints, 68 degrees in the proximal inter-phalangeal joints and 65 degrees in the distal inter-phalangeal joints. Muscle strength was eventually nearly normal in the fingers.

Due to the inability to grasp objects between the remaining fingers, and/or the palm, a specially designed prosthesis was constructed utilizing a plastic prosthetic thumb for opposition to the second and third fingers (Figure 2). The prosthesis consisted of a naugahyde lined melmac plastic cuff attached to the stump by two straps. Mounted on a bolt type pivot,



Figures 3 and 4 above.

Figures 5 and 6 at right.

with a piano wire spring for automatic return, was the prosthetic thumb. The thumb was activated by a rod, set off-center, and attached to the index finger by a plastic ring (Figure 3). With the prosthesis the amputee was able to attain a maximum opening between the index finger and the prosthetic thumb of $5\frac{1}{2}$ inches, and tightly oppose the index finger to the tip of the prosthetic thumb (Figure 4). As a result, he was able to handle objects ranging in size from a coin or nail to a large can or glass (Figures 5, 6.) The amputee was able to flex against 10 lb., with the index finger, and resisted a 5 lb. pull with the prosthetic thumb.

The activated rod can be lengthened or shortened to accommodate the range of motion in the activating finger. From a therapeutic standpoint, the spring return resistance offered by the prosthetic thumb enabled this particular amputee to in-

crease the range of motion in the metacarpal-phalangeal joints of the index finger by 20 degrees, with a similar increase noted in the other finger joints during a period of three months. Assuming that this progress will continue, the activating rod can be shortened and the proximal phalanx be used for activating the rod to the thumb lever.

The principle of this appliance can also be used to activate a prosthetic finger for opposition to a normal thumb. Other materials can be substituted for the plastic used in this case such as a molded leather cuff, stainless steel ring, and stainless steel thumb. Individual preferences and needs should be the basis for the proper selection of materials.

In view of the fact that very few partial hand amputations are alike, each one presents a new challenge to the ingenuity of the prosthetist.

Without a standard pattern or prosthesis to follow, the trial and error method may be the only way to solve a particular problem in fitting the partial hand amputee. Many partial hand amputees do require more time

to equip with a prosthesis than the so-called standard below-elbow amputation. However, the fitting of a prosthesis to a partial hand amputee is a real challenge and we must do our best to assist them toward the goal of maximum rehabilitation.

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