Forearm Flexion Device

Controlled by Hip Motor

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Many people fail to understand that the loss of the upper extremities in poliomyelitis is more frustrating, and a greater hardship, than the loss of the lower extremities. The legs can be braced and they can afford the needed support for locomotion. However, the upper extremities when paralyzed cannot be so readily assisted because of their function of fine movement and dexterity. Therefore, in considering the patient's total happiness and ability to function in daily living, more mechanical aid must be given to a flail upper extremity as a result of poliomyelitis.

Faced with a poliomyelitis patient with almost complete paralysis of both upper extremities, except for a potential functional right hand, it became apparent that in order to use this hand some special type of apparatus must be devised to assist the patient in placing the hand where she desired. Considering the child's age, which at the time was seven years, date of onset (October, 1951), and the many frustrations encountered by this young child because of her inability to help herself, a team composed of doctors, physical therapist and orthotists was formed to formulate the apparatus.

The lower extremities and the trunk of the patient were not involved except for slight weakness in the erector spinae muscles of the cervical area. The patient had been under treatment at Children's County Home, Westfield, New Jersey (a rehabilitation center for poliomyelitis cases) since her admission in June of 1952, with improvement of muscle power. However, this improvement was not great enough to be considered functional. With the possibility of the left shoulder as a motor removed, we selected hip flexion and extension as our motor and locking movements. This selection was based upon the strength of the muscles on a 1 Repetition maximum basis and 10 Repetition maximum and the range of motion desired. Construction of the actual apparatus was started in September, 1953, when the locking mechanism first became available. The child's

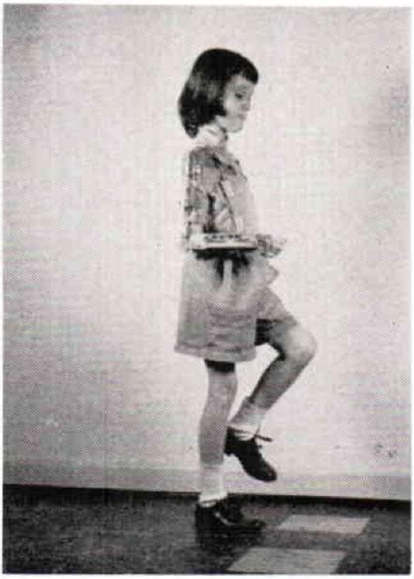

Fig. No. 1 Hip flexion on the left, produces elbow flexion on the right.

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Fig. No. 2. Hip extension locks and unlocks brace.

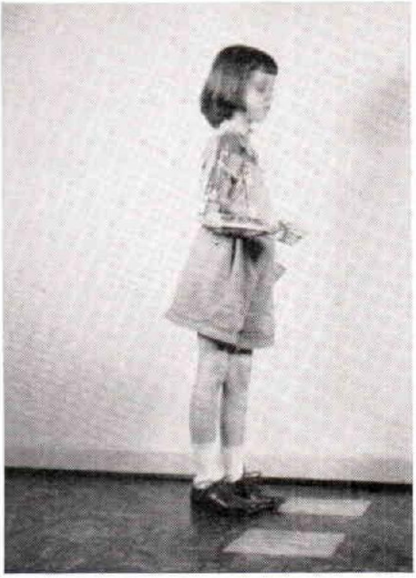

Fig. No. 3. Brace locked at 90° elbow flexion, position No. 4

cooperation and acceptance of the device made its construction simpler.

The component parts of the braces are as follows:

Shoulder cap and part of humeral section molded of leather and celastic over plaster of paris cast.

Elbow joints are active or positive locking type. Lock can be installed on lateral or medial side.

Control is of dual type.

Joints may be made as long as desired with half band and, if necessary, a full cuff.

The control cable 3/64 and cable housing is fastened to end of forearm with an anchor at end, leather lift loop installed about 1 ¾ inches below center of elbow and 1 ¼ inches from center of the lateral side of joint.

Retainer plates are riveted to humeral section and shoulder cap at direct line of pull.

Retainers are so placed on cable housing to come into proper place with retainer plates.

Hanger and clamp for hanger are fastened to upper end of cable for harness and control straps.

The shoulder cap is held on with either 1 inch or 1 ½ inch webbing of any kind of material.

Leg straps are made of 1 inch vinyon or similar material with buckle on end for adjustment.

Special hand brace to hold the hand in dorsal flexion and prevent ulnar deviation, yet permit ulnar flexion, and wrist flexion.

The teaching of the child to work the device, considering her age, was remarkable with her speed of adaptation. The apparatus is operated by flexing the left hip which produces flexion of the right elbow. (fig. No. 1) The range of motion that can be obtained is from 15° to 120°. The brace can be locked by extending the left hip, which releases the plunger into any of the five openings at the joint. (Fig. No. 2) Hip extension also releases the plunger to unlock the elbow.

Fig. No. 4. Brace locked in position No. 5, under blouse.

Fig. No. 5. Patient opening door.

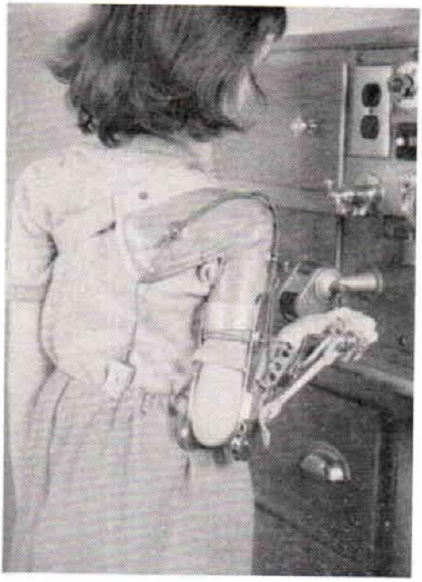

Fig. No. 6. Patient practicing operating pencil sharpener.

Fig. No. 7. Patient opens drawers with brace locked in position No. 5.

The brace can be locked in the following five positions:

Position No. 1	15°	$21\frac{1}{2}$	inches.
Position No. 2	30°	24	inches.
Position No. 3	60°	27	inches.
Position No. 4	90°	31	inches. (Fig. No. 3)
Position No. 5	120°	34	inches.

The inches are measured from the head of the first metacarpal to the floor.

This is very important because as the child grows the mechanical joint range of 105° will remain the same. However, because of her body growth, the hand will be placed higher, in relationship of things she can reach; therefore making the apparatus much more purposeful.

The brace weighs $1\frac{1}{2}$ lbs. and can be worn under clothing for cosmetic effect. (Fig. No. 4)

Some of the activities of daily living which the apparatus enables the patient to perform are as follows: 1. Opening door (Fig. No. 5). 2. Working pencil sharpener (Fig. No. 6). 3. Opening drawer (Fig. No. 7). Activity number 1 shows patient moving left hip to obtain position of hand. Activities numbers 2 and 3 show patient with elbow locked and just placing hand. Thus the patient can keep the joint locked for a period of time and work at a certain height. Also, it enables her to carry an object by keeping the elbow locked.

The brace can easily be adjusted as the patient grows. It is comfortable because of its light weight. With the development of our particular apparatus, we hope we have helped this child in her total rehabilitation.

There are still many problems that remain unsolved. There seems to be a need for more work in the field of mechanical aids for flail upper extremities.

"What's New(s)"

• It has been announced by the Advisory Committee on Artificial Limbs that an autumn session of the Upper-Extremity Prosthetics Training Course will be offered at the University of California, Los Angeles. Dates for this session, the eleventh to be held, are October 11 through November 19, and attendance times will follow the pattern established in former schools: 6 weeks for prosthetists, beginning October 11; 3 weeks for therapists, beginning November 2; 1 week for physicians, beginning November 15. First priority will be given to those prosthetists, therapists, and physicians located in areas already covered by the Upper-Extremity Field Study being conducted by New York University but who to date have been unable to avail themselves of these courses. If sufficient demand exists, clinic teams from areas not already covered will be offered courses at a later date.

• Randolph N. Witt is co-author with Dr. Duane A. Schramm, M.D., of an article, "Assistive Apparatus for the Paralytic Hand," which appeared in "The American Journal of Occupational Therapy." Mr. Witt is a certified orthotist at the Gonzales Warm Springs Foundation Hospital, Gonzales, Texas.

• The firm of Chester B. Winn, Inc., of Buffalo has purchased the assets of James Beck & Co. of the same city and is operating it as a branch facility. The Beck Co. had been operated as a partnership by Rupert Tiebold, Jr., and George Dillon.

• A new service to the individual brace shop is offered by William Wagenseil in his newly developed brace parts made of stainless steel. Each part has been tested for tensile strength and is precision-made, saving time and money for the local firm. A catalogue and price list may be obtained from Wagenseil Brace Parts, Inc., 115 So. Portland Avenue, Brooklyn 17, N. Y.