Corrective Splints for Club and Drop Hands Due to Dysmelic Disabilities*

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The pathology of the thalidomide embryo encompasses all types of deformities. Prevalent are those of the upper and lower extremities caused by the action of the thalidomide on the embryo.

Thalidomide, containing the drug known as "Contergan" in West Germany, is generally held responsible for the catastrophic results which particularly affected the birth years between 1960-62. Due to the particular and problematic conditions of the misformed extremities the Orthopedic Technician was from the start engaged in the rewarding task of combatting these deformities. One of the most important pre-requisites for daily living activities of those severely handicapped children is to improve the usefulness of their arms and hands by mechanical means—if that can be done at all.

When we began the construction of these mechanical means we lacked experience and had only very primitive splints at our disposal. In February 1963 a special department for dysmelics was opened in our clinic. Through research and a great deal of trial and error we developed a new corrective hand splint showing definite improvements over previous ones.

Since then approximately 100 children have been fitted with these splints. No patent will be filed, but we hope that these unique splints will find appreciation and are therefore describing them below. The corrective club hand splint consists of only two major components, yet is finely adjustable. The particular qualities of this splint are its clear and economic construction giving maximum effect through a minimum effort.

Fig. 1 shows a severe club hand condition of an approximately 18 months old girl. Fig. 2 shows the same hand fitted with the corrective splint. Correction is very noticeable. The spring, constructed of a 1.5mm wire, pushes the hand toward a more normal position. The tension of the spring does not stop the normal hand motions but only limits them. The white knurled knob permits increase or decrease of spring tension. In order to increase or decrease dorsiflexion the nut directly above and to the right (as seen in Fig. 2) must be loosened and the base of the spring turned.

By varying the direction of the spring wire arm, which is directly connected to the palmar piece, pronation or supination of the hand may be influenced.

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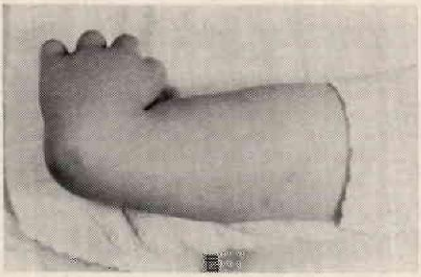

Figure 1

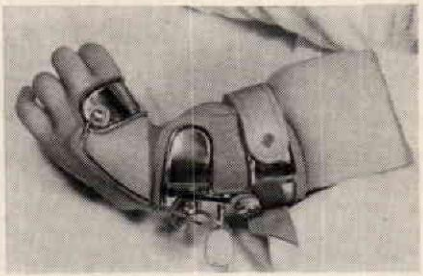

Figure 2

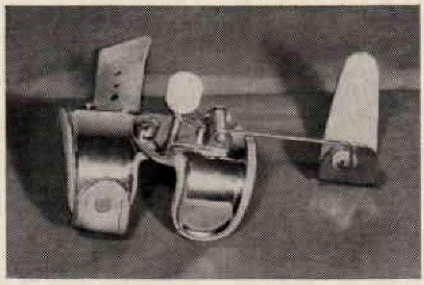

Figure 3

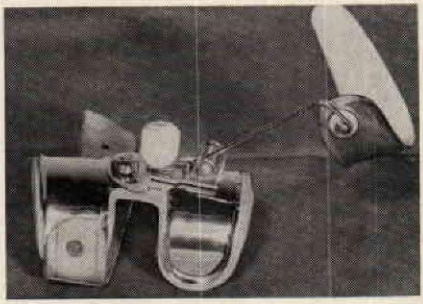

Figure 4

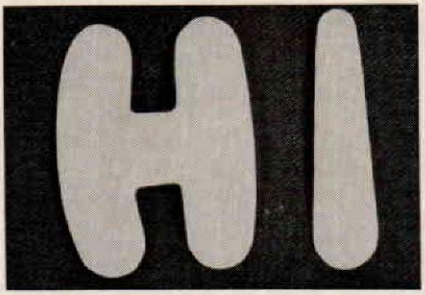

Figure 5

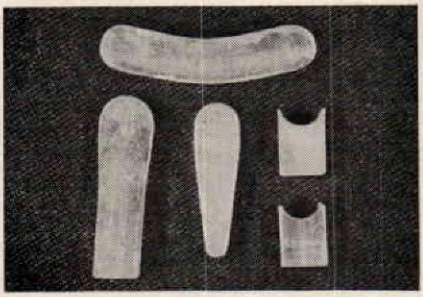

Figure 6

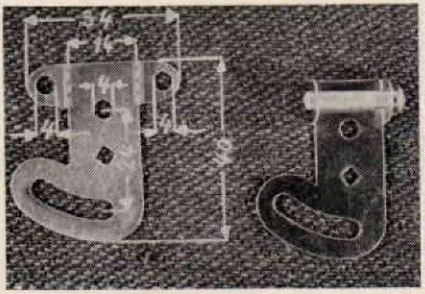

Figure 7

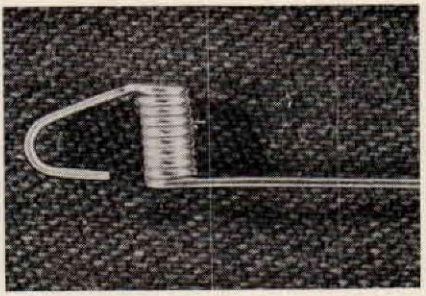

Figure 8

The position of initial adjustment may be considered correct when the white knob, as seen in Fig. 2, has been nearly turned off the threaded stud and yet the spring possesses sufficient force to influence the hand toward a corrected position. Clockwise turning of the knob increases the tension of the spring and thus increases the corrective force acting on the hand.

To fabricate this splint a plaster cast is not necessary. This we consider particularly favorable since all components are quite small. Also, to obtain a satisfactory cast with these small and restless children is very difficult.

It suffices entirely to cut a paper pattern of the "H" shaped forearm and the palmar piece (Fig. 5). One should be careful not to cut the forearm part too long so as not to interfere with elbow flexion. Saving of all patterns may come in handy for future re-use.

For material a hard rolled stainless steel of ½mm thickness is used.

The patterns are transferred to the SS (grain of SS being unimportant) and cut out on a fine toothed metal band saw.

In order to prevent skin pressure the edges are smoothed and slightly rolled. By means of some simply made tools this rolling can be easily and neatly done. Fig. 6 shows these tools. They were made of approximately ¼" dural round stock. The rolling is performed by placing parts and tools in a vise and pressing them together.

The forearm and palmar components are hammered over a concave block of wood (lead) and shaped to the desired form. The carrying and guiding component as well as the "T" shaped section plate are fitted with the holes and cut-outs as seen in Fig. 7. The two 4mm holes receive the studs employed to hold the spring. In the middle, below the other two holes a third one is drilled. This hole is fitted with a pin with a 3mm off-set and riveted to the forearm unit. This then becomes the point of rotation for the unit. A 4 by 16mm long threaded stud is riveted into the square hole. Another 4mm threaded stud, squared on one end, is then riveted to the forearm part passing through the elongated slot. When later fitted with a nut this part permits dorsiflexion positioning. A 1.5mm spring wire is used for the fabrication of the spring. The coil consists of about 9 turns wound over a 4mm drill. To begin with the shank should be allowed to be of adequate length. The opposite and shorter end is "U" shaped and wrapped around the long threaded stud.

When fabricating the spring, left or right winding must be observed in order to apply to the left or right hand respectively. The adjustment knob has a 4mm inside thread and consists of "Polyamid," a fiber of the perlon family (nylon). It is easily made on a lathe. The head of the knob should be knurled for better gripping. The thread in the knob should be loose so as to permit turning by hand, but not so loose as to permit accidental turning by the child.

The characteristics of Polyamid are very advantageous. It allows for a tight fitting knob which however is easily turned by an adult. The assembly of all parts is quickly done. The spring with its coil is inserted and held in place with a small guide pin—which will be riveted after the fitting. The adjustment knob is then placed on the threaded stud, see Fig. 9. The assembled part, with the adjustment knob, and spring is then mounted to the forearm shell. A synthetic washer of approximately 15 by 15mm is placed between the pivoting parts.

Prior to the fitting the forearm shell should be slightly padded with a 3mm fairly dense sponge rubber and be fitted with a small leather strap. The splint should now be fitted. Particular emphasis should be given to the

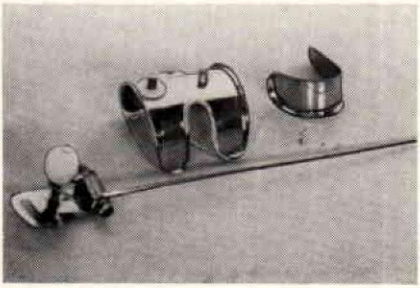

Figure 9

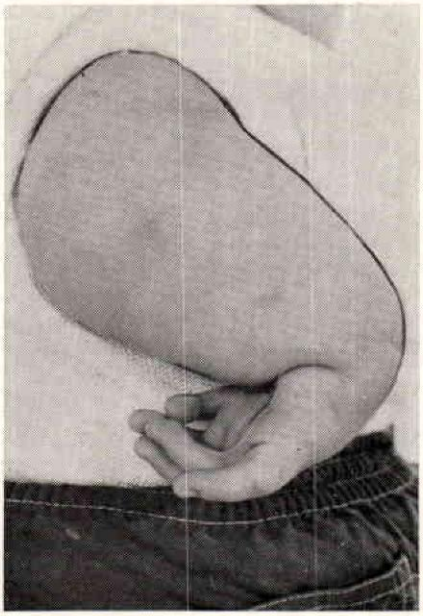

Figure 10

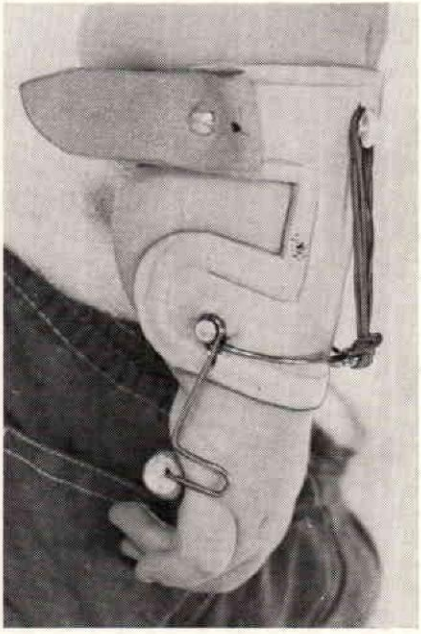

Figure 11

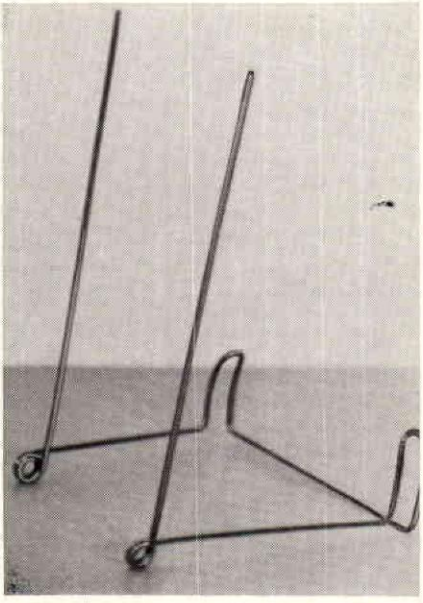

Figure 12

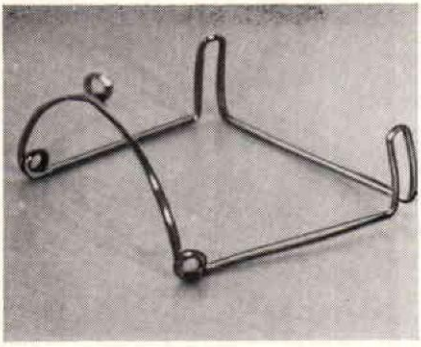

Figure 13

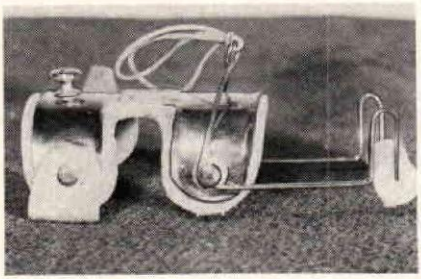

Figure 14

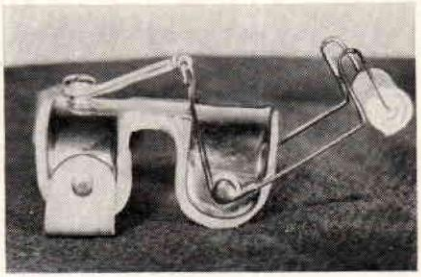

Figure 15

fit of the palmar piece. It must in no way limit prehension. Its narrowing as it encircles the hand should be noted.

The spring should be cut to the correct length, bent to an angle as seen in the pictures, and the end bent into a small loop. The palmar piece is riveted to the spring with a 3mm rivet with a washer in between. The palmar piece is then padded with a soft leather. Covering of the entire splint has been abandoned. The SS can be highly polished and thus give a lasting and more attractive appearance.

Parties interested in obtaining this splint can obtain small quantities of the components as seen in Fig. 9, directly from us. The control unit with the spring will fit all sizes of splints. It should merely be stated whether it is for the left or right hand.

Fig. 10 shows an extreme drop hand of a two year old. In order to lift this hand we fitted a spring-type corrective splint. The splint is simple, light and durable. Fig. 11 shows the same arm with the applied splint. The result is very satisfactory. Measuring for this splint is similar to the one previously described. In this instance the forearm shell is not applied to the ulnar side of the arm, as is the club hand splint, but to the dorsal side. In order to determine the size of the bail-like spring, a tracing of the forearm and hand is needed. The size and shape of the spring bail is correct when the two coils—which serve as rotation points—are congruent with the wrist joint and the bail is well fitted in the palm without hindering prehension. The bail passing through the hand will be covered with felt—constituting a roll.

The bail is made from a 1.5mm spring wire. Fig. 12 shows its shape. The loops are formed by winding the wire around a 4mm drill—giving it 1½ turns. Two rivets, passing through the loops, will fasten the bail to the forearm shell. The lateral projections on the forward part of the bail prevent the hand from sliding off—as well as helping in the correction of adduction or abduction. These projections should be padded with a sponge rubber. The two ends will be shaped into a semi-circle and soldered. A small eye is then soldered to the center of the semi-circle. See Fig. 13. The lift of the hand is obtained by passing small rubber bands through the eye and over the stud of the forearm shell. The tension can be varied by the winding or unwinding of the rubber bands around the stud. See Fig. 14 and 15.

In Fig. 11 one of the older models is shown which previously were covered with leather.