Dynamic Heel Cord Stretching Orthesis

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The need for a brace to stretch a tight, stubborn heel cord was recognized by J. A. Bailey II, M.D., while he was Chief Orthopedic Resident at the State Hospital for Crippled Children, Elizabethtown, Pennsylvania. Since Dr. Bailey had obtained good results with a plaster cast, he inquired if it would be possible to develop a brace to accomplish the same result.

The plaster cast used was loosely fitted over the forefoot. A patten was incorporated into the cast, the heel was cut from the cast allowing the heel to settle through the hole and the heel cord to stretch. **Figure 1** shows the completed brace.

The measurements of the metal used in the description of this brace are appropriate for a child approximately 10-11 years old, and weighing about 90-100 pounds.

Actual construction is as follows:

The distance is measured from the sole of the foot to a point distal to the head of the fibula deducting about 15% from the measurement (to make certain the peroneal nerve is not involved), adding two and a half inches to the above measurement to allow for the heel cord to stretch on weight bearing. This gives the overall length for the medial and lateral uprights. These are made of 5/32″ x 5/8″ #304 stainless steel. A 16-gauge steel sole plate, that is slightly curved to facilitate roll-off, is welded to the medial and lateral uprights. Sole leather is riveted to the sole plate which, in turn, is covered with rubber to give a more positive walking surface.

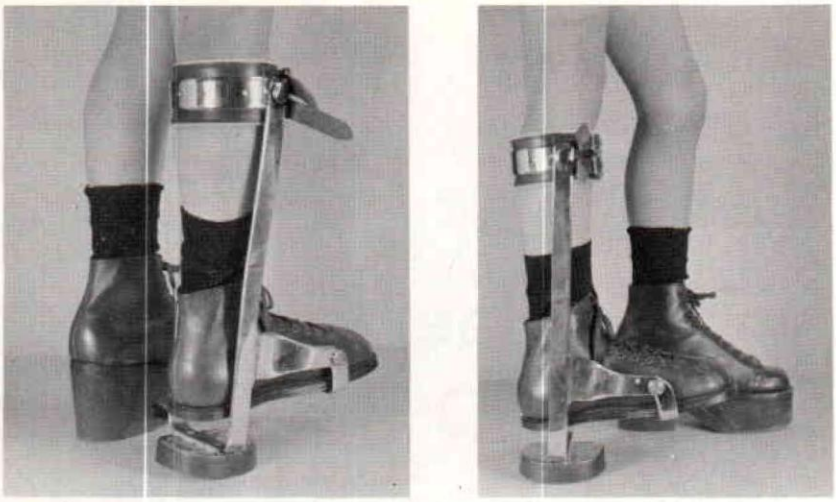

FIGURE 1 and 1A—Complete brace.

To the medial and lateral uprights the anterior supports, which are cut from ⅛″ x 1¼″ #304 stainless steel, are welded. These must extend far enough anteriorly to attach to the anterior stirrup. The stirrup is cut from ⅛″ x 1¼″ #304 stainless steel. This is then butt-welded to a piece of ⅛″ x 1¼″ #304 stainless steel which is shaped to fit on the outside of the sole of the shoe to retain the shape of the shoe. The placement of the pivoting joint coincides with the metatarsophalangeal joint **(Figure 2).**

Surgical shoes are the easiest to attach to the stirrup, since they facilitate insertion of the distal rivet which holds the shoe to the foot plate. The type of shoe is determined by the pathology of the foot; some feet require a normal last shoe; others, outflares or straight lasts.

The pivoting joint is a shouldered rivet. This has worked well. When the patient bears weight, the foot pivots and the patient's weight stretches the heel cord. When the patient lifts his foot to take a step, the upright contacts a stop set at 90° **(Figure 3),** so that the foot cannot be plantarflexed. When the patient is weight-bearing on the foot opposite the brace, this stop causes the brace to lift with the foot as that foot is raised. The stop is simply a projection on the stirrup which contacts an 8 x 32 cap screw set in the anterior support bracket.

An adjustable stop was tried **(Figure 4),** but it did not justify the effort, so it was discarded in favor of the fixed stop set at 90°.

The calf is measured at the fullest part and the band is made of stainless steel with a leather calf cuff. Buckles and straps or Velcro may be used as fasteners. Anterior and posterior bands were tried; the removable posterior band seems to offer the better result. It supports

FIGURE 2—Sole plate and stirrup.

the calf posteriorly where the pressure is greatest and also facilitates applying the brace when the heel cord is extremely tight. The calf band is attached by a square shank rivet which fits into a slot in the medial and lateral bar **(Figure 5).** This also insures a better fit of the calf band and cuff as the patient moves up and down in the brace.

At this time the placement of the fulcrum is at the metatarsophalangeal joint. Whether this is the optimum point for its placement remains to be proven. One of the local universities is planning to do a study of this feature.

Due to the fact that the brace is of the patten type, the shoe on the other foot must have a build-up to balance the patient for proper gait.

Patients with bilateral involvement wear the brace alternately on each foot for a given period of time, which requires the shoe on the other foot to have an elevation on the sole. There are several ways of doing this that are feasible. If straight-last shoes are used bilaterally, they are worn alternately; if regular-type shoes are required, the one on the brace a straight-last shoe and a pair of normal-last with elevations to be worn alternately on the foot opposite the brace. If outflare or normal-last shoes are indicated in bilaterally involved patients, two braces are needed. One brace is used at a time because it is almost impossible to walk on a pair of patten-ending appliances without crutches.

I have avoided mentioning any claims or conclusions, since we are in the process of compiling data for later publication.

At this time no effort has been made to engineer any of the weight out of the orthesis. In fact, sturdy

FIGURE 3—90° stop.

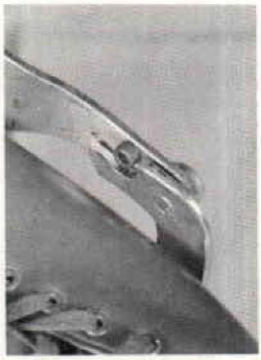

FIGURE 4—Adjustable stop.

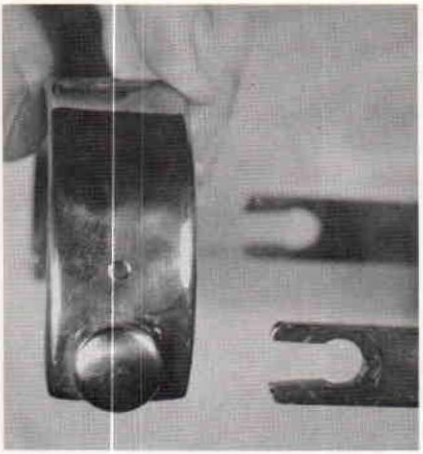

FIGURE 5—Removable calf band.

construction without consideration of weight was deliberate to eliminate mechanical breakdown.

For taking X-rays, the shoe is removed from the uprights and inserted in a jig **(Figure 6).** This eliminates the anterior support bar's obscuring the midtarsal region when a lateral X-ray is taken. The jig consists of a board 6″ x 12″ in size to which is attached a pair of anterior uprights approximately 3″ high. The shoe is attached to these uprights which serve as a fulcrum.

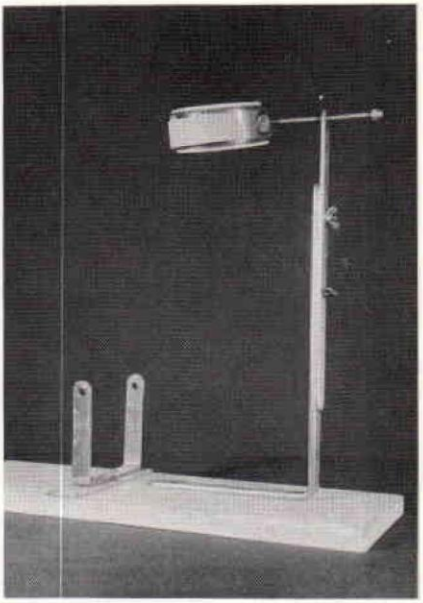

FIGURE 6—X-ray jig.

There is a posterior vertically adjustable bar and a calf band, adjustable posteriorly and anteriorly, that are used to align the leg properly. The X-ray is then taken obtaining an unobstructed view of the midtarsal region to help the orthopedic surgeon and the radiologist in reading the X-rays.

ACKNOWLEDGEMENTS

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Dr. Bailey is now affiliated with the Hospital for Joint Diseases, New York, New York.