Newsletter...

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INSTEP STRAP

Ankle-foot orthoses are prescribed for a variety of reasons, but chief among them is the control of undesirable positions of deformities, the most common being equino-varus. Gravity alone will cause the ankle-foot complex to adopt the equino varus position, but spasticity or contracture of the triceps surae can only complicate the situation.

A conventional metal ankle-foot orthosis, with either a single or double uprights, can be effective in combating this deforming position, but success depends on proper construction and application of the orthosis. While in most instances the shoe is strong enough, in the presence of severe spasticity it is necessary to reinforce the shank of the shoe lest it break down at the anterior edge of the tongue and thus allow the shoe and foot to adopt a position of equinus. To properly control the foot the shoe should fit snugly when laced up. This latter point can be difficult to achieve and it is not uncommon to find that the heel has ridden up in the shoe. It may be necessary to prescribe a high-top surgical boot with undesirable economic and cosmetic side effects that weigh against use of the orthosis, as does the stipulation, when necessary, that the orthosis be worn at night. It is unconventional, uncomfortable, inconvenient, and unsanitary to wear shoes to bed.

The situation with unmodified plastic ankle-foot orthoses is much the same, although it is somewhat easier to apply the orthosis properly than is the case with the shoe. For this reason it has proven popular to modify the basic orthosis by the addition of straps in various configurations. The attraction of this course of action should be obvious. First it makes it possible to don the orthosis and maintain the desired position without a shoe, and thus eliminates the need for expensive high-top surgical boots and it is practical to wear the orthosis in bed. The clear view afforded by these orthoses (as well as the translucency of polypropylene when used) and the strap makes it easy to secure the foot in the proper position before donning the shoe, which obscures the view. Moreover, the use of an instep strap makes the selection of a proper shoe even less critical than it is with the unmodified ankle-foot orthosis. While selection of proper heel height is unaffected, the instep strap allows the use of loose floppy shoes and slippers. This can be important for people who must get up at night or who desire to use the orthosis at poolside.

In the hospital the use of an orthosis modified by an instep strap allows ambulation to proceed with an ordinary bedroom slipper while a proper shoe is being obtained. Frequently, delays can be encountered in obtaining shoes, with needless extension of the hospital stay.

What is less clearly appreciated is the proper positioning of the strap. For our purposes in this instance the shin-foot complex can be considered as two arms, the tibia and the foot, set at right angles to each other and articulating at the ankle. In combating equinus the orthosis imposes two anteriorly directed forces, one at the top edge of the orthosis, and the other at the metatarsal heads. If unopposed by an anterior third point the leg will ride up in the orthosis, pivoting about these two points with the ankle moving forward. In effect, the leg bowstrings about the two most extreme points. To be maximally effective and comfortable the third force should be as far as possible from the two end points so as to develop the maximum resistance with the minimum force and thus minimum pressure under the strap. In the ordinary course of events this third force is provided by the lace closure of the shoe over the oblique instep of the foot. Since this surface is oblique the force provided normal to this surface can be resolved into two right-angle forces, each of which opposes one of the two anteriorly directed forces of the orthosis. If an accessory strap is added in this bony area it is likely to prove uncomfortable owing to the relatively small area underneath it and the fact that it is positioned too far distally to oppose the anterior motion of the tibia with minimum force. Moreover, if a shoe is worn over it the additional bulk in the shoe is likely to prove undesirable. Conversely,

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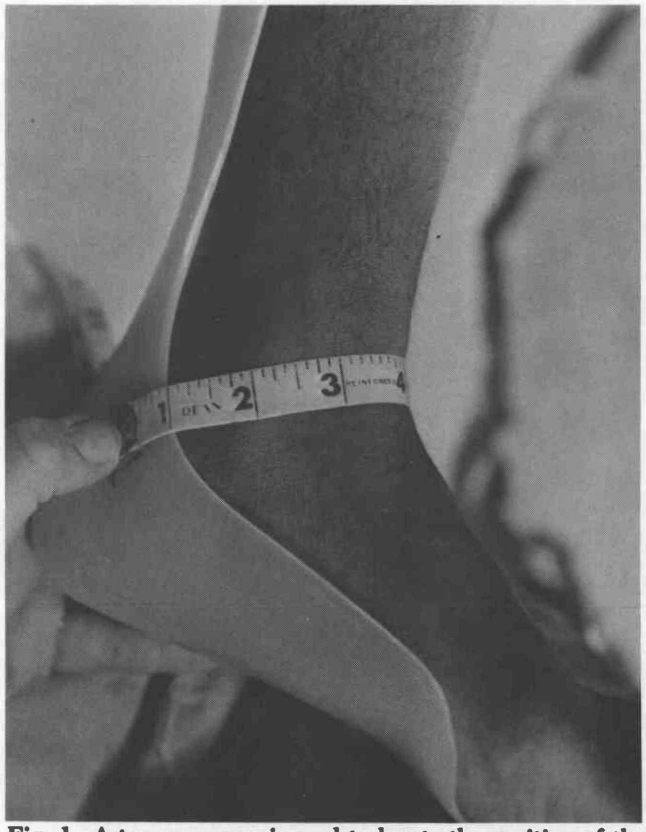

Fig. 1. A tape measure is used to locate the position of the rivet hole for attaching the Velcro strap. This can be done on the patient or around the positive model.

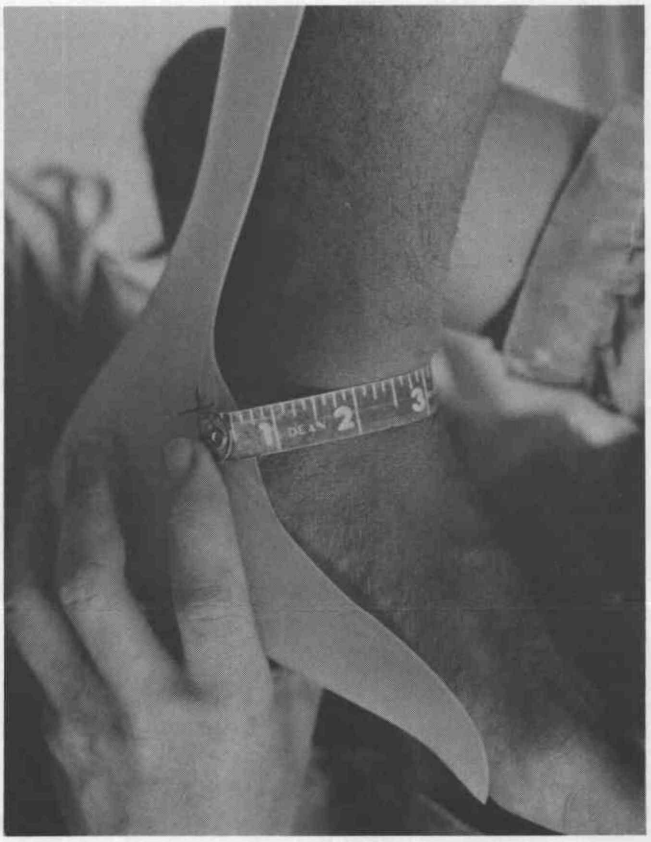

Fig. 2. Similarly, a tape measure is used to plan the location of the slots to be cut in the orthosis.

if the strap is added proximal to the malleoli it will be in good position to control the tibia but inadequate to affect the foot.

Unless opposed by a second strap or the shoe, equinus is likely to occur and since anterior motion of the tibia is prevented all the motion is likely to occur in a proximal direction with the malleoli riding up and shear taking place under the strap.

Following the foregoing analysis then, it seems logical to locate the strap at the deepest point of the radius connecting the oblique dorsal surface of the foot and the vertical tibia, roughly equidistant to the ankle mortice and the subtalar joint. In this position the instep strap is as far as possible from each of the two end points, well positioned to control motion in each segment, and free of the lace area of the standard low-quarter shoe. Instep straps have been used in this configuration a number of years now and, contrary to expectations, irritation under the strap in this relatively unpadded area has not been a problem. This can be attributed, in part, to the fact that the strap is well placed to develop maximum torque with minimum pressure. It is, of course, possible to pad the strap if so desired.

Method

Two methods of adding the strap have proven successful. In one the strap and a narrow loop are riveted to the orthosis on either side along the intended line of force. In the second two slots are cut in the material of the orthosis if the orthosis extends far enough anteriorly to permit it. One end of a Velcro strap is passed through one of the slots and sewn back on to itself. The free end of the strap can then be passed through the other slot and placed back on itself to secure the orthosis. In each case a flexible tape measure can be used to measure the proper length of strap and to plan the proper points of attachment (Figs. 1-4). This procedure can be done either over the positive model or the involved extremity itself and a strap can be added at any time.

SUMMARY

A rationale for the use of an accessory strap to control equino-varus in an orthosis without the shoe is given. Some thoughts about its placement and descriptions of two methods of attachment are also given.

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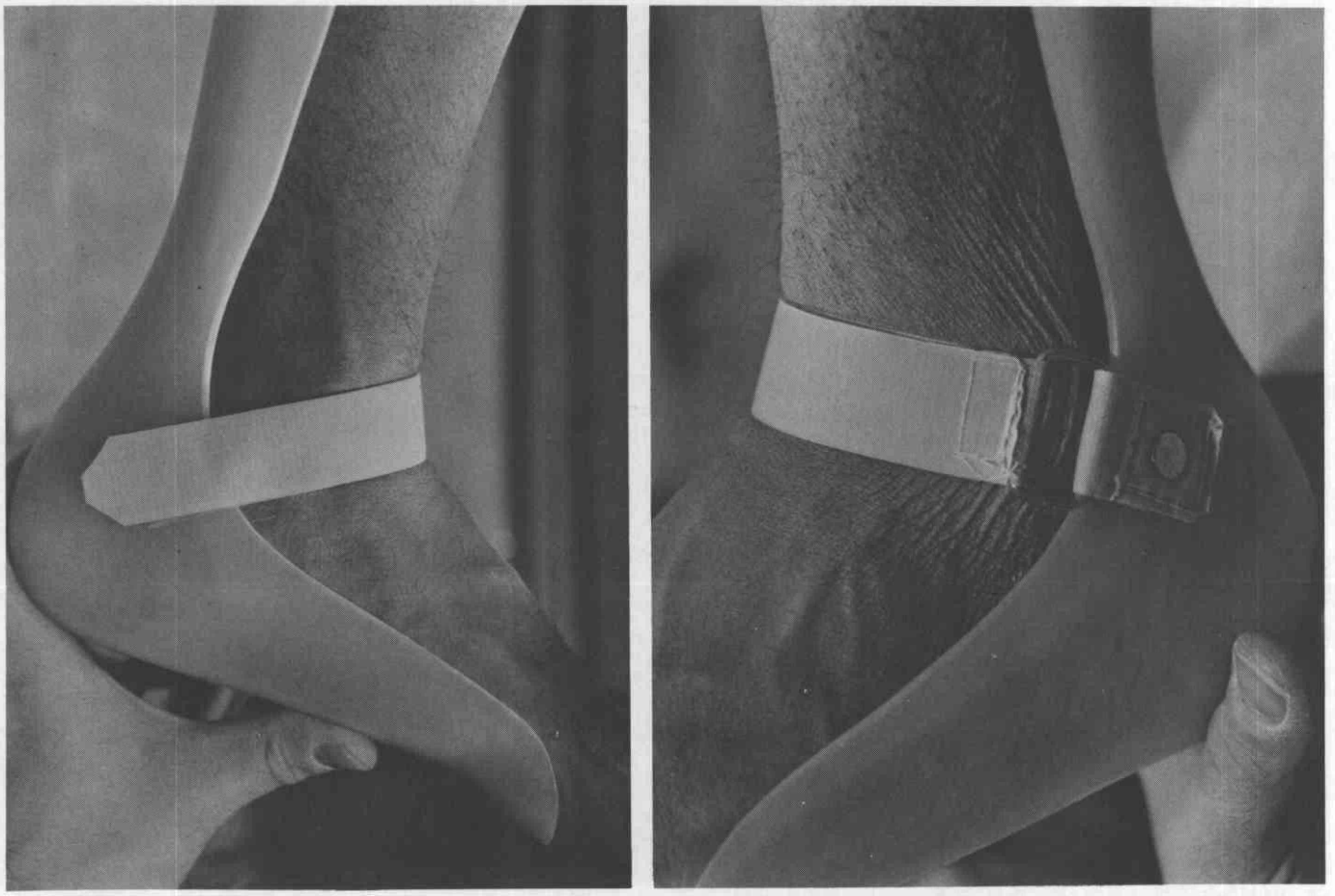

Fig. 3. Appearance of the Velcro strap and metal loop once they are riveted to the orthosis. Normally, of course, the patient would be wearing a stocking. The metal loop should be located further posterior so as not to impinge on flesh.

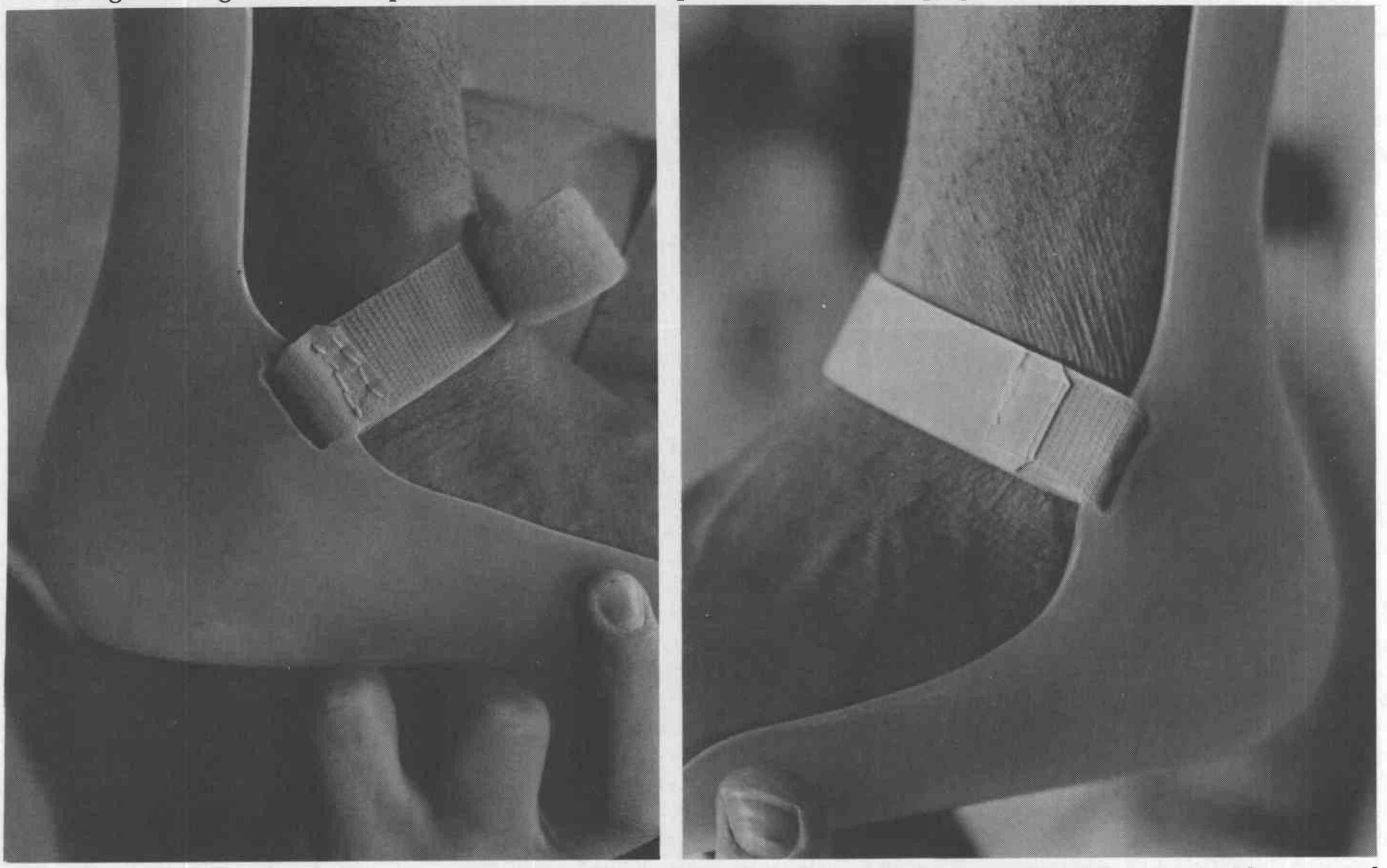

Fig. 4. The Velcro strap attached to an orthosis through slots cut in the orthosis. Excess material has been cut away from around the slots to present a neat and finished trimline.