Application of the Varus T-Strap Principle to the Polypropylene Ankle Foot Orthosis

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INTRODUCTION

The ankle mortise with the severe yet flexible varus or valgus deformity presents a challenging case for orthotic management. The trend towards the use of thermoplastics in lower extremity orthotics can enhance this problem through the elimination of the varus or valgus correction strap (T strap). When a patient presents a dynamic ankle that has a profound tendency towards the varus or valgus attitude upon weight bearing, pressure on either malleolus is inevitable. For many patients, padding and relieving the medial or lateral aspect of the orthosis is sufficient in preventing pressure related problems. It is the active, well ambulating patient with the strong lateral displacement at the subtalar joint that often exhibits chronic pain at the malleolar site. A patient in this category was the motivation for the development of the concept of the internal varus correction door.

CASE REVIEW

E. G. is a 37 year old male with Friedrick's Ataxia and Charcot-Marie-Tooth disease. Numerous surgical procedures were performed bilaterally and the patient was presented to the orthotics department for post-operative provision of bilateral Ankle Foot Orthoses (AFO's). The patient's right leg was more severely involved than the left, exhibiting a more unstable and dynamic malalignment. This resulted in severe pressure on the lateral malleolus upon weight bearing. The first orthosis provided had been relieved and padded at and around the pressure area with only short term alleviation of pain. The critical factor was maintaining correct alignment at the ankle without causing breakdown or pain at the lateral malleolus. The patient refused the option of the conventional double upright metal AFO with varus correction strap due to the advantages that thermoplastics offered (i.e. shoe inter-

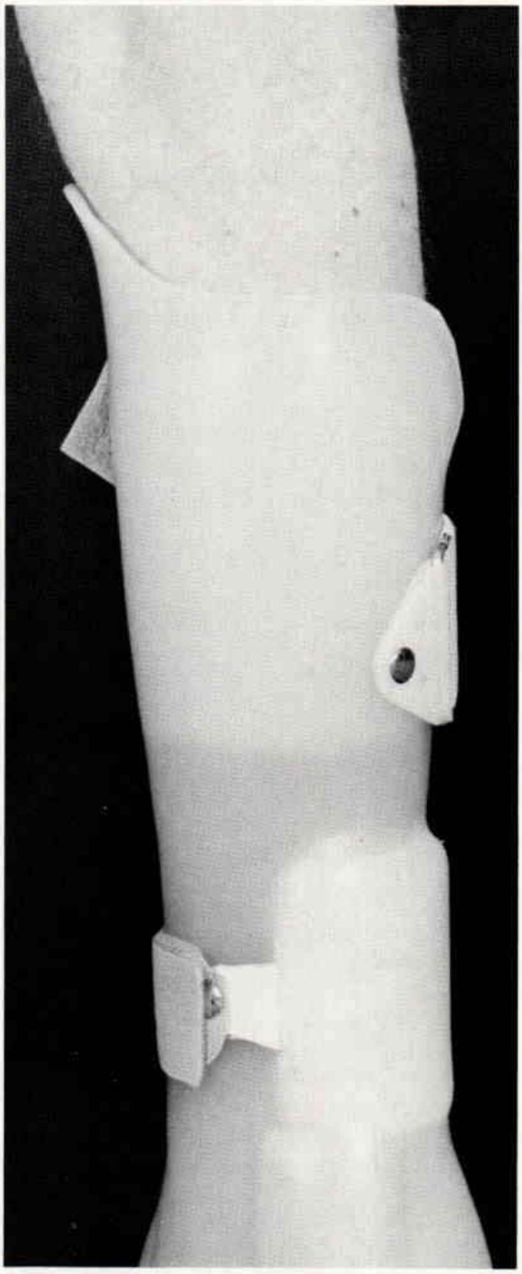

Fig. 1—Posterior view of the Varus control pad. A slot is made in the posterior section of the orthosis to allow a strap attached to the Varus control pad to exit.

changeability, cosmesis, lightweight, etc.). Eventually a new right AFO was fabricated incorporating the internal varus correction door and conventional thermoplastic principles.

FABRICATION

Positive Model Modifications

The mold is taken high and incorporates a medial tibial flare. Care must be taken to accurately mark all bony prominences, especially the malleolus and the slope of the medial tibial flare. The positive model is then modified similar to those specifications for the NYU equinovarus solid ankle orthosis. One-eighth of an inch of plaster is removed from the positive model at the following areas: the medial/tibial flare, distal third of the shaft of the fibula, medial aspect of the os calcis distal to the medial malleolus. The amount of plaster removed can vary depending upon the presence or absence of subcutaneous fat at those above mentioned sites.

Varus Control Pad

Once all the plaster work is completed, a small padded, 3⁄16″ polyethylene square is heated and conformed to the cast beginning two centimeters proximal to the proximal border of the malleolus and extending approximately ¼ of the way up the shaft of the fibula. The size and shape of the square determines the surface area with which the corrective force is applied. This can, very effectively, reduce the chance of skin breakdown. Padding of the square further decreases the pressure. The principal corrective force is directed to the distal third of the fibular shaft and is adjustable by way of two Velcro straps. The padded door is then temporarily glued to the positive model and the mold is prepared for vacuum molding the polypropylene AFO. After molding, the door is separated and hinged via a strap exiting through a small slot cut in the posterior aspect of the orthosis (see Fig. 1). A Velcro strap is attached to the anterior aspect of the door and padded to prevent strap pressure on the tibial crest.

Proximal trimlines extend over the medial tibial flare, thus providing the proximal-most force of the 3 point force system. The hinged door provides an adjustable second force with the medial aspect of the calcaneous acting as the third vector (Fig. 2). A single diagonal strap adequately stabilizes the orthosis on the leg with assistance from the shoe.

Two variations have been used with other patients with a similar clinical picture. In one case a ⅛″ polypropylene door was used in place of the 3/16″ one. This decision was based on the relative weight of the patient and the level of activity anticipated.

In the other case a thinner padding, (⅛″ instead of ¼″ Plastazote) was used at the site of the lateral malleolus with subsequent success. Such options are available to the orthotist depending on the characteristics that each individual case presents.

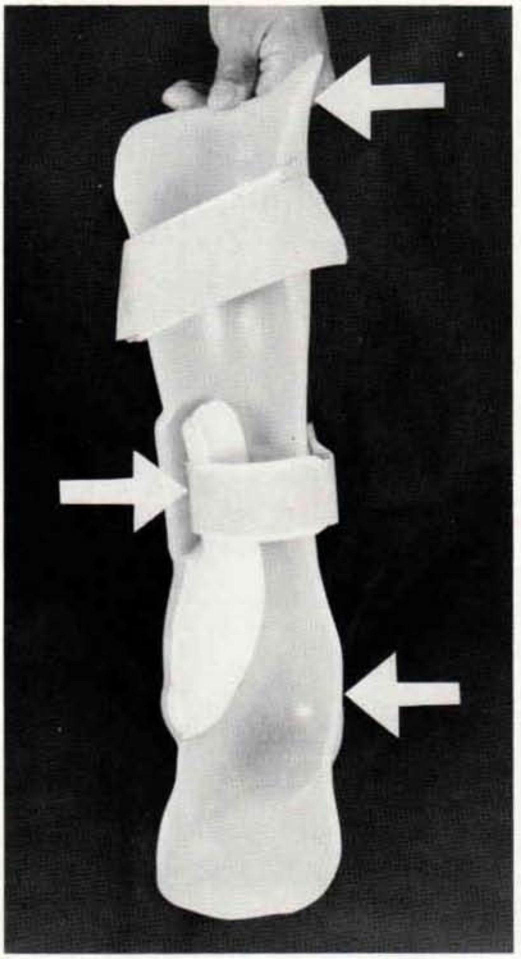

Fig. 2—The three point pressure system controls Varus forces. A high medial flair at the proximal trim line increases the level arm and decreases skin pressure. The Varus pad in the center acts as the fulcrum. The distal medial orthosis and the shoe provide the third force.

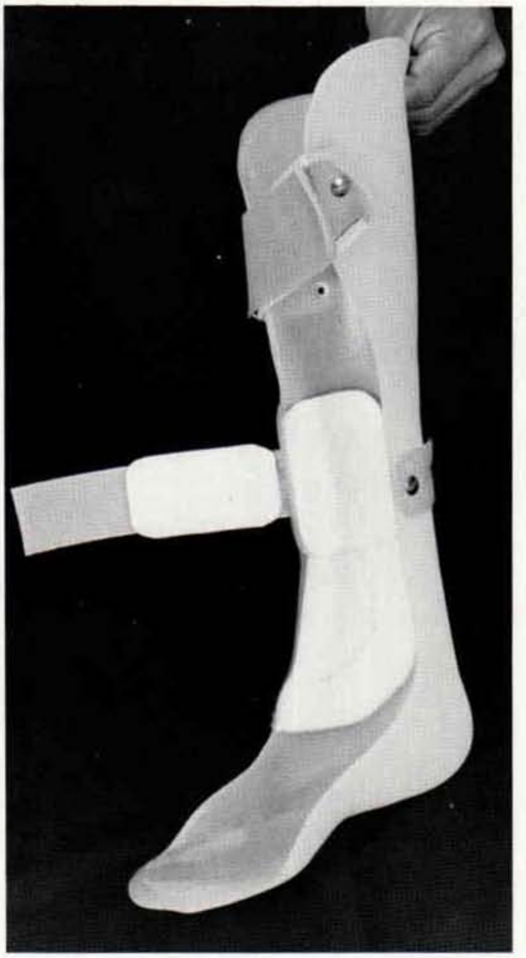

Fig. 3—The strap extending from the Varus control pad is padded where it crosses the tibia.

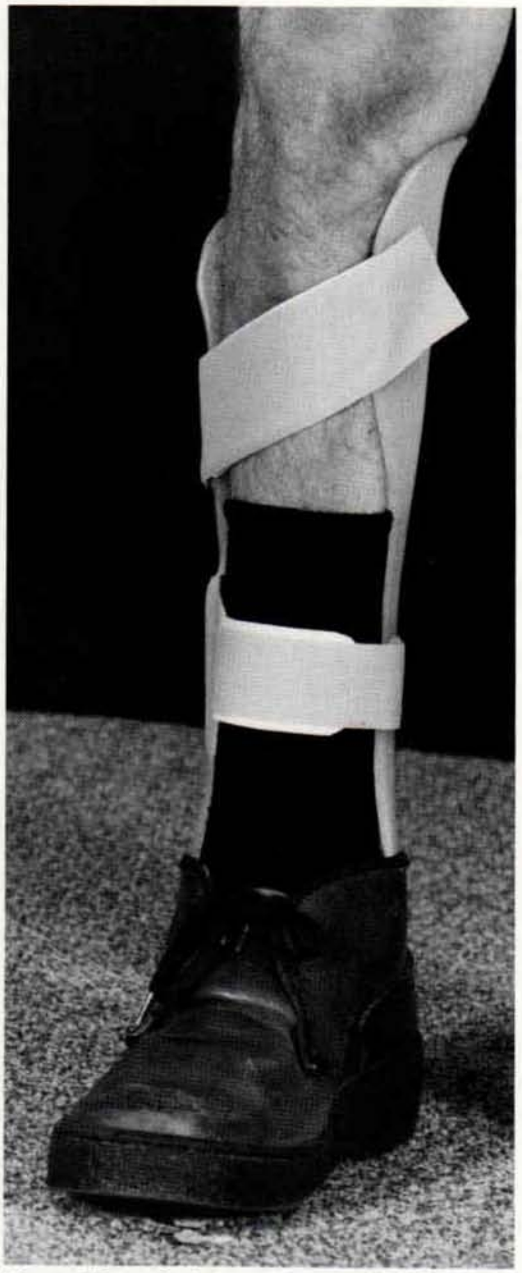

Fig. 4—The orthosis is worn with normal bluchor style shoes.

SUMMARY

Application of the internal varus correction door in this case study has proven successful to date. The underlying principles are precedented and widely applied in the conventional T-strap arrangement used with double upright AFO's. This new concept allows stable alignment of the ankle mortise with the aforementioned advantages of thermoplastic bracing and the virtual elimination of undue malleolar pressure.

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