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An Ankle-Foot Orthosis For Immobilization of the Ankle

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New Ankle Immobilizer

A lightweight, flexible, posterior-opening ankle immobilizer (Figs. 1-4) has been designed and used at the Hospital for Special Surgery for the past four years. The appliance has been prescribed on 67 occasions for patients with severe degenerative and hemophilic arthritis, primarily for the relief of pain. Most patients have had substantially restricted ankle motion. The device has not been used to replace the standard drop-foot brace.

Structurally, the ankle-foot orthosis is flexible posteriorly at the point of entry and rigid along the anterior, medial, and lateral surfaces. This combination of flexibility and rigidity is provided to prevent dorsiflexion and to provide mediolateral stability to the ankle. A plastic foam (Pelite) is placed along the crest of the tibia to prevent excessive pressure. When a problem is anticipated over the malleolus, additional Pelite is incorporated over the positive model at the time of fabrication. The flexibility of the plastic in the posterior area affords the patient the opportunity of adjusting the appliance by the use of Velcro straps with relatively uniform pressure. Because the appliance encompasses the entire ankle region, it tends to minimize local edema, a circumstance that contributes substantially to the patient's comfort during walking and standing.

Fig. 1. The "long" ankle-foot orthosis on a hemophilic patient.

Casting Procedures

A casting board for the appropriate heel height is used. With the shank maintained in a vertical position, or as near vertical as possible mark out the anticipated problem areas and cast in the usual manner (1). Because arthritic patients may have limited motion, the foot should not be forced into an attitude that causes pain.

Fitting

Fitting for the arthritic and the hemophilic patient differs primarily in the extent to which the proximal trim line of the orthosis terminates. For the hemophilic patient the proximal border extends to three-quarters to one inch distal to the fibular head (Fig. 1). For the arthritic patient the height is less and the trim line termintes below the gastrocnemius muscle approximately six inches above the medial malleolus (Fig. 2).

Posteriorly the calcaneous is free of all plastic contact. The heel pad and the Achilles tendon at the point of insertion is exposed. The plantar surface of the orthosis terminates three-quarters of an inch posterior to the metatarsal heads extending dorsally to the mid-instep region (Fig. 3).

A lightweight leather tongue is attached to one side of the flexible plastic opening with three or four Velcro straps attached for securing the appliance. A SACH-type heel cushion with a rocker bar extending posterior to the metatarsal region of the foot is added to the shoe. This attachment of soft rubber allows for the sole of the shoe to compress, reducing the force that would otherwise be transmitted on the appliance (Fig. 4).

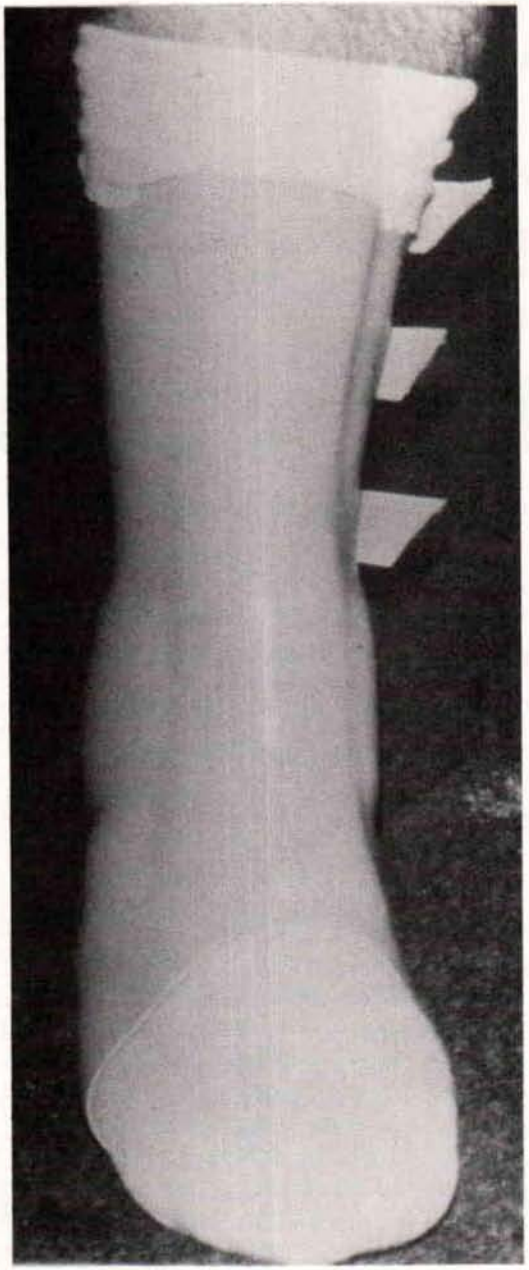

Fig. 2. The shorter length ankle-foot orthosis on an arthritic patient.

Fabrication Procedures

The materials used for the orthosis are as follows: five lengths of Banlon stockinet, five long strips and three short strips of fiberglass, a long strip of Pelite (optional), and two discs for the malleoli.

Fig. 3. Lateral view of the ankle-foot orthosis showing the length of its plantar surface.

Fig. 4. The ankle-foot orthosis and shoe adjusted with the SACH-type heel cushion.

First the Pelite, when used, is placed along the anterior aspect of the shank, extending past distal and proximal trim lines and brought anterior to the lateral and medial midlines. Secondly the discs are placed over the malleoli. This is then covered by the inner PVA sheeting sleeve and two full layers of the Banlon stockinet. Next, a long fiberglass strip consisting of five layers is placed on the anterior aspect of the shank, not extending beyond the lateral midlines. The fiberglass over the dorsum of the foot is slit so as to provide a "Y" configuration. Each arm of the "Y" is brought around the foot to form a stirrup which extends slightly posterior to the first and fifth metatarsals. The malleolar areas are not covered with fiberglass, so that these areas may be heated and extended when it is necessary to provide for relief. The five layers of fiberglass are covered with another Banlon stockinet, and the three short fiberglass layers are placed over the entire plantar aspect of the foot, covering everything with the last two Banlon stockinets and the outer PVA sleeve. The resin mix used is polyester 60%-4110 and 40%-4134. The Banlon and fiberglass may be increased by one layer if necessary for heavier adults.

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Summary

The flexible posterior-opening ankle-foot orthosis has been remarkably well received by hemophilic and arthritic patients. It is light in weight, streamlined in appearance, and, therefore, easy to camouflage. Functionally, the unique characteristics of the material where rigidity is combined with flexibility affords the patient the opportunity of controlling the distribution of pressure over the area of the ankle.

Of the 67 patients fitted at the Hospital for Special Surgery, only a few patients encountered some difficulty. Where the dorsal trim line of the appliance blends into the plantar surface trim line of the foot, there was evidence of the plastic "creasing" at approximately the first and fifth metatarsal head regions. Consequently, this stress point must be reinforced with fiberglass during the initial lamination. Also, to reduce the stress on the orthosis on this point, the rocker bar on the plantar surface of the shoe must be maintained in good repair. In most such cases the crease was cut away which relieved the problem without interfering with the function of the orthosis. Other than the need for an occasional relief from pressure, no other significant problems were encountered.

Footnotes

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References

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