Orthotics and Prosthetics, Volume 38, Number 1, Spring, 1984, pp. 68-70.

Technical Note— Case Study: A Multiple-Form Plastic Ankle Foot Orthosis

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INTRODUCTION

There are universally accepted orthotic designs for the patient who presents weak ankle dorsiflexors coupled with swing and stance phase lateral instability of the subtalar joint. In most cases, these standard designs are adequate for the problem. However, the orthotist will occasionally have a patient on whom the routinely prescribed Ankle Foot Orthosis (A.F.O.) designs are unsatisfactory or unacceptable. In one such case, illustrated within, a Multiple-Form molded A.F.O. was devised to meet the extraordinary needs of the patient. In select cases, the orthotist may find this Multiple-Form molded A.F.O. a valuable alternative design.

CASE HISTORY

A twenty-eight year old male was diagnosed as having permanent nerve damage in his left leg as a result of a fall down a flight of stairs. On examination, he exhibited weak ankle dorsiflexion and lateral instability of the subtalar joint. The patient himself complained of pain and instability of his ankle when standing or ambulating Moreover, the muscle imbalance in his leg was a potential cause of contractures.

Two different types of Ankle-Foot Orthoses had been prescribed, used, and subsequently rejected by the patient. The first was a solid-ankle, custom molded, polypropylene A.F.O. which unnecessarily restricted ankle plantarflexion and dorsiflexion. The second orthosis was a double-upright A.F.O. with dorsiflexion assist and a lateral control T-strap attached to the shoe. The patient found this orthosis bulky, noisy, cosmetically unacceptable, and not truly supportive, as the foot continued to invert inside of the shoe.

TREATMENT

When this patient was referred to me, I recommended a custom molded plastic ankle foot orthosis with articulated ankle and dorsiflexion assist.[1] Although this design would have been functional and supportive, the patient rejected the idea of having metal ankle joints.

Since any use of metal joints would be refused, I designed a custom molded single-form A.F.O. with medial and lateral extensions to control the M-L instability.[2] The patient accepted the design, but the difficult to finish ankle trimline sacrified purchase area, reducing the effectiveness of M-L support. Also, the design was prone to fatigue and breakage in the narrow curves.

The final solution was found in designing a Multiple-Form Plastic A.F.O. combining a posterior leaf-spring Molded A.F.O. and an overlapping reinforced form extending medially and laterally for rigid support. The patient was satisfied with the

function, support, and cosmesis of this orthosis. His physician and therapist approved after their respective evaluations.

FOLLOW-UP EVALUATION

Five years later, the patient was seen for an updated evaluation. The medical team concluded that the orthosis was still functioning well and it was refurbished with new Velcro® closures and new plastizote® malleoli padding (Figures 1, 2). The team was pleased to find that the patient's ankle joint was not rigid and that he had not developed a varus contracture at the subtalar joint. The patient now receives six month periodic evaluations due to the age of his orthosis.

FABRICATION AND FITTING

A standard design, polypropylene, posterior leaf spring, molded A.F.O. is fabricated and trial fitted to finalize a trim line that will support the weak dorsiflexors, yet allow flexibility for normal active plantarflexion. The completed leafspring section is again placed on the plaster model and a second polypropylene form is vacuum formed over the first. The second form should be reinforced with strips of polypropylene.[3] From this, a section to control medio-lateral instability will be cut and fitted for optimum function (Figure 3). The distal posterior underside of the second form must be beveled generously to prevent the stress of repeated plantarflexion from causing premature fatigue of the plastic. The second form is secured with screws to the mid-calf section of the first form allowing for easy removal for trimline adjustments (Figure 4). Velcro® closures keep the leg positioned in the orthosis.

CONCLUSION

The Multiple-Form Plastic A.F.O. is made of two sections, a posterior leafspring A.F.O. for antero-posterior control, and a reinforced second form for medio-lateral control. This orthotic design was

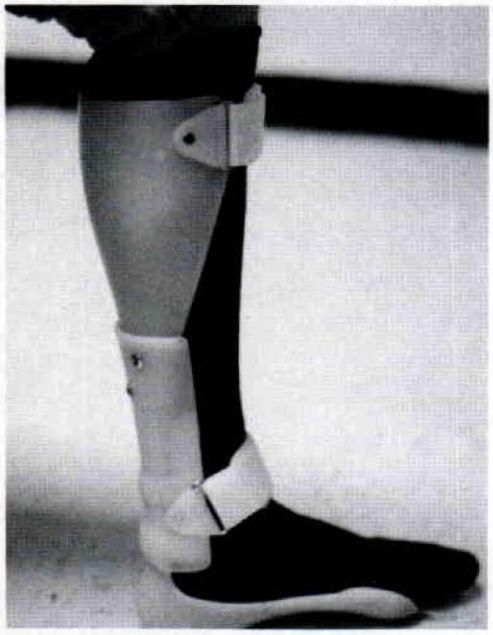

Figure 1. Medial view of multiple form plastic AFO.

Figure 2. Anterior view of multiple form plastic AFO showing minimal anatomical change.

Figure 3. Lateral view of the multiple form plastic AFO showing the added material at the ankle to provide sufficient control of the lateral instability. The trim line is crucial in this area.

Figure 4. Posterior view showing the attachment points of the second form.

able to meet one patient's needs for maintaining ankle function, preventing further subtalar instability or deformity and displaying acceptable levels of visual, auditory, and sensory cosmesis. Whereas most patients who display weak dorsiflexors and lateral instability can be accommodated through more standard orthotic designs, it is suggested that the Multiple-Form molded A.F.O. may be useful in select situations.

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ACKNOWLEDGMENT

The author would like to acknowledge Martha Strunck, C.P. for her assistance in preparing this article.

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