The Cosmetic Below-Knee Brace

William T. Murray, B.A., M.S.*
and Jack E. Greenfield**

Cosmesis is one of the factors influencing patient tolerance of an orthotic appliance. Conventional below-knee braces are conspicuous and, of necessity, heavy. A little over a year ago a plastic below-knee brace was developed by Jack Greenfield, C.O. of the Orthotic Department, Rancho Los Amigos Hospital, Downey, California, in an attempt to improve cosmesis and decrease the weight of standard devices. Plastics of many types were tried, including laminated prosthetic resin, ortholene, and polyethylene. Polypropylene proved to be the only plastic suitable for the molding of a rigid orthosis which would hold up under the stresses of ambulation.

Other workers have reported on lightweight cosmetic below-knee braces. The work of Simons, Jebson, and Wildman[1,2] on a laminated prosthetic resin type brace has been the most notable. Engen[3] also has worked on a laminated resin and woven polypropylene type brace.

The cosmetic brace described herein consists of a posterior molded plastic shell of ⅛th inch thick polypropylene plastic (Fig. 1). It is held on the patient by an anterior velcro strap at the proximal end

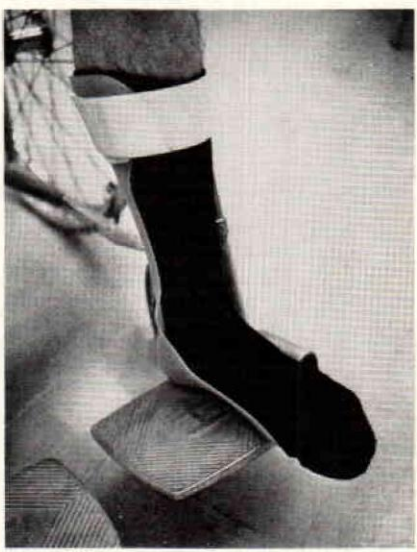

Figure 1

*Orthotic Intern, Rancho Los Amigos Hospital, Downey, California
**Certified Orthotist, Rancho Los Amigos Hospital, Downey, California

Figure 2

and by the patient's shoe at the distal end. Since its development, over 75 patients have been successfully fitted with this brace.

Most patients wear the brace in contact with the skin; however, stockings may be worn underneath. When males wear their normal stocking over the orthosis, the result is excellent cosmesis. Shoe modifications are generally not necessary, although a size wider than usual may be required. Orthopedic shoes are also not necessary, although laces or a strap with buckle over the instep are needed.

Fabrication

A plaster negative is made of the patient's leg in the following manner: A piece of three-inch tubular stockinette containing a piece of one-inch webbing is pulled over the patient's foot and lower leg; the webbing is positioned over the full length of the anterior crest of the tibia and extends to the distal portion of the foot. The stockinette is then marked over each malleoli and any other bony prominences are marked.

With the patient in a sitting position, the foot and lower leg are wrapped, distal to proximal, with four-inch plaster of Paris bandage. Two rolls are usually sufficient. Elastic plaster of Paris bandage is suggested for the foot as this seems to result in better molding of the longitudinal arch and heel.

The casted foot is positioned on a standing board like that used in casting for the Berkeley shell (Fig. 2). The patient is asked to place his hands on the knee of the leg being casted and press forward. The desired degree of dorsiflexion is controlled by placement of the foot and standing board. Any varus or valgus is corrected by pressure on the appropriate malleolus until the cast has hardened.

Horizontal lines are marked across the anterior portion of the hardened cast. The cast then is cut over the crest of the tibia and dorsum of the foot and removed. Immediately upon removal, the cast is closed and held with tape, using the horizontal lines to correctly position the cut edges.

When completely hardened, the cast is prepared for filling with plaster of Paris and the placing of a mandril. The resulting plaster positive is smoothed with a surform file, care being taken not to remove any plaster from the area of the malleoli or other bony prominences marked on the cast. If indicated, the arch may be modified to prevent valgus. In fact, any modification that can be made on the inside of a shoe can be made on the cast.

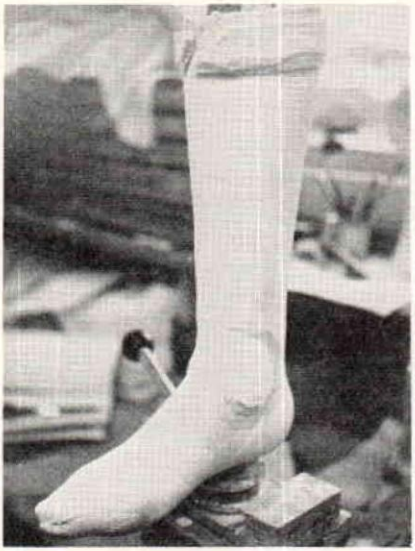

Figure 3

When smooth, the area over each malleolus is built up with a piece of ¼ inch felt, 1½ inches in diameter, with skived edges. These pieces are glued into position. Another piece of ¼ inch felt, one inch wide and long enough to cover the posterior portion of the calf, is glued to the apex of the bulge of the calf to give a rolled effect to the proximal end of the finished brace (Fig. 3). A piece of cotton stockinette is pulled over the cast and tied at each end. The cast is now ready for use in molding the polypropylene.

Figure 4

Figure 5

To prepare the polypropylene for molding, it is heated in an oven at 400° for eight to ten minutes. When warm enough to mold, it turns clear. Because polypropylene is very tacky when heated, a special frame is needed to hold the sheets while in the oven (Fig. 4). Two layers of cloth are stretched and stapled over this wooden frame. Before the plastic is put on the cloth, the cloth is sprinkled with talcum power so the plastic will not adhere to it. Talcum powder also should be used on the gloves worn to handle the moldable plastic.

When it becomes moldable, the plastic is lifted off the cloth by its corners, placed on the cast, and fused together along the anterior surface (Fig. 5 and 6). Care must be taken not to touch the surface of the plastic until it cools because in a tacky state it marks easily and these marks cannot be buffed off. After the surface cools, the plastic is sprinkled with talcum powder and molded into the contours of the cast.

When the plastic is cool, it is cut from the cast with a cast saw. The edges are finished by sanding to the desired shape and by smoothing with a hard felt wheel run at 1000 rpm or less. Higher speeds will burn the edges of the plastic.

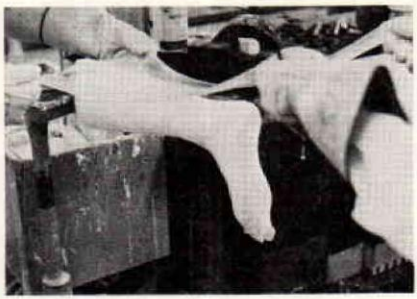

Figure 6

Pressure over each malleolus and the navicular should be checked durng fitting. In most cases any excess pressure can be relieved by heating with a heat gun and stretching the troublesome area.

Indications

1. Drop foot—flaccid or with mild spasticity.

Contraindications

1. Plantar flexion contracture—the foot must come to 90°.
2. Minimal sensory involvement—slight involvement is allowable as contact of the brace with the skin seems to aid proprioception.
3. Spasticity—mild spasticity can be controlled.
4. Knee instability—up to 5° of hyperextension at the knee has been controlled by casting the patient in slight dorsiflexion.

A cosmetic below-knee brace having excellent cosmetic value is presented. Details of fabrication are included to facilitate duplication by other orthotists. Compared to conventional orthoses, the plastic brace is more cosmetic and lighter in weight. Costs are comparable to standard below-knee braces.

References

[1] Simmons, Bernard C.; Jebsen, Robert H.; and Wildman, Louis E.: Plastic Short Leg Brace Fabrication. *Orthop. and Pros. Appl. J.*, 21: 215-218, September, 1967.

[2] Simons, Bernard C.; Jebsen, Robert H.; and Corcoran, Paul J.: Experimental Plastic Short Leg Brace. *Arch. Phys. Med.*, 49: 108-109, February, 1968.

[3] Engen, Thorkild J.: Panel on Lower Extremity Orthotics, Subcommittee on Design and Development, Committee on Prosthetics Research and Development, National Academy of Sciences, held March 9-12, 1970, at Rancho Los Amigos Hospital, Downey, California.