

POLYPROPYLENE SPIRAL ANKLE-FOOT ORTHOSES¹

Samuel Cohen, C. O.² and
Warren Frisina, B. E.²

This paper describes a specific technique for moulding polypropylene in a spiral configuration with excellent control over dimensions and surface finish. Because the concept, technique, and indications for spiral ankle-foot orthoses have been described elsewhere (1,2) they will not be repeated in this article.

EQUIPMENT AND MATERIALS

- Vacuum pump³ capable of drawing at least 25 in. of mercury within a few seconds under load to be described. A vacuum gage should be attached to the pump.
- Oven large enough to accept spiral blank.
- PVA (polyvinylalcohol) bag, approximately 25 cm wide and long enough to extend approximately 20 cm beyond cast when it is slipped over.
- Polypropylene spiral blanks cut from sheet stock 5 mm thick, and finished to 5½ cm wide.
- Soft felt patterns 3 to 6 mm thick that duplicate the shape of the plastic blanks, but are 12 mm wider than the blanks on all edges.
- Insulated gloves.
- Thin stockinet to fit snugly over cast.
- Pressure-sensitive tape.

- One pair of supports for plastic blanks for use in oven to permit even heating and fine oven timing by allowing observation of the amount of sag (Fig. 1). Supports are topped with nylon rods sprayed with silicone or fine talcum ("baby") powder to ensure free motion of blank when sagging occurs.
- Retaining band—a stiff elastic band with Velcro sewn on to hold calf band on cast temporarily and hold footplate in place while winding the spiral.

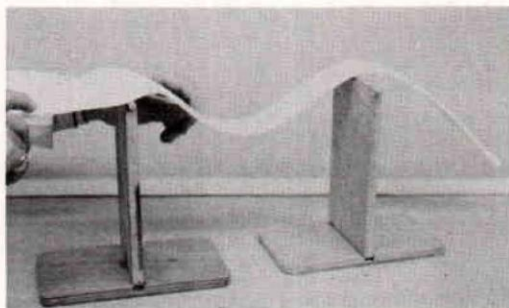


Fig. 1. Supports required for polypropylene parts when heated in an oven. These are made of plywood.

PROCEDURE

Obtain the modified cast. A hollow pipe should be imbedded so that it extends approximately 30 cm beyond the proximal end of the cast.

Drill a 3 to 4 mm hole *through* pipe approximately 12 mm proximal to the junction of the cast and the pipe.

Clamp the pipe in the vise at a point approximately 12 cm from the cast.

Cover the hole drilled through the pipe with approximately 5 layers of stockinet.

Cover the cast with 1 layer of stockinet and fasten it with tape to the pipe proximal to the drilled hole.

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²Orthotics and Prosthetics Department, Institute of Rehabilitation Medicine, New York University Medical Center, 400 East 34th Street, New York, New York 10016.

³Pump preferably larger than the model BLVGH from Pneumotive, Monroe, Louisiana, that was used in this work.

Connect the end of the pipe to the pump with a flexible hose.

Sprinkle both faces of polypropylene with fine talcum ("baby") powder, or spray with silicone.

Place the polypropylene calf band blank in an oven that has been preheated to 165° C., and support by uprights as shown in Figure 1. Leave for approximately 10 minutes. Continue to observe until a sagging of 5 cm occurs when the uprights are 20 cm apart. The polypropylene must be free to slide on the supports during sagging.

Turn on the vacuum pump.

Place the softened plastic on the cast. Wrap the plastic with the felt pattern, making sure that the pattern overlaps the plastic on all edges. Hold the plastic and the pattern in place with the retaining band. Figure 2 shows this with the spiral portion.



Fig. 2. Application of felt patterns needed to apply uniform loading over the softened polypropylene.

Slip the PVA bag over the cast and seal off by hand against the pipe proximal to the drilled hole (Fig. 3). If the plastic has shifted position or the PVA bag has been drawn under the polypropylene, the "hand" seal is easily released to disperse vacuum and correct the condition. When the positioning is satisfactory, the bag is sealed more permanently to the pipe with plastic tape. Pressure should be maintained for at least 10 minutes.

Remove the retaining band and felt, but leave the calf band on the cast.

Repeat the procedure with the spiral blank. The spiral blank should sag 8 cm when supports are placed 28 cm apart (Fig. 1). To facilitate posi-

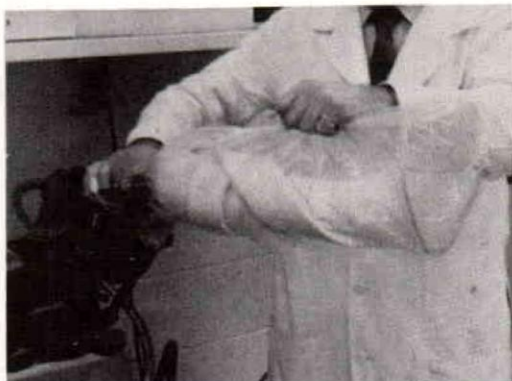


Fig. 3. Application of PVA bag over assembly, just prior to application of suction.

tioning of the spiral, place the footplate first, cover with the felt pattern, and hold the footplate and cover in place with the retaining band. Wrap the remainder of the spiral around the cast, being certain that folds in the plastic do not occur because of an improperly positioned footplate. Hold the end of the spiral piece against the calf band *by hand* while slipping the bag over the assembly. Do not fix the upper part of the spiral because this encourages folds to occur when vacuum is applied.

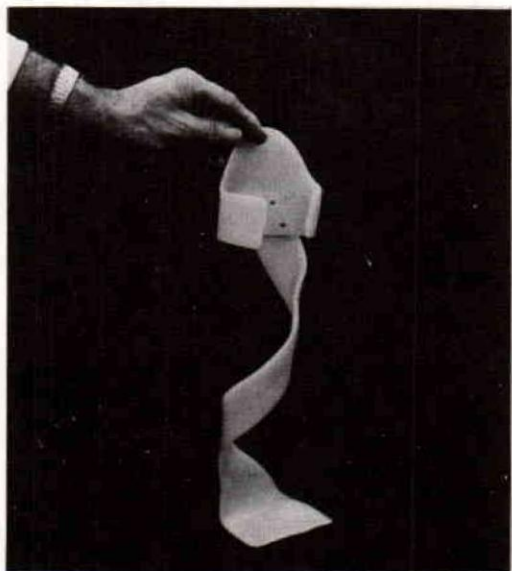


Fig. 4. Finished spiral AFO made of polypropylene.

Just before the vacuum is to be released (after a minimum of 10 minutes), ensure that the polypropylene has stabilized by wrapping the proximal and distal portions of the spiral with an elastic bandage and allow it to stand for a few hours.

Join the spiral to the calf band with rivets. The finished orthosis is shown in Figure 4.

PVA bags can be reused many times. However, if they become excessively dry they will

crack and allow the vacuum to disperse. To avoid this the bag could be wrapped in a dampened towel prior to use.

When more support is required than can be supplied by material 5 mm thick, either or both the width and thickness can be increased. More heating time will probably be required and the footplate will need grinding when the thickness is increased.