

Imler Partial Foot Prosthesis I.P.F.P.—“Chicago Boot”

by Clarence D. Imler, C.P.

Introduction

Surgeons are now performing a greater number of distal amputations, including those of the distal forefoot. Among these are the Lis-France, Chopart, Boyd, and other difficult to fit deformities.

The Imler Partial Foot Prosthesis fulfills the need for a light weight, structurally strong prosthesis, that provides ankle support, has an anterior lever arm, acts as a shoe filler, and is cosmetically acceptable.

The essential element of the prosthesis is the interface, consisting of a vacuum formed copolymer U.C.B. type insert with a toe filler of soft foam. This interface is inserted into a laminated, flexible rubber-epoxy-resin (Lynadure) cosmetic sleeve that encompasses the foot and interface. This sleeve extends proximally to above the malleolus and has an anterior opening. The interface is removable, and enables the prosthetist to make adjustments (i.e., alignment and/or relief). Closure is obtained by eyelets and lacer for greater suspension, or Velcro® for cosmesis.

Casting Procedure

A negative impression may be obtained using any conventional method. A midfoot amputation should be placed on a casting board or covered with a plastic bag and inserted into a patient's shoe to simulate heel height. Very little weight should be applied to avoid spreading of the foot. With a Chopart amputation, where the calcaneus is plantar flexed or

rotated posteriorly, a casting board is not used. The casting in all cases is similar to the procedure used when casting for a U.C.B. shoe insert.

Modification of the Positive Model

Modification includes a standard 3mm anterior relief. A 1mm relief for the malleoli is added, along with relief for any bony prominence or scar tissue as needed. Remove 2mm of plaster both medially and laterally, proximal to the calcaneus to enhance the support effect of the U.C.B. type heel cup. There is no relief needed for the anterior tibia, and in some cases plaster is removed for a tighter fit (Figure 1).

Interface with Toe Filler

Over the modified positive model, thermomold a section of 5mm Pelite™, for an anterior end pad. Trim and bevel the edges to achieve a smooth transition (Figure 2). A sheet of 3/16" Colyene is vacuum formed over the cast and end pad, with an anterior seam (Figure 3). The interface may also be laminated with either acrylic or polyester resin. The posterior trim line is proximal to the calcaneus. The medial and lateral trimlines are both distal to the malleoli, and the anterior trimline is at mid-height level. Care should be taken not to cut into the Pelite™ pad as it extends above the trimline (Figure 4). The anterior toe section can be constructed by various means. Pelite™ of 5mm firm density should be added until a flat surface

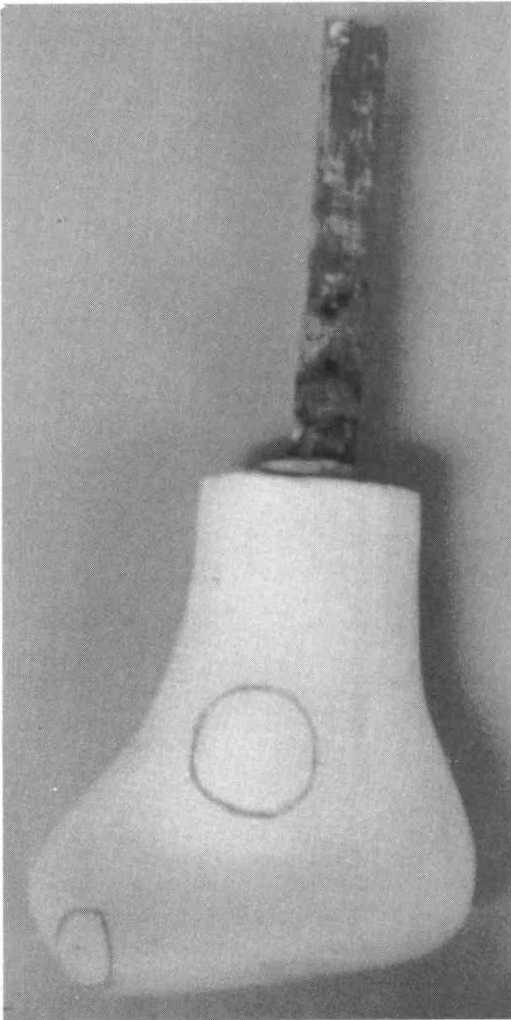


Figure 1. A modified positive model.

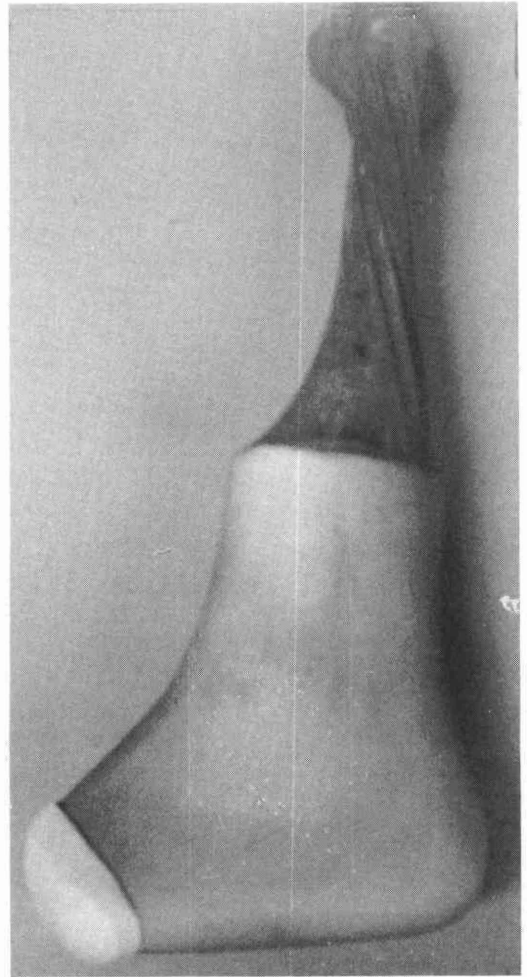


Figure 2. The positive model with distal cap in place.

distally is attained (Figure 5). The anterior toe section is constructed of 12mm firm density Pelite™, bonded together lengthwise. This toe section is bonded to the heel cup and shaped to size. Other materials or foams may be used but they must be firm enough to hold their shape during lamination (Figure 6). The finished heel cup interface with toe filler is replaced on the cast and inserted into the patient's shoe. At this point, a final determination is made of the alignment, and whether additional material must be added or removed to fit the shoe to leave room for the outer lamination (Figure 6).

Adjustments are made at this juncture. The heel cup and toe filler can be divided and the

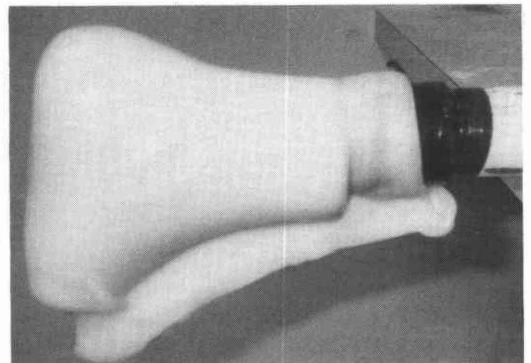


Figure 3. A vacuum-formed heel cup.

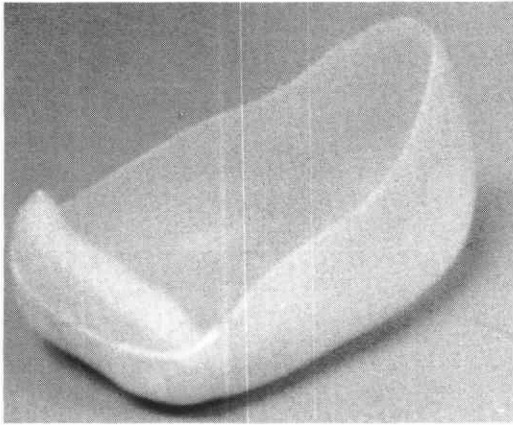


Figure 4. A heel cup with distal end cap.

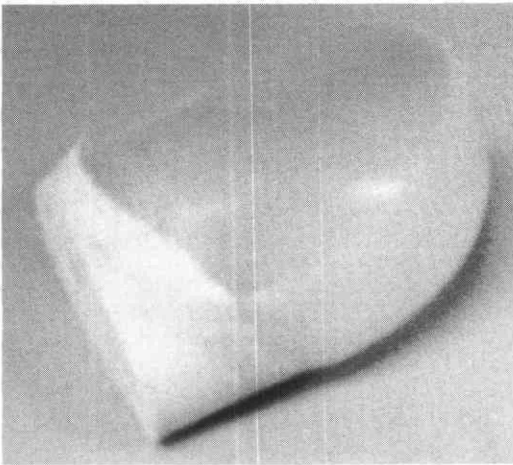


Figure 5. A heel cup with distal end built up and flattened.

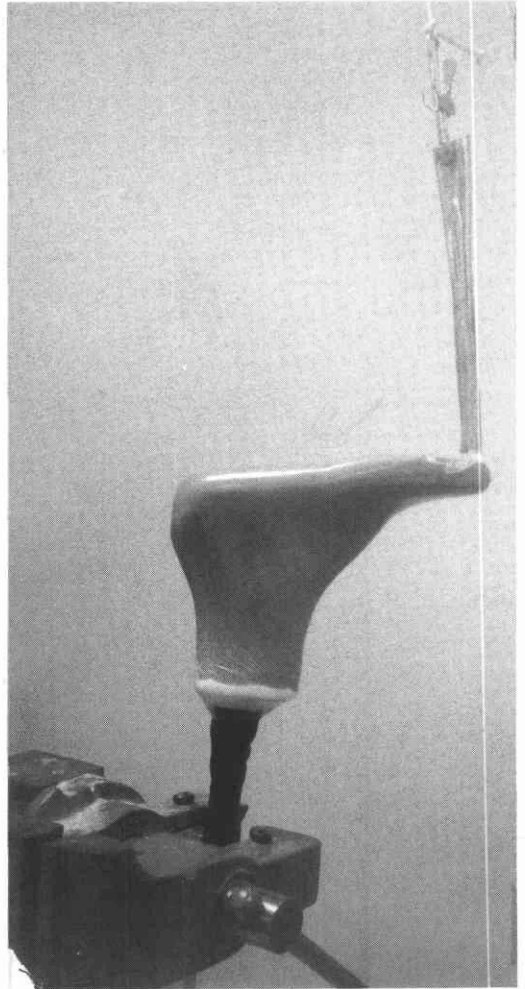


Figure 7. Lynadure lamination.

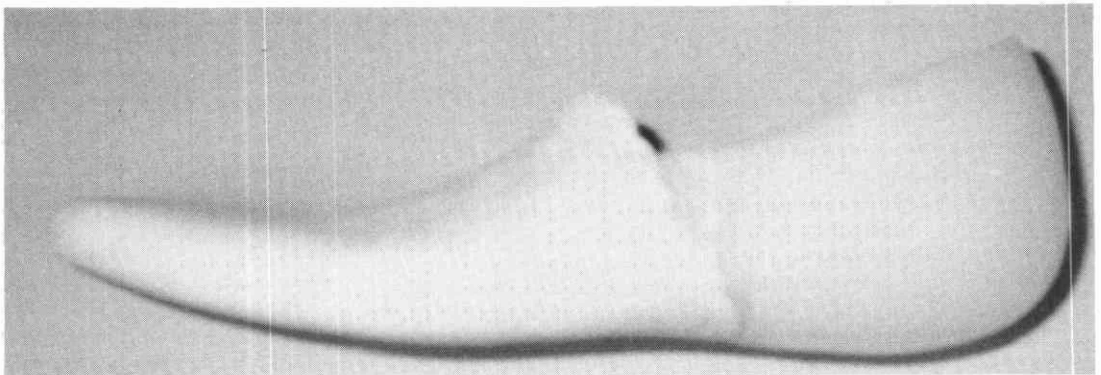


Figure 6. Toe extension.

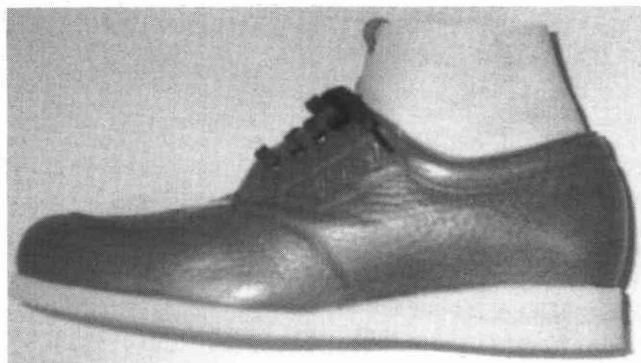


Figure 8. The prosthesis in the patient's shoe.

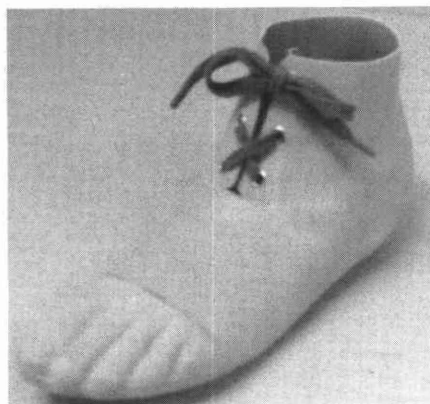


Figure 9. The finished prosthesis.

heel cup rotated, relative to the toe filler, to produce eversion, inversion, plantar/dorsiflexion, toe-in, or toe-out. Due to the flexibility of the outer sleeve, these changes may be accommodated without the need for a new lamination.

A 1.5mm thick strip of polyethylene is thermo-formed over the anterior surface. This will act as a separating agent, forming the tongue and overlap. This is cut to a width of approximately 2.6cm. The length extends from the proximal edge of the cast, to 5mm past the proximal edge of the Pelite[™] toe filler. The edges are beveled for a smooth transition.

The layup for the outer sleeve lamination consists of a nylon hose covered by a PVA bag, which is capped off and put under full vacuum. Two layers of Comfort[®] stretch nylon stockinette and one layer of IPOS stretch nylon are applied. The strip of polyethylene wrapped in two layers of Dynalon³ is sandwiched between this and two additional layers of Comfort[®] stretch nylon and two layers of IPOS stretch nylon. A second PVA bag is applied with vacuum, and the rubber epoxy resin (Lynadure) is introduced (Figure 7).

Before final trimming, determine if closure is to be achieved by eyelets and lace or Velcro[®]. If eyelets are used, make a center cut through to the polyethylene strip, with inverted “T” slits to the edges of the strip. Remove the polyethylene strip and cut the inner tongue along the medial and distal edges only. To obtain a Velcro[®] closure, first cut along the medial and distal edge of the polyethylene strip, remove the strip, and cut the inner tongue along the lateral and distal border. Before cutting the laminate, be sure the material has fully cured;

if the material has not completely cured, it may pull apart.

The I.P.F.P. weighs approximately 250 grams, depending on the shoe size. It is extremely lightweight, but very durable.

A leg length discrepancy may be accommodated for in the prosthesis by adding a Pelite[™] pad of the proper height, either before or after the interface is vacuum formed.

The prosthesis is thinly constructed to be used by the patient with regular shoes. There is no need for split-sized, or extra depth inlay shoes, in most cases. Figure 8 shows the finished prosthesis in a patient's shoe.

Fabrication has changed very little since initial development. The Lynadure lamination layup has been strengthened with additional layers of stockinette and Dynalon. A few prosthetists have requested that the co-polymer heel cup be extended anteriorly to the toes as an A.F.O. for greater push off.

Another adaptation is the anterior section of a SACH foot with toes laminated into the Lynadure sleeve with the toes exposed, for cosmesis when wearing open toe shoes or sandals (Figure 9).

This may not be the answer to every partial foot amputation, but is an alternative to be considered when fitting a patient with a particularly difficult situation.

Resources and Materials

Co-Polymer, Colylene: Orthotic Prosthetic Enterprises, 1316 Sherman Avenue, Evanston, Illinois 60202.

Lynadure: Medical Center Prosthetics, 6955 Alameda

Clarence D. Imler, C.P.

Road, Houston, Texas 77021.

Dynalon: Hosmer Dorrance Corporation, 561 Division
Street, Campbell, California 95008.

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