

# UC-BL SHOE INSERT

## Casting and Fabrication<sup>a b</sup>

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### I. INTRODUCTION

The University of California Biomechanics Laboratory (UC-BL) Shoe Insert was developed to answer a need that became evident in the course of initial clinical tests of an experimental ankle brace (1) designed at this laboratory. It was found that the brace would not function properly when major foot problems were present, such as, for example, talipes equinovarus deformities. In such cases, the shoe was unable to transmit to the skeletal structures of the foot the corrective forces produced by the brace because the shoe was not rigid enough and the fit not wholly accurate.

Custom-made shoes were too expensive to consider as a possible solution to the problem. One attempt was made in this laboratory to fabricate a shoe in which bonded construction and a fiber-glass-reinforced polyester-laminate shell were used to maintain the correction. Shoes made in this manner were satisfactory but the process was too time-consuming to be practical.

The plastic laminated shell, molded to the foot and worn inside the shoe, seemed to be the key to the success of the experimental shoes. Sub-

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<sup>b</sup> Also published as: Henderson, W. H., and Campbell, J. W.: UC-BL Shoe Insert: Casting and Fabrication. Biomechanics Laboratory, University of California, San Francisco and Berkeley, Technical Report 53. San Francisco, The Laboratory, Aug. 1967. 22 pp.

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sequent studies along these lines led to the development of the *shoe insert*.

Helfet (2) described a laminated shell structure which he called the "heel seat." This device, which is designed for treating pes planus in children, encompasses only the calcaneus and is intended to maintain this bone in a neutral position. The UC-BL Shoe Insert (Fig. 1) applies corrections to all three sections of the foot, rather than just to the calcaneus, and is thus a more effective and useful device. It can be used to maintain the calcaneus in a neutral position. Since the calcaneus is fixed, the forefoot may be adducted, abducted, pronated, held in a neutral position, or—if found to be necessary—supinated relative to the midfoot and hindfoot. Forefoot adduction or abduction may be used to raise or lower the longitudinal arch.

Another publication (3) deals with the biomechanical principles involved in correction of foot disorders with use of the shoe insert, as well as with indications for prescription of the insert. It is assumed that the physician will use the present manual for instruction in the technique of cast-taking. If the physician is unable to take the cast, this publication may be used as a basis for communicating to the orthotists the corrections that are to be made in the weight-bearing cast.

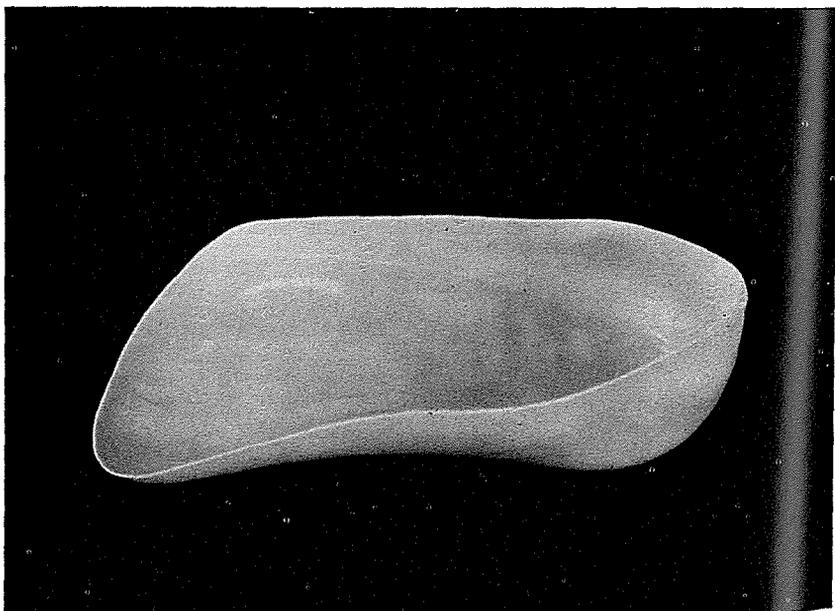


FIGURE 1

## Foot Casting

Conventional methods of making plaster impressions of the foot do not yield casts with the desired corrections nor are they taken with the foot in a weight-bearing position. Modifications of casts of the foot taken by these methods are done empirically. Meaningful measurements are time-consuming to obtain and difficult to use because the soft tissues and the flexibility of the foot make it hard to establish suitable reference points.

The fabrication of inserts to provide the desired correction, fit the foot, and fit the shoe, was made possible by the development of a procedure for taking accurate, weight-bearing, corrected casts of the foot. In this report, the casting procedure and the fabrication of the shoe inserts are described in detail.

## II. CAST-TAKING AND FABRICATION

### A. Special Material and Equipment

#### 1. *Elastic Plaster Bandage*

The technique entails the use of an elastic plaster-of-paris bandage.<sup>e</sup> The 10-cm. width is adequate for most adults. The 8-cm. width is used for children and infants. This material does not buckle when the foot begins to bear weight or when it is manipulated into the position of correction.

#### 2. *Balloons*

A large balloon<sup>f</sup> is inflated and then invaginated over the foot in order to provide a smooth surface on the inside of the plaster wrap. In addition, the balloon exerts a relatively uniform compression on the soft tissues of the foot, providing a more precise fit in the completed insert. A cast taken with the aid of a balloon results in an insert which usually requires no increase in shoe size.

#### 3. *Contoured Standing Surface*

Since the shoe insert must fit the shoe as well as the foot, a standing surface which has a suitable configuration must be provided. The shape of this standing block is determined by pressing a strip of thin sheet lead against the insole of the shoe. The shape obtained in this manner is then transferred to a block of wood and cut out with a band saw. The cut surface is covered with linoleum so that the surface can be easily

<sup>e</sup> Elastik, distributed by Fillauer Surgical Supplies, Inc., Chattanooga, Tenn. 37401.

<sup>f</sup> Manufactured by Ashland Rubber Products, Ashland, Ohio. The sizes are: for adult patients, 836, and for children, 625. They should be purchased clear (without pigment), since they are then much more elastic.

cleaned. A typical standing block is shown in Figure 2. Actual full-scale contours are provided in a drawing (Fig. 3).

#### 4. Casting Stand

A casting stand (Fig. 4)<sup>§</sup> was developed to minimize the need for moving the foot once the patient is brought to the standing position. The stand consists of a lazy-Susan type of platform to which a pipe support has been added. This assembly is mounted on a suitable base. The stand provides support for the foot and leg while the plaster wrap is

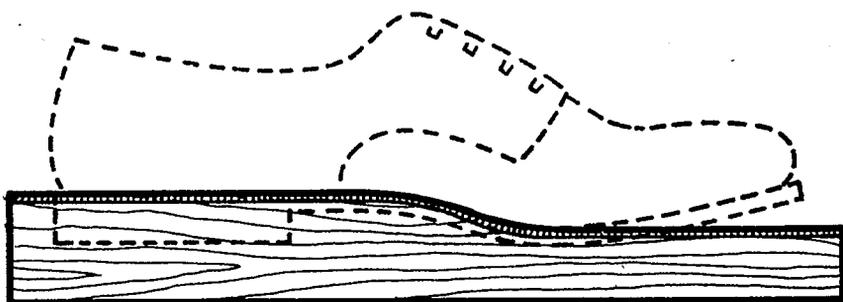


FIGURE 2

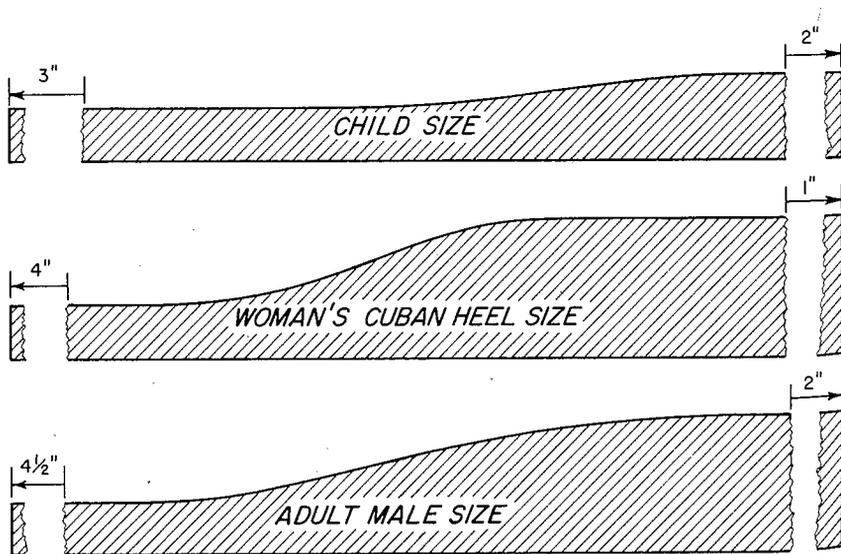


FIGURE 3

<sup>§</sup> The design and development of the casting stand and the vacuum jig were supported by the Veterans Administration under Contract V1005M-2075.

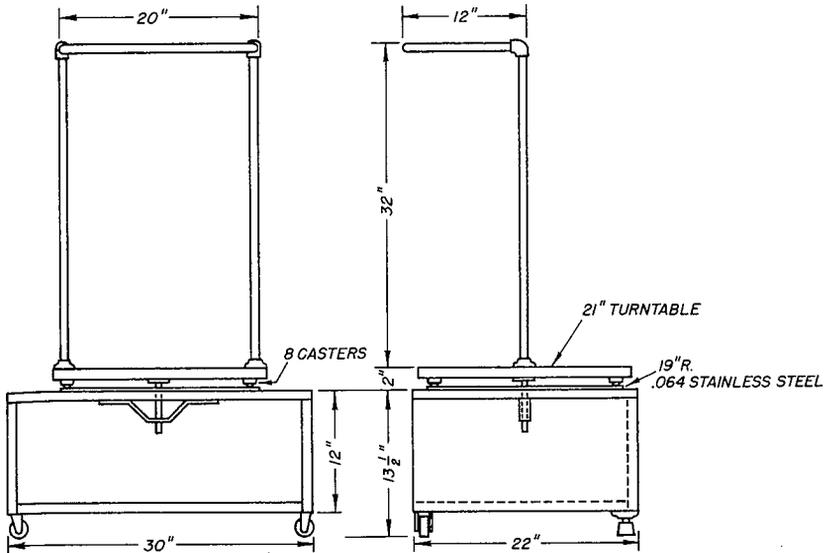


FIGURE 4

being applied, and enables the patient to stand and to be rotated 180 deg. so that the cast-taker can observe the calcaneus and the Achilles tendon while the foot is maintained in a corrected weight-bearing position as the plaster hardens.

### 5. Vacuum Jig

A simple vacuum jig (Fig. 5) allows for lamination of a lightweight, thin shoe insert. The jig consists of two vacuum chambers with separate control valves. The pipe (A) is one vacuum chamber and the cylinder (B) is the second vacuum chamber. The cylinder also has a port (C) which is sealed off from the rest of the chamber and through which the resin is introduced. A plug (D) is used to seal off the port so that a vacuum can be created.

## B. Detailed Procedure

The following procedures have been developed for making standard shoe inserts. When young children are fitted, it is recommended that the use of the balloon and cast-taking procedures be explained, in order to avoid frightening them.

### 1. Establishment of Trim Line

The subject should be comfortably seated on an examining table or its equivalent, with his bared feet in his shoes. A line is drawn on the

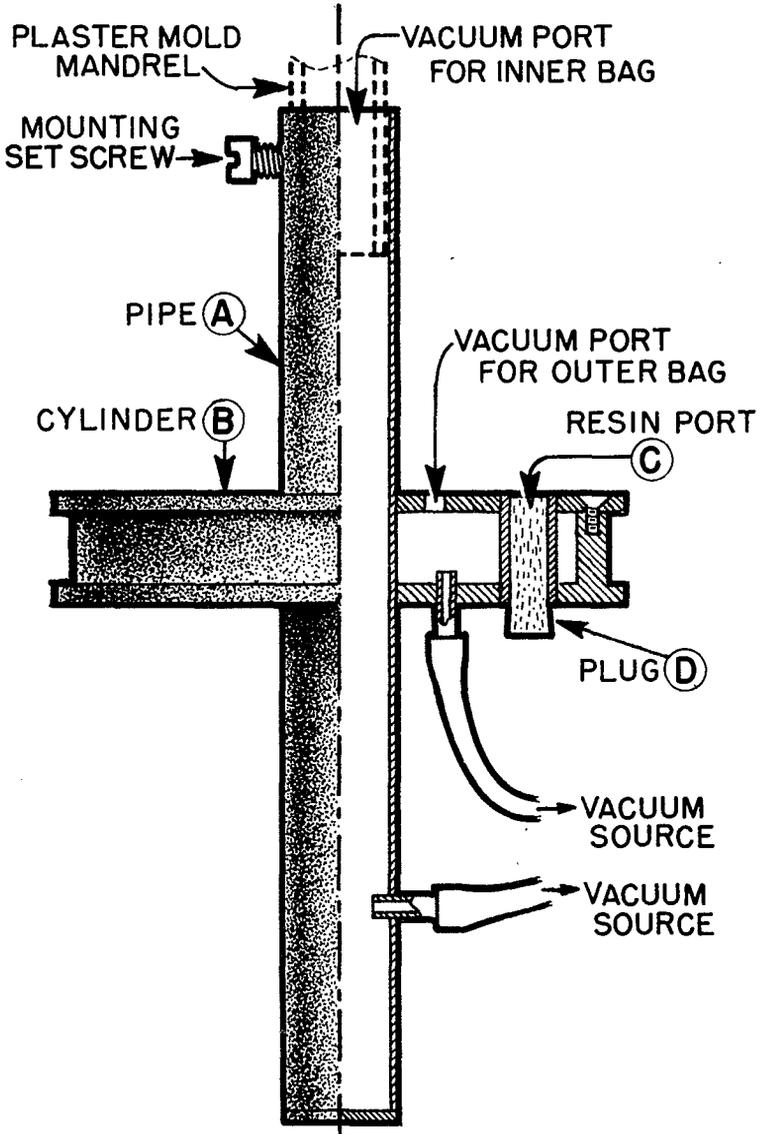


FIGURE 5

foot along the top of the counter of each shoe from midline of one malleolus to the midline of the other (Fig. 6). This line will establish the height of the insert. The patient then removes his shoes and the cast-taker draws a line on the plantar surface of the foot  $\frac{1}{4}$  in. proximal to the metatarsophalangeal crease (Fig. 7). This line is extended up the



FIGURE 6



FIGURE 7

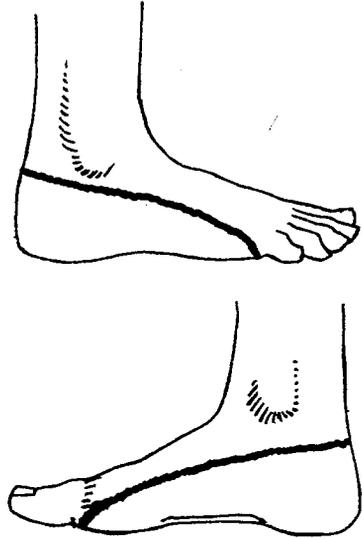


FIGURE 8

medial and lateral sides of the foot, including the heads of the first metatarsal and the fifth metatarsal respectively. The line is then adjusted so that it joins the line around the ankle on the medial and lateral sides (Fig. 8). This now continuous line becomes the trim line.

In some cases initial examination of the foot reveals a prominent tuberosity of the navicular. In this case a small piece of felt should be taped over the prominent bone. This felt will produce a corresponding protrusion in the plaster positive and, in the finished insert, a relief area for the tuberosity.

## 2. *Application of Balloon to Foot*

The subject should be comfortably seated on an examining table or its equivalent, with his bare foot and leg extended toward the person taking the cast.

A fully inflated balloon is placed with the closed end against the toes of the extended foot of the subject (Fig. 9). As the balloon is carefully pushed onto the foot, air is gradually released so that the balloon will slide freely upon itself. A simple way of controlling the release of air and maintaining control over the balloon is as follows: The cast-taker holds the open end of the balloon against his abdomen while he uses both hands to guide the balloon onto the foot. Trunk movement is used to control the rate of air release. If the balloon is applied over the toes without restricting the release of air until it is well up on the heel, the toes will be much more comfortable. Pressure of the balloon against the toes may cause them to bend, but unless there is acute discomfort, this is not a problem, since the toes will not be included in the completed insert. When completely deflated, the balloon should extend above the malleoli, as shown in Figure 10. The projecting mouth of the balloon is stretched and cut off as shown in Figure 11. The fingers of both hands are placed under the cut edge; the balloon is then stretched and pulled

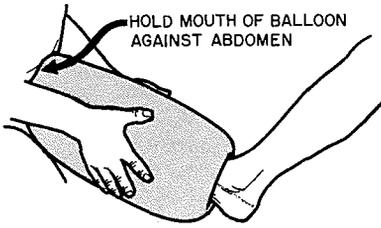


FIGURE 9

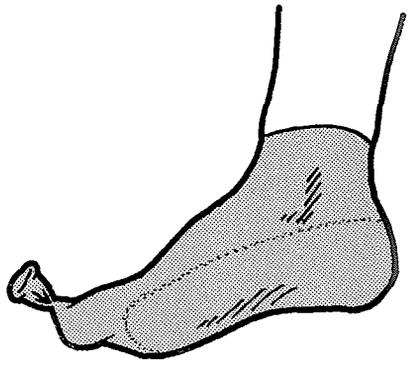


FIGURE 10

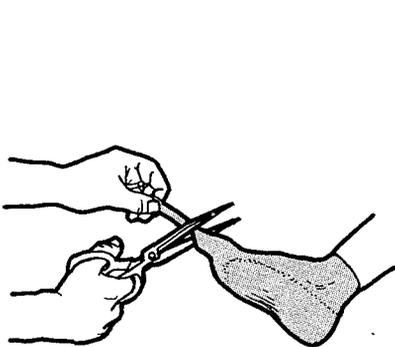


FIGURE 11

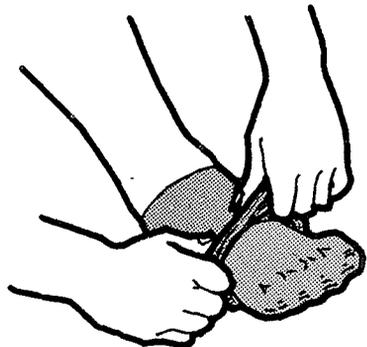


FIGURE 12

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up onto the leg, as shown in Figure 12. The balloon is now inside out on the foot, and the first step of the casting procedure is completed.

In the case of a small child or of a subject with a flail leg, this procedure may require two persons, one to hold the leg and the other to apply the balloon.

### 3. Transfer of Trim Line

The trim line must be traced (Fig. 13) on the balloon with an indelible pencil so that it will be transferred to the wrap and ultimately to the plaster positive.

### 4. Determination of Glass Line

The glass line (Fig. 14), which marks the outer limit of the glass lay-up, runs approximately  $\frac{1}{4}$  in. below the trim line except on the plantar surface of the forefoot; here it is drawn  $\frac{3}{4}$  in. proximal to the trim line for adults; a proportionately smaller distance is required for children.

### 5. Plaster Wrap Procedure

Before the plaster wrap is made, a 12-in. strip of  $\frac{3}{8}$  in. O.D. latex tubing is placed on the dorsum of the foot and secured with several pieces of tape, as shown in Figure 15. This tubing is coated with petroleum jelly. When the wrap has hardened the tubing can be easily withdrawn, leaving a  $\frac{3}{8}$  in. tunnel into which bandage scissors can be introduced. The wrap can be cut down along this tunnel and removed conveniently without a cast-cutter.

The subject is now seated with the leg and foot extended over the stockinet leg support as seen in Figure 16.

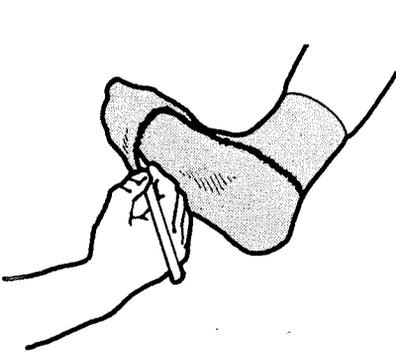


FIGURE 13

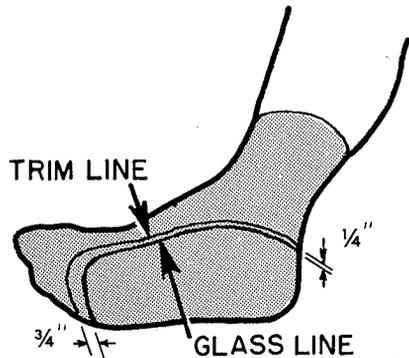


FIGURE 14

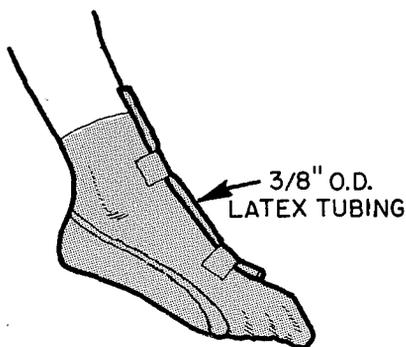
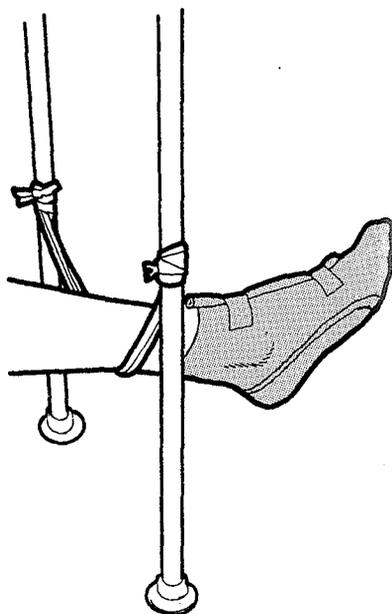


FIGURE 15



The Elastik plaster bandage is placed in a pan of cold water. (The water should be cold to retard the setting time.) The bandage should stand on end to expedite the removal of air and to insure rapid saturation of the plaster bandage. As soon as air bubbles have ceased to rise from the roll of bandage, it is removed from the water. These two points are important in order to extend the working time of this material. To insure a smooth inner surface, a thin layer of a separate mixture of water and plaster is applied to the balloon-covered foot before the wrap is made. It is also helpful to add plaster to the first few layers of the wrap.

The wrapping procedure begins just above the heel. The roll of bandage is held with the roll *toward the foot*. (The subsequent circular wrap requires more control of bandage tension, and with the bandage started in the reverse manner, as indicated, it will be possible to do the circular wrap—Step 7, Figure 23—in the orthodox manner.) It is desirable to hold the foot at 90 deg. to the leg during the wrapping stage.

From the starting position (Step 1, Fig. 17), the bandage is brought distally along the sole of the foot, then over the toes. It is continued proximally along the medial border of the foot and then around the heel (Step 2, Fig. 18) to secure the starting end of the bandage. The

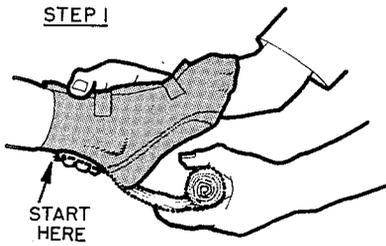


FIGURE 17

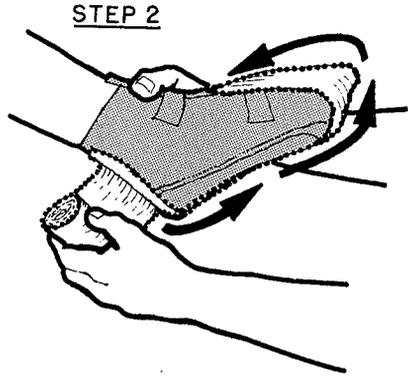


FIGURE 18

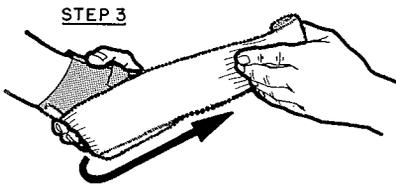


FIGURE 19

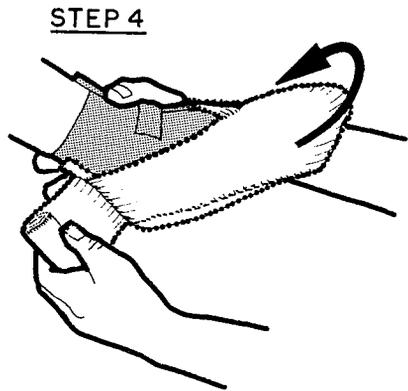


FIGURE 20

wrap is continued (Step 3, Fig. 19) distally along the lateral border of the foot. It is carried across the toes, proximally along the medial border of the foot, and continued over the heel well up onto the Achilles tendon (Step 4, Fig. 20). At this point, the bandage is folded over the fingers of the cast-taker and brought distally along the sole (Step 5, Fig. 21), around the toes, and then proximally along the medial border and around the heel to secure the area at the fold (Step 6, Fig. 22). The bandage is then carried along the lateral border approximately to the instep, at which point the circular wrapping of the foot begins. The foot is wrapped in the circular manner (Step 7, Fig. 23) from heel to toe while a light but constant tension on the bandage is maintained. The plaster must be continually worked into the fabric to prevent delamination and to provide a smooth inner surface to the complete wrap.

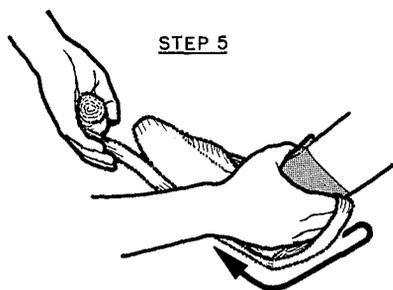


FIGURE 21

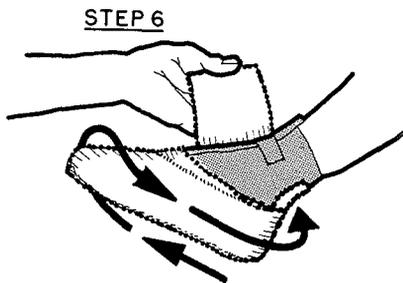


FIGURE 22

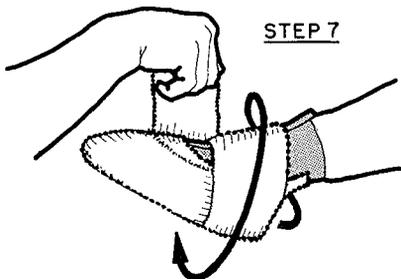


FIGURE 23

#### 6. Use of Casting Stand

While the plaster is still pliable, the subject is brought to a standing position, maintaining his balance with the hand rail. The cast-taker carefully positions the wrapped foot on the shaped surface seen in Figure 24, until the full heel is located on the upper horizontal surface and the heads of the metatarsals are on the lower horizontal surface of the standing board. (A more precise manner of placing the foot on the standing board is to relate the contour of the shoe to the contour of the board. A strip of lead  $\frac{1}{2}$  in. wide by  $\frac{1}{8}$  in. thick is pressed into the shoe and up the back of the heel counter. This shaped piece of lead is positioned on the standing block until the two contours match as closely as possible. A piece of tape is used to mark the posterior limit of the heel on the standing surface. Before the patient stands, his heel is positioned so that it is aligned with the tape.)

In this position, the subject is facing the cast-taker, who is seated on a stool of a height sufficient to bring his eyes to a mid-calf level. The platform carrying the subject is rotated 180 deg. so that his heels are now facing the cast-taker who can manipulate the forefoot by gripping the toes with one hand and pushing against either the medial or the lateral malleolus with the other hand to achieve the desired correction (Fig. 25).

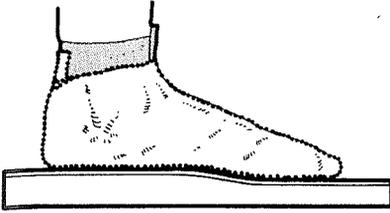


FIGURE 24

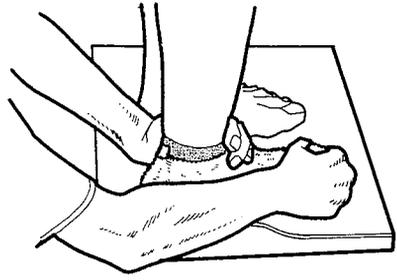


FIGURE 25

### 7. Corrections During Weight Bearing

The type of corrections attempted can be described more easily by distinguishing the three parts of the foot: the hindfoot (calcaneus and talus), the midfoot (navicular, cuboid, and cuneiforms 1, 2, and 3), and the forefoot (metatarsus and phalanges). The corrections attempted so far have been eversion or inversion of the hindfoot to a neutral position; raising or lowering of the midfoot (arch); and abduction, adduction, or pronation of the forefoot.

In most cases the corrections can be simply stated as raising and lowering the arch or stabilizing the arch to correct the forefoot. These corrections are done during weight bearing, and thus against the ground reaction. In order to raise the arch, the cast-taker externally rotates the leg with one hand and adducts and pronates the forefoot with the other, as shown in Figure 26. Depression of the arch is accomplished by internal rotation of the leg, abduction of the forefoot, and application of pressure by the cast-taker's wrist on the dorsum of the forefoot (Fig. 27).

To correct forefoot abnormalities when the midfoot and hindfoot are

#### ELEVATING ARCH (RIGHT FOOT):

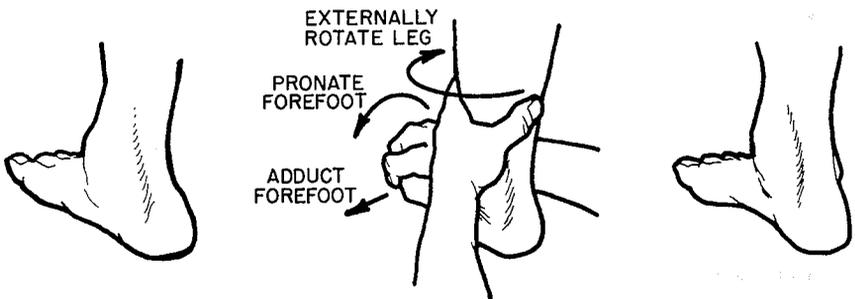


FIGURE 26

DEPRESSING ARCH (RIGHT FOOT):

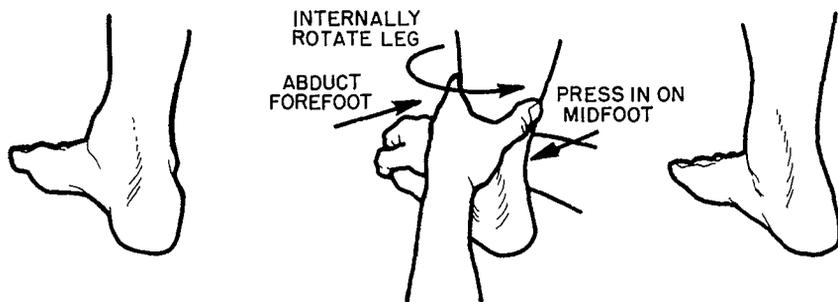


FIGURE 27

essentially normal—as, for example, in metatarsus adductus—the calcaneus is maintained in a neutral position by preventing rotation of the leg while the forefoot is abducted (or, in other cases, adducted) to the desired position of correction.

The person taking the cast should sit behind the standing patient so that he may observe the effect of these corrections on the Achilles tendon, which is a useful indicator of the relation of the heel to the leg. The adult patient is usually asked to bear less weight on the foot until the correction is made. He will then gradually apply equal weight to both feet unless the cast-taker cannot hold the correction. If the calcaneus is not in a proper relationship to the talus, hand pressure cannot hold the correction. This fact provides a simple criterion for determining the degree of correction to be obtained.

After the plaster sets, the subject is rotated back to the starting position and is instructed to ease his weight off the wrapped foot carefully before sitting down.

After the latex tubing is removed, the wrap is cut down the dorsum of the foot in the tunnel produced by the tubing. The wrap, which is now like a high-top shoe, can be slipped off the subject's relaxed foot. The cut edges can be approximated and held by a circular wrap of regular plaster bandage.

At this point the wrap can be held up to a light and examined for thin spots. If any exist, they can be reinforced with regular plaster bandage.

*8. Pouring of Positive Plaster Mold*

A parting agent of soap and water ( $\frac{1}{2}$  cup of liquid soap to 1 qt. of water) is poured into the wrap and then removed before the plaster positive is poured. Casting plaster is mixed in the usual manner and poured into the wrap. A  $\frac{1}{2}$ -in.-diameter pipe (3–5 in. long) is inserted

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into the plaster to serve as a mandrel when the insert is laminated. When the plaster has set, the wrap is removed.

Small surface imperfections caused by air entrapment can be removed by light sanding while the cast is held under running water.

A completed positive is shown in Figure 28.

### 9. Lamination

Lamination of the shoe insert is accomplished with the aid of a simple vacuum jig (see Section 5. *Vacuum Jig* and Fig. 5 for details). The use of the vacuum system is recommended because the resulting laminate is thin, lightweight, and strong.

The plaster surface is coated with Vaseline or light grease to provide a moisture barrier between the cast (if it is wet) and the PVA sheet, and to serve as a lubricant when the sheet is stretched under vacuum, as well as to fill any minor surface imperfections in the plaster.

An 18-in.-square piece of PVA is immersed in water, removed, and the excess water shaken from it. The PVA sheet is stretched over the plaster positive, at a 45-deg. angle, from the heel toward the dorsal portion of the arch as shown in Figure 29. Then, with both edges held at the dorsum by the left hand, the PVA is pulled and tied with a strip of PVA below the inner vacuum port. The PVA is pulled further, with care being taken to prevent wrinkles from extending beyond  $\frac{1}{2}$  in. from the trim line while air is evacuated from the PVA covering; a vacuum of at least 5 in. Hg should be provided (Fig. 30). A smooth parting surface is thus formed for the laminated insert.

Four pieces of nylon tricot 12 in. square are separately folded and sewn (Fig. 31). The slight curve in the stitching provides a better fitting contour for the heel section.

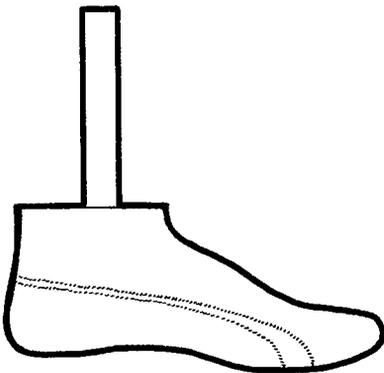


FIGURE 28

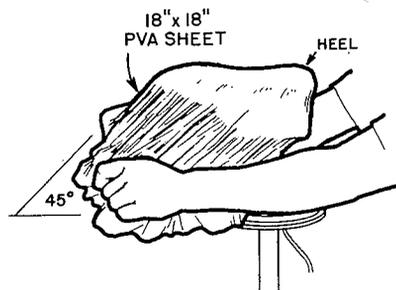


FIGURE 29

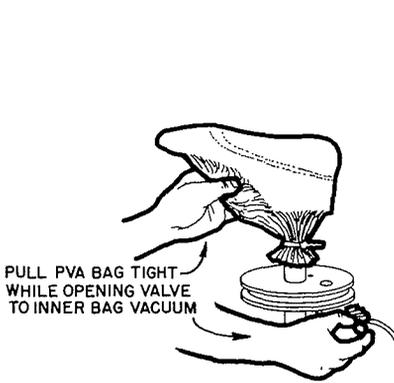


FIGURE 30

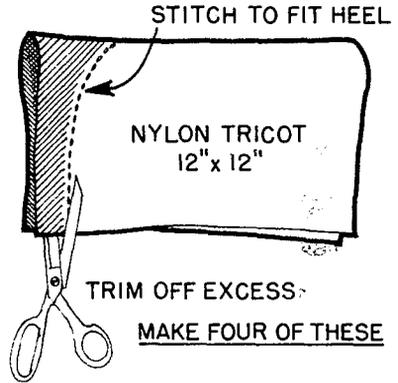


FIGURE 31

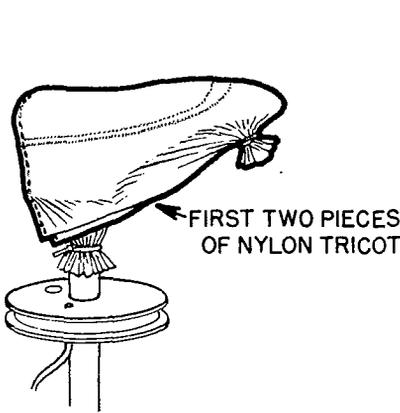


FIGURE 32

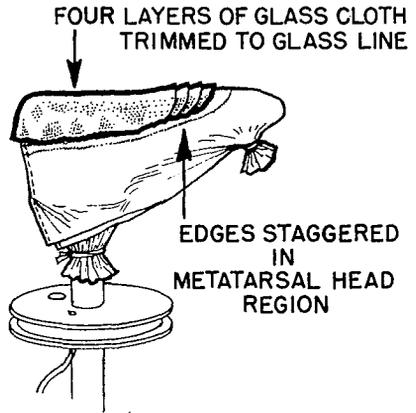


FIGURE 33

Two of the tricot pieces are pulled onto the cast and securely tied at the toe (Fig. 32).

The fiber-glass reinforcement is constructed by cutting glass cloth<sup>h</sup> into four approximately egg-shaped pieces. The four layers may be stitched or stapled together for easier handling, arranged as shown in Figure 33. The first of the four layers begins just proximal to the heads of the metatarsals, extending over the plantar surface of the foot and up the heel. For adults, each successive layer begins  $\frac{1}{2}$  in. behind the preceding layer; for children, the distance is proportionately smaller. The first layer extends just to the glass line. The purpose of this arrangement is to give graded flexibility to the insert at the ball of the foot.

<sup>h</sup> Glass type 181P, supplied by A. J. Hosmer Corporation, Campbell, Calif. 95008.

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The remaining two pieces of nylon tricot are pulled over the fiber glass and tied as before (Fig. 34).

We have found four layers of glass to be satisfactory for an "average" insert, but the number may be increased or decreased to fulfill individual needs. As the cast-taker gains experience, he will be able to determine how many layers to use. We have used as many as 12 layers for a very heavy man or one who required especially difficult corrective measures. Conversely, an infant with very flexible feet may require less than four layers, but this is rare.

Similarly, the number of layers of nylon tricot may be increased or decreased from the standard four layers. The decision as to the numbers of layers of both glass and nylon is based on the facts that an increased amount of glass increases rigidity, whereas an increase in nylon increases toughness.

A 36-in. square of PVA is thoroughly dampened on one side and draped loosely over the positive, with the dry side in. The free border is now pulled over the large cylinder of the vacuum jig and tied with latex tubing, as shown in Figure 35.

The vacuum jig is now inverted so that the positive is positioned with the sole down, forming approximately a 15-deg. angle to the floor, and with the heel of the positive closest to the floor.

The access hole is opened and a paper or cardboard funnel is inserted into the opening (Fig. 36). Approximately 100 gm. of a mixture of 50 percent rigid<sup>1</sup> and 50 percent flexible<sup>2</sup> resin, prepared in the usual

OUTER TWO LAYERS OF NYLON TRICOT  
OVER GLASS CLOTH

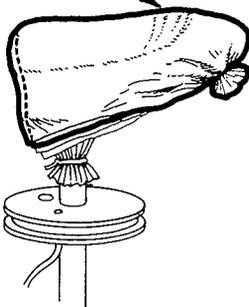


FIGURE 34

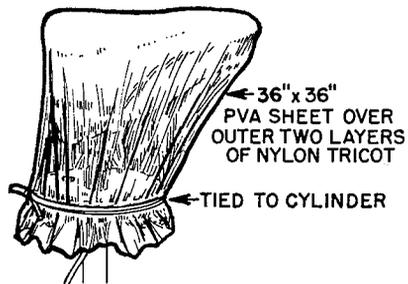


FIGURE 35

<sup>1</sup> Laminac No. 4110. Name of the nearest distributor can be obtained from American Cyanamid, Berdan Avenue, Wayne, N. J. 07470.

<sup>2</sup> Polylyte 31-830. Name of the nearest distributor can be obtained from the Reichhold Chemical Company, 120 South Linden Avenue, South San Francisco, Calif. 94080.

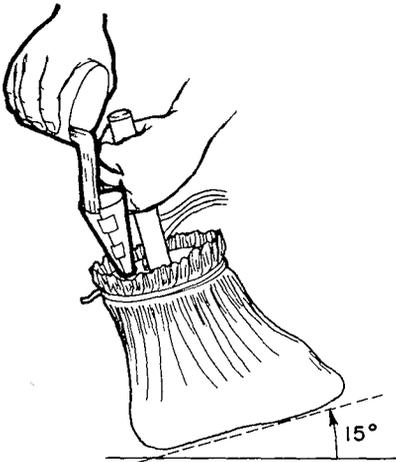


FIGURE 36



FIGURE 37

manner, is poured into the funnel. The resin is now between the outer bag and the lay-up, and is worked into the desired areas.

The access hole is now closed and a low vacuum is introduced by a slight opening of the valve. The bag is stretched over the heel, sole, and forefoot until all folds and wrinkles have been eliminated. The excess PVA is pulled to the dorsum and toes of the positive. The valve is opened further to increase the vacuum to  $1\frac{1}{2}$  in. Hg. *Care should be used in adjusting the vacuum since too high a vacuum will pull resin from the bag into the vacuum lines.* (Control of the excess resin will keep clean-up at a minimum.) The resin is then carefully worked into the fabric lay-up. The thenar eminence of the hand is used as a roller to apply pressure to the heel and to roll entrapped air and excess resin out of the fabric (Fig. 37). When the PVA is dry enough, stripping is done to remove the bubbles.

The laminating procedure described above is only one of several methods. For example, lamination may be done in exactly the same manner as that used for plastic laminated sockets for artificial limbs. The method is of little importance as long as the result is a dense lamination which has neither resin-rich nor starved areas.

Usually, twice the prescribed proportion of promoter is used to accelerate the initial hardening time. The lamination is allowed to stand 12 to 20 minutes before it is removed from the positive.

To remove the insert from the positive, the lamination is cut with a cast-cutter  $\frac{1}{2}$  in. to  $\frac{3}{4}$  in. above the trim line.

The insert is trimmed to the anticipated trim line with aircraft snips and the cut edges are sanded. The fit is then checked, and trimming

completed. Cut edges can be finished by sanding and buffing or with lacquer. Local relief, if necessary, can be provided by heating small areas with a heat gun or an infrared lamp.

In most cases, the insert is placed in the shoe and is worn by the subject to check fit and comfort. If no problems are encountered, the subject is asked not to wear the insert for approximately 12 hours, to permit post-curing of the resin.

The patient may experience some discomfort for the first week to 10 days. This discomfort is attributed to the changes in position of skeletal structures and to the stretching of tight soft tissues.

If red pressure marks occur along the trim line, the cause is either insufficient correction during the making of the plaster wrap, or curling of the laminate because the insert had been removed from the positive before cooling sufficiently. In the former case, it is recommended that a new cast be taken. In the latter, the insert can be replaced on the positive and heated in an oven to approximately 250 deg. F., and then thoroughly cooled before being removed from the positive.

### **III. APPLICATIONS OF THE SHOE INSERT**

In the last four years, 450 inserts have been fitted to 93 patients.<sup>k</sup> The following remarks regarding the application of the shoe insert are intended to provide only preliminary information, since the results of clinical testing to date have been limited to certain abnormalities. Furthermore, the clinical sample of patients with specific foot disorders is small except for those with flatfoot and subtalar arthritis.

Correction of foot deformity with use of the shoe insert has been most successful when the requirements for correction were restriction of motion in the subtalar joint and maintenance of the foot in a neutral position with extremes of motion eliminated. Physicians on the staff of the Biomechanics Laboratory have had a high rate of success in treating patients with pes planus and with arthritis of the subtalar and midtarsal joints, and they feel confident that the insert provides a useful form of treatment for these disorders.

Although we have applied the inserts to patients with such disorders as talipes equinovarus, metatarsus adductus, cavus conditions, rotational problems of the leg, and genu valgum, and although we have had sufficient success to warrant further investigation, the pathomechanics of these conditions are not clearly enough understood to recommend use of inserts outside of an experimental study.

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<sup>k</sup>The clinical studies initiated under VRA Grant RD-924-M were extended after expiration of that grant to include a greater number of children. The latter studies were sponsored by Children's Bureau Grant C-21.

### A. Advantages

The main advantages of the UC-BL Shoe Insert are:

1. Corrections of the foot can be maintained without the damaging effects of long-term immobilization.
2. Expensive corrective shoes (often of questionable value) can be replaced by inexpensive shoes, since the elements of correction and support are provided by the insert and not by the shoe.
3. Shoe inserts are quickly and easily made, so that new ones can be fabricated to meet growth requirements.
4. Corrections are applied directly to the foot. This feature precludes distortion of the shoe and loss of correction by wear of the shoe sole and heel or by breakdown of the shoe upper.
5. The physician has excellent control of the corrections to be obtained.
6. Supplemental physical therapy can be utilized without interruption for plaster therapy.
7. Shoe inserts can be worn in shoes at night for effective night splinting.
8. Shoe inserts may be cleaned with cleaning fluid or soap and water without affecting the material.

### B. Limitations

Successful application of the shoe insert depends on one primary factor: The deformity must not be fixed—the foot must be sufficiently flexible to permit manipulation into the desired position of correction. In many instances of mild deformities where this is the case, the use of shoe inserts alone can be depended upon to achieve the desired correction. However, a constant follow-up by the physician is necessary. In more severe cases, surgical procedures or wedge casting, physical therapy, and night splinting may be required. The shoe insert may then be used to *maintain* the correction after other procedures have *achieved* it. In general, the shoe insert should be considered as an adjunctive rather than as a primary treatment, except in relatively mild deformities.

It is important to note that the calcaneus must be maintained in a neutral position under the talus if the foot is to be stable on weight bearing. Undercorrection of either varus or valgus positions results in an unstable position of the foot. The shoe insert cannot support abnormal forces of the magnitudes developed under these circumstances and therefore should not be used in such cases in which undercorrection is a necessary phase of treatment.

**REFERENCES**

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