Clinical Prosthetics & Orthotics

Prosthetic Management of Partial Foot and Syme Amputations

Volume 12, Number 1 Winter, 1987/88

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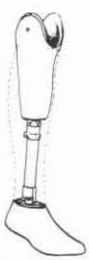

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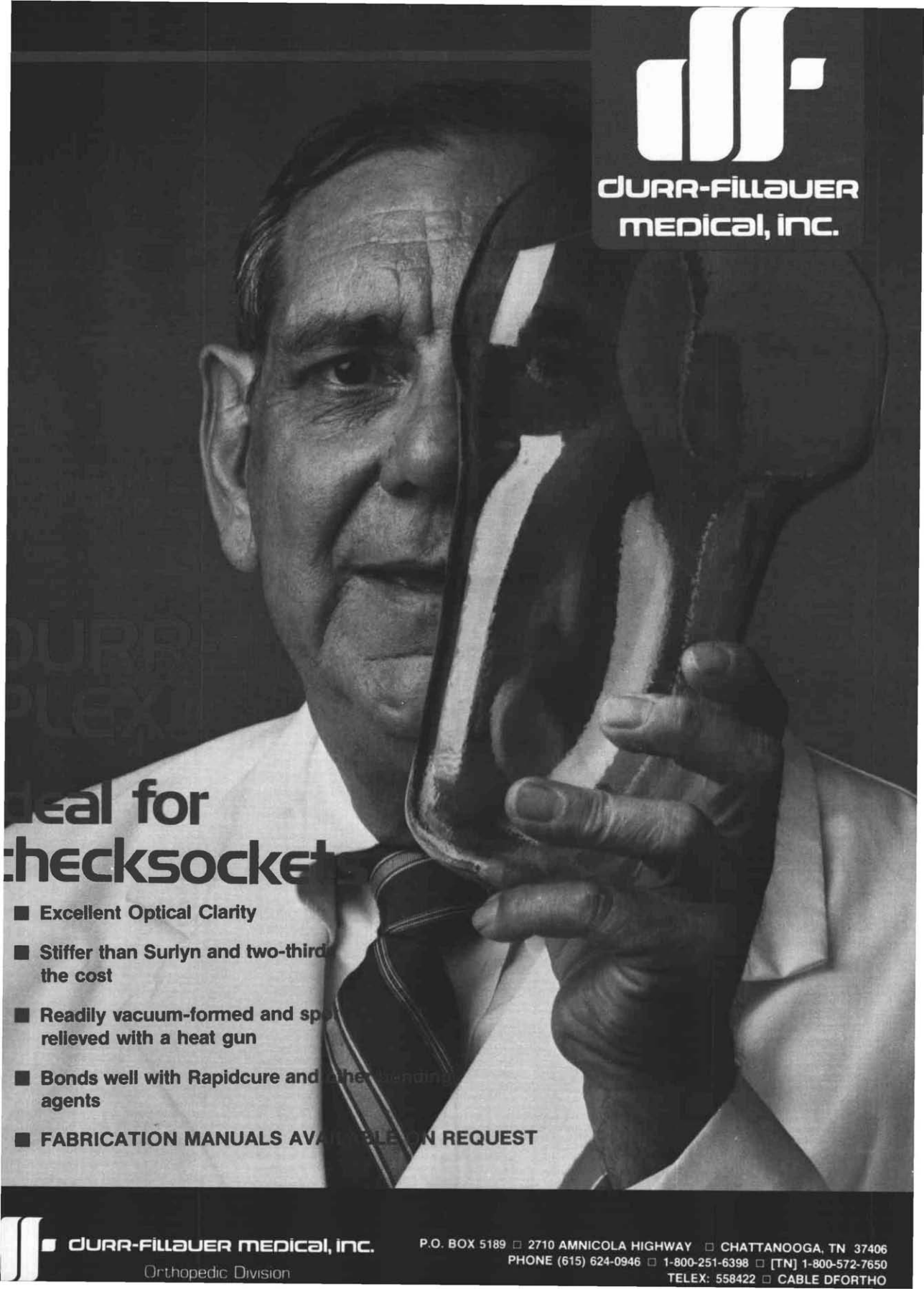
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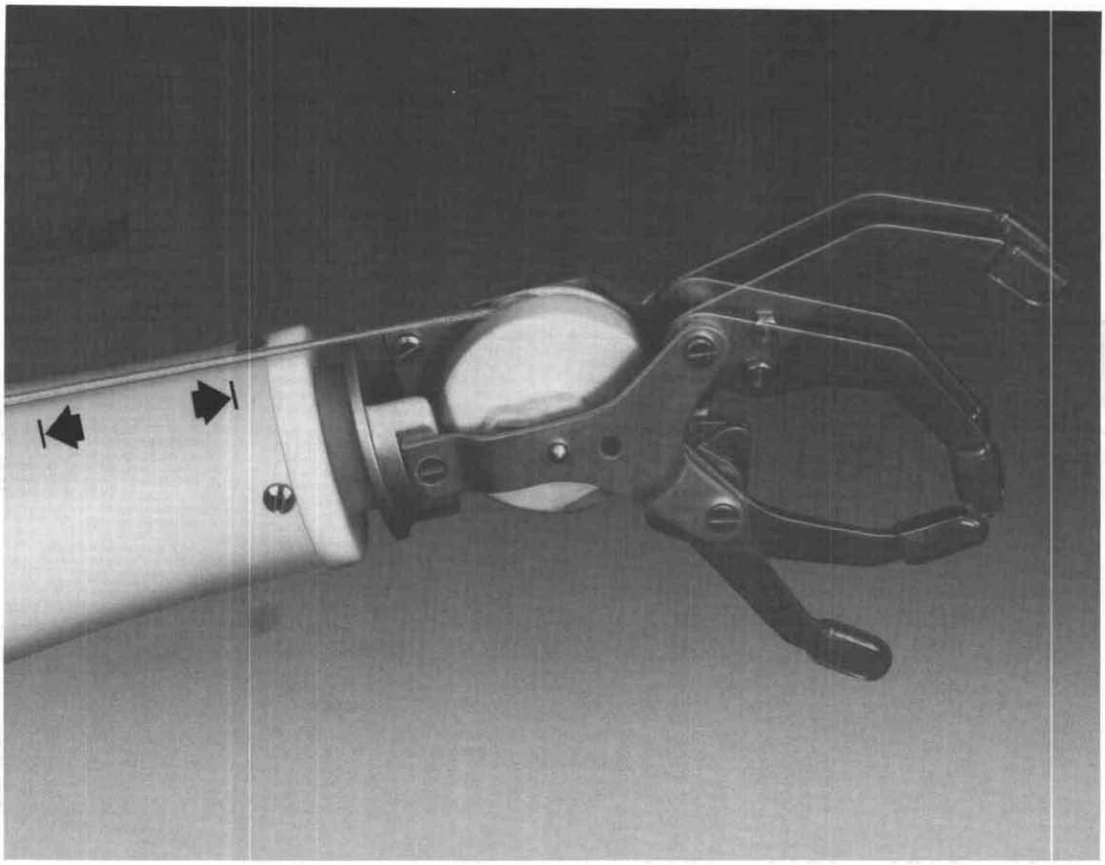

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The initial and most difficult problem every writer faces is how to organize the material. The quickest way to organize material is through the use of an outline. In its most basic form, an article is divided into three parts—introduction, body, and conclusion. The introduction states the subject and gives pertinent background information that is necessary in order to understand the topic. The main body of the article is the intent to inform and answer a variety of questions. The body can include subheads, such as review of literature, method, clinical materials, discussion, and results. The conclusion restates the main points presented in the article.

Clinical Prosthetics and Orthotics addresses broad, philosophical issues, and as such invites a more subjective style. Each issue of *C.P.O.* centers on a main topic. Usually, an issue will contain a lead article, an editorial, and one or more technical articles pertaining to the topic. Authors are solicited by the Academy editorial board; however, *C.P.O.* also accepts unsolicited articles. Unsolicited articles need not cover the topic at hand and may be of a more technical and objective nature. All articles are submitted to the editor, a professional in the field, who checks every article for accuracy, terminology, format, and references. The articles are then forwarded to the publications staff at the Academy National Office for production and printing.

The chosen topics for *Clinical Prosthetics and Orthotics,* Volume 12, Number 2 through Volume 12, Number 3, and deadlines for submission are as follows:

Volume 12, Number 2	"Orthotic Management of the Foot" Deadline: December 1, 1987
Volume 12, Number 3	"Disarticulation Amputations" Deadline: March 1, 1988

Please remember that although these are the chosen topics for these particular issues, we gladly welcome submissions on other topics. Please feel free to contact the National Office if you have any questions on whether your article would be appropriate for *C.P.O.*

If you have an article that has been previously published in another scientific journal and think it may be appropriate for *C.P.O.,* please let us know.

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   c. Lecture or Verbal Presentation
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      2. Wagner, F.W., Jr.: "Classification and treatment for diabetic foot lesions"; Instructional Course, American Academy of Orthopedic Surgeons, New Orleans, Louisiana, February, 1976.

   d. Personal Communication

      Irons, George, C.P.O., Personal communication, June 1977. Presently, Director of Research, United States Mfg., Glendale, California. Formerly, Research Prosthetist, Patient Engineering Service, Rancho Los Amigos Hospital, Downey, California.

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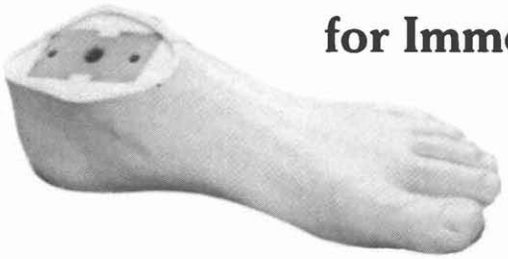

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Clinical Prosthetics and Orthotics, Vol. 12, No. 1, pp. 10–13

Partial Foot and Syme Amputations: An Overview

by John H. Bowker, M.D.

Historical Aspects

Until the middle of this century, partial foot and Syme amputations were done almost exclusively as a sequel to trauma. The presumption was that the normal vascular supply of the remaining foot would usually lead to healing. Both dry gangrene due to peripheral vascular disease and wet gangrene, related to infection superimposed on dysvascularity, were commonly treated by above-knee amputation or below-knee amputation, the choice often being dictated by local surgical prejudice.[3] The rationale was to amputate at the level where one could anticipate primary healing. This had considerable validity in the pre-antibiotic era, when failure of primary healing might mean death of the patient from secondary infection. However, in the United States at the present time, a growing number of partial foot amputations are being done for patients with arterial and/or capillary blood vessel disease, the majority of whom have diabetes mellitus.

This major turnaround in attitude on the part of progressive surgeons is due to a number of technological breakthroughs of the past two decades. These may be characterized as follows:

1. A proliferation of antibiotics to cover most aerobic and anaerobic bacterial infections, largely eliminating the specter of death following failure of an initial procedure.
2. Development of techniques to measure limb blood flow, both in small distal arteries by means of the Doppler effect and at the tissue level, by determination of transcutaneous oxygen perfusion and other methods.[1]
3. The evolution of the operating microscope, which has led to the development of evermore distal arterial bypass procedures, including ankle to foot jump grafts.[6] These often allow healing of distal amputations which would not have healed prior to bypass.
4. Development of new plastics with a variety of production-controllable characteristics in liquid, sheet, and foam versions. This has led directly to the design of more physiologic and cosmetic partial foot prostheses.
5. Studies of energy consumption during gait which demonstrate the physiologic advantages of distal amputations such as the Syme.[7]

With the risk to the patient minimized and the probability of better function, the surgeon should now be willing to risk the occasional failure, that is, the need for a secondary procedure, in order to better assist the vast majority of his or her patients.

Advantages of Partial Foot and Syme Amputations

The partial foot amputee continues to bear weight on the residual foot in a manner which approximates the normal in regard to proprioceptive feedback, as opposed to the below-knee

level in which an entirely new feedback pattern must be interpreted. The great majority of adult onset diabetics with peripheral neuropathy also retain sensation in the arch and heel areas. The heel-lever is intact and variable portion of the toe-lever remains. This will range from full-length, as in the case of a ray (toe and metatarsal) amputation, to virtually none in the case of a Chopart (midtarsal) amputation. The ease of restoration of a normal gait pattern is largely dependent on the length of toe-lever remaining. Whenever possible, therefore, toe-lever length should be preserved by election of a longitudinal (ray) amputation rather than a transverse level (transmetatarsal, tarsometatarsal (Lisfranc) or midtarsal). A further advantage is, in an emergency, the partial foot amputee is not dependent on a prosthesis.

There are also two distinct psychological advantages of partial foot amputations. The less drastic alteration of body image as compared to the below-knee level may decrease the sense of loss as well as produce a smaller disruption of an active life-style. The less conspicuous and more cosmetically acceptable prostheses available today, even for the more radical partial foot amputations, may also help reduce the impact of the psychological loss.

There has been disagreement about whether the Syme amputation qualifies as a partial foot amputation because all the bony elements of the foot have been removed. The preservation of the heel pad, a major soft tissue component of the foot, in the Syme amputation is what confers full weight-bearing capability and distal proprioceptive benefits on the residual limb. The notion that the heel pad is not an important element of the foot is easily dispelled by observing the difficulty in effectively reambulating a person who has lost the heel pad in an otherwise intact foot. Studies of gait parameters including oxygen consumption, cadence and velocity have shown the advantages of the Syme over the below-knee level.[7] The benefits noted are not diminished by the need for a more extensive prosthesis than is necessary for less radical partial foot amputations.

Etiology

Trauma continues to result in a significant number of these amputations. In wartime, booby-traps and land-mind explosions are frequent, while in peacetime, accidents with motor vehicles, especially motorcycles and lawn mowers seem to be the most frequent causes. In northern latitudes, frostbite remains a common etiology.

However, the majority of partial foot and Syme amputations in our institution are an indirect result of inadequate protective sensation to the feet, secondary to peripheral neuropathy. This loss of normal sensation is commonly associated with diabetes mellitus, alcoholism, Hansen's disease (leprosy), or myelomeningocele (spina bifida). The difficulty starts with injury to the foot, either acutely as a laceration, puncture or burn or, more commonly, from pressure or shear forces associated with ill-fitting shoes, and/or chronic overuse of the foot. In response to these forces, areas of skin over bony prominences develop calluses which then break down to form ulcers. These are most common under the metatarsal heads or on the toes. Infection ensues, progressing from cellulitis to abscess formation to septic arthritis and osteomyelitis, resulting in amputation.

Circulatory factors also play a role, especially in diabetic patients. Small vessel disease results in restricted passage of oxygen and antibiotics, across the capillary basement membrane, to damaged and infected tissues. Atherosclerotic changes in the arterial tree can produce major blockage of blood flow correctible only by arterial reconstruction or by-pass. Smoking can play major roles both in the onset and aggravation of atherosclerotic arterial disease and in delaying or preventing wound healing after injury or surgery.

In persons with neuropathy, compliance with a careful routine of foot care is mandatory if major problems are to be prevented. It is easy to deny that a problem exists when no warning pain is felt. Depression over the long-term possibility of limb loss may so depress many diabetic patients that they are immobilized, unable to protect themselves and to prevent what they most fear, amputation. Psychological counseling, individual or group, can aid in breaking patterns of denial and in dealing with the subsequent depression. Ultimately, the patient must accept the responsibility for foot care if amputation is to be avoided.[2]

Surgical Considerations

Partial Foot Amputations

The surgeon should attempt to preserve as much length and width of the foot as possible commensurate with:

1. Healing potential of the soft tissues as determined by circulatory evaluation;
2. Eradication of the local disease process, i.e., removal of all necrotic and infected tissues;
3. Closure of the wound with local skin flaps over all surfaces subject to major weight-bearing or shear forces (Split thickness skin grafts may be used elsewhere, such as the dorsal surface and arch of the foot.); and
4. Good function. A lesser toe should not be left as the only remaining toe because of its increased susceptibility to injury. A second ray amputation is preferable to a second toe amputation alone because of the loss of lateral support to the great toe, which may result in a secondary bunion deformity. This constitutes a new bony pressure point likely to result in another ulcer.

With amputation at or proximal to the tarsometatarsal (Lisfranc) joint, care must be taken to balance the motor (muscle) function of the foot to prevent contractural deformity. At or above this level, release of dorsiflexor and evertor tendons without their reattachment leads to a severe equinovarus deformity due to the unopposed action of the triceps surae (gastrosoleus). Even with reattachment of the muscles at the more proximal level, their effective force is lessened due to shortening of the toe-lever. To overcome this advantage of the triceps surae, it is recommended that a fractional percutaneous heel cord lengthening of the Hoke-Hatt type be done as part of the initial surgery.[4] Even short transmetatarsal amputations may benefit from this procedure.

Syme Amputation

Full end weight-bearing on the heel pad with normally-channelled proprioceptive feedback is what distinguishes the Syme amputation from below-knee amputation. The three keys to success in Syme amputation are selection of the proper candidate, meticulous surgery to preserve the Syme's unique characteristics and maintenance of the weight-bearing heel pad in a centralized position. Since the heel pad is dependent on the posterior tibial artery for its blood supply, preoperative evaluation of the heel pad blood supply by Doppler or other means is recommended in order to reduce the chance of failure to 20% or less. Meticulous surgical technique is required throughout to avoid damage to the posterior tibial artery and to the vertically oriented, fat filled chambers of the heel pad, which provide the cushioning, allowing comfortable and long-lasting end-bearing.[5] Painful incisional neuromas are avoided by finding and cutting short all sensory nerves in both wound edges. Excessive laxity of the heel pad, which will cause difficulty in fitting, is avoided by several means. First, accurately planned incisions will avoid tissue redundancy. At closure, any excess skin should be trimmed, but closure under tension must be avoided. Second, suturing the deep fascial tissues of the heel pad to the anterior fascia or to the anterior tibial cortex will hold it firmly in place. Third, a light-weight carefully padded plaster cast (two 4″ rolls) will prevent pad shift during the first four to five weeks of healing, when a snug walking cast can be applied. This is changed every two weeks until shrinkage has slowed. From this point on, centralization of the heel pad is a function of a carefully fit and maintained prosthesis.

Basic Problems to be Solved

Despite the obvious physical and psychological benefits of partial foot and Syme amputations, these procedures have not enjoyed wide popularity. In my opinion, this is largely due to a failure of dissemination of information regarding these advantages to the two groups most involved: amputation surgeons and prosthetists/orthotists. On the one hand, amputation surgeons must be able to recognize potential candidates for conservative procedures and be willing to try them. On the other hand, the prosthetist or orthotist to whom he refers his patients must be able and willing to accept the challenge of fitting these sometimes difficult cases, e.g., producing a prosthesis which adequately meets the suspension needs of a Chopart amputation residual limb. Parenthetically,

both the techniques and materials used put this area of expertise somewhere between prosthetics and orthotics, hence the name "prosthoses" for the devices constructed.

Further refinement of present designs, especially in regard to cosmesis, and development of new concepts to produce better suspended and lighter prostheses are needed. Studies of gait patterns using these devices will assist in this effort and will help select the most physiologically effective designs. Elimination of shear forces, a function of both suspension and fit, will eliminate most of the criticism of these devices common in the past.

Summary

At the present time, partial foot and Syme amputations are considered viable alternatives to the below-knee level. This is true not only in trauma cases, but in diabetic patients with arterial and/or capillary blood vessel disease. Technological advances which have produced this change over the past two decades include: improved broad-spectrum antibiotics; effective devices for measurement of arterial blood flow and tissue oxygenation; development of arterial by-pass procedures, including the ankle and foot; and more physiologic and cosmetic partial foot and Syme prosthetic designs made possible by development of new plastics in a variety of physical forms. The end weight-bearing and proprioceptive benefits of these amputations lead to low excess energy demands on the amputee as compared to higher amputation levels. A major psychologic benefit is the relatively small alteration of body image. The etiology of these amputations and the surgical details to be observed and pitfalls to be avoided are discussed in some detail. Better dissemination of information to amputation surgeons and prosthetists/orthotists regarding the benefits of these amputations is recommended. There is a need for the refinement of present designs as well as development of new concepts to produce better suspended, lighter and more cosmetic prostheses.

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Author

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Clinical Prosthetics and Orthotics, Vol. 12, No. 1, pp. 14–18

Partial Foot Prostheses/Orthoses

by Melvin L. Stills, C.O.

Introduction

Prostheses and orthoses prescribed for partial foot amputations vary in design and principle. Authors have described the need or the lack of need of toe lever arms, extensions above or below the ankle, and hard and soft sockets. Almost every design violates a principle thought to be a requirement of the other designers of partial foot prostheses/orthoses. The purpose of this paper is to describe some of the designs now being advocated and to give the rationale for their use.

Above the Ankle

Many authors and designers believe that the proper management of a mid-transverse metatarsal amputation, or more proximal, must include an extension above the ankle. Many of these designs take the form of an ankle-foot orthosis (Figure 1). This orthosis may be fabricated from thermoplastic materials (polypropylene), thermoset plastics (polyester or acrylic) which may be incorporated with graphite or other space age materials to reduce weight and increase strength (Figure 2), or may be incorporated into conventional metal and leather types of orthoses. Those devices fabricated from thermoplastics and thermoset materials are generally formed over a positive model of the amputated extremity. The portion of the device contacting the foot is designed to achieve total contact and is generally lined with a soft interface material to increase comfort and/or provide better distribution of forces. The normal profile of the foot may be restored during the initial fabrication process or added later as a buildup of foam. This foot buildup acts as an extension of the foot lever arm, or in some instances may only act as a shoe filler. If an attempt is made to extend the foot lever arm, it may be necessary to complete shoe modifications which would include a full length spring steel shank cushion heel and walker sole. It is considered that this combination of prosthesis,

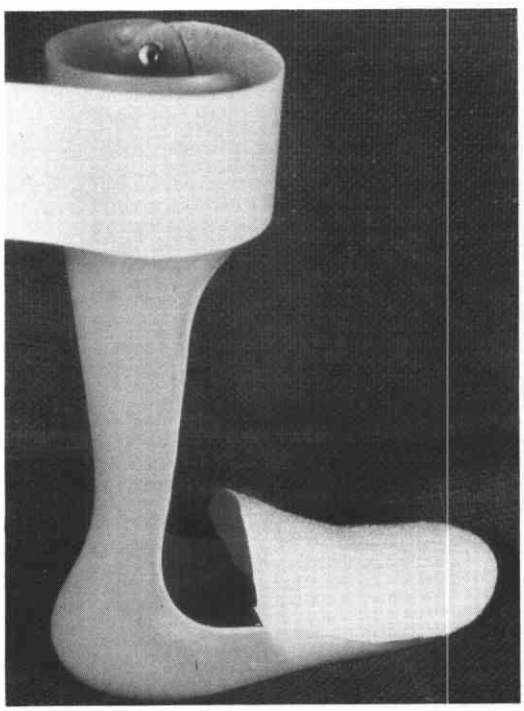

Figure 1. Polypropylene ankle-foot orthosis with foam toe filler.

orthosis, and shoe will provide a smooth transition from foot flat to heel off and permit an effective push off.

Tarso-metatarsal amputations may require a solid ankle device. This device employs similar methods of construction with the addition of an anterior section extending from the level equal to the height of the posterior section and distally to the dorsum of the remaining foot. This addition acts to lock the foot and lower leg into the posterior section and eliminates ankle motion. The shortened foot is difficult to retain in the posterior section, and the addition of the anterior shell provides better purchase and retention. The proximal region of the anterior section may take the form of a patellar tendon bearing socket, or extend to midcalf, or in some designs extend only to the area just above the ankle. Variations of all three commonly exist, and the amount of ankle control will be determined by the design selected. If a design is selected which limits ankle motion, most authors agree that shoe modifications are required to achieve normal gait. A cushion heel applied to the shoe will permit smooth transition from heel strike to foot flat. Prosthetists who routinely employ these designs have reported good results with successful ambulation.

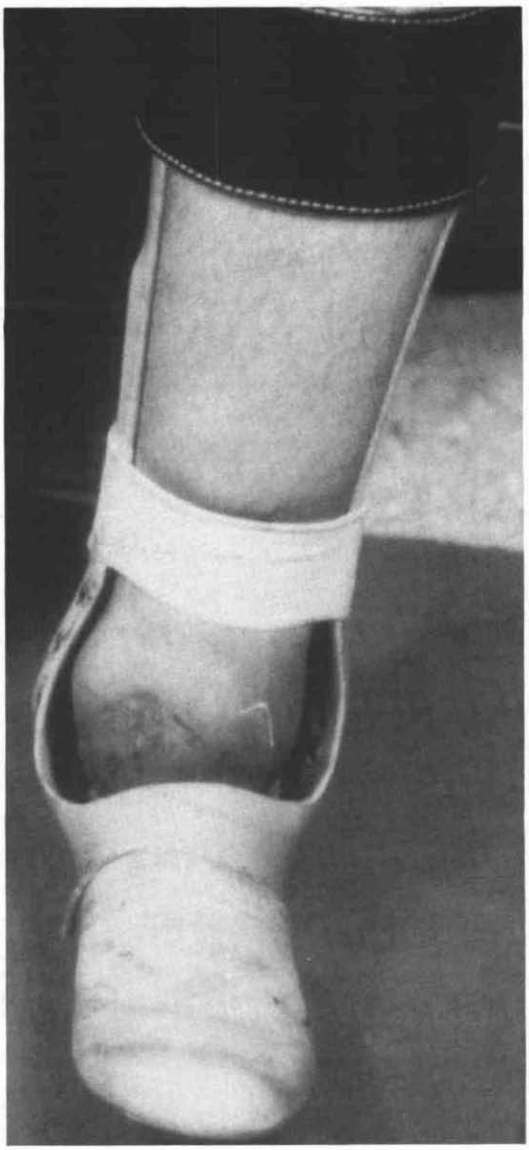

Figure 2. Graphite reinforced laminated posterior prosthetic shell for transtarsal amputation.

Below the Ankle (Slipper Type)

A number of designs exist that do not extend above the ankle joint. They appear to be divided into the following categories: (1) rigid, (2) semi-rigid, (3) semi-flexible, and (4) flexible. All of these systems are fabricated on a positive model of the residual limb. The positive model is modified to increase loading of good tissue and to relieve or decrease pressures on sensitive areas prior to the forming of the definitive socket.

The rigid and semi-rigid systems are based on a laminated or thermoform socket. Limited flexibility is built into these systems, using flexible resins in fabricating the semi-rigid shells. A foam lining is generally employed to act as an interface between the rigid walls of the socket and the skin of the residual limb. The profile of the foot is restored with a build-up added to the socket. Complications may be encountered in using the rigid/semi-rigid designs when motion occurs inside the socket. Breakdown on the distal plantar surface of the residual limb is not uncommon, and this complication has led to the development of the semi-flexible and flexible designs.

Semi-flexible designs utilize a combination of material, generally having a base of urethane elastomer. One such system which is semi-flexible in nature and utilizes a laminated rigid University of California-Berkley shoe insert as its base. The insert is bonded to a modified monoelastic cushion heel foot and the entire

system is laminated together with a urethane elastomer.[1] The resultant system does not interfere with normal ankle motion, and authors report good acceptance (Figure 3).

Another semi-flexible design uses solely a urethane elastomer for fabrication of the socket and foot. This design is referred to as a slipper-type elastomer prosthesis (STEP). The STEP design is somewhat complex in its design and fabrication. Permanent tooling is developed for each individual patient and may be retained by the patient for possible fabrication of replacement devices at a later date. This tooling consists of a permanent polyester resin positive model of the residual limb and a negative mold of the finished prosthetic foot. This device is fabricated using semi-flexible urethane elastomer.[2] If a pressure point is noted on the residual limb, modifications are made to the prosthesis by removing material from the exterior surface of the prosthesis in order to reduce rigidity in that area and to insure a smooth socket interface. Good results have been reported from the use of this prosthesis.

Flexible Foot Prostheses

A flexible cosmetic prosthetic foot (Figure 4) has been developed which utilizes only reinforced silicone materials. A negative weight bearing alginate impression is made of the residual limb and contralateral foot. An exact detailed dental stone positive model of the residual limb is made from this impression. A wax check socket is fabricated on this model and checked for comfort and fit on the patient. Modifications are made to relieve sensitive areas and to load appropriate surfaces. Appropriate loading is based on the prosthetist's impression of soft tissue density and how much pressure the patient can tolerate. A mirror image model of the sound foot is sculpted from wax and checked for sizing against the patient. A negative model of the sculpted foot is then made using a lost wax method. The resulting negative model of the foot may then be used in conjunction with the rectified model of the residual limb to produce the prosthesis. The material employed is a pure reinforced silicone that is precolored to match the patient's skin tones. At the fitting, the detailed colored matching is achieved using the sound side as a model for cosmetic restoration. To date, approximately 100 patients have been fit with this flexible silicone cosmetic prosthetic foot, and patient acceptance has been almost 100 percent. The developer[3] initially intended the prosthesis solely as a cosmetic device (Figure 5). However, patients reported they had increased comfort and functional levels with the reinforced silicone prosthesis.

Requests for cosmetic restoration by males are almost equal in number to those requested by females. The psychological effect of cos-

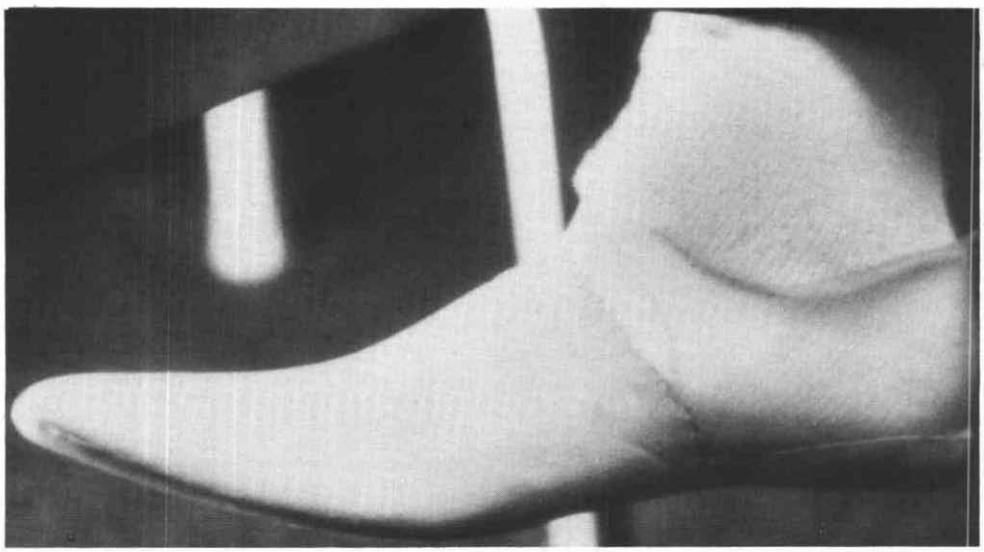

Figure 3. UCBL thermaformed shoe insert with Lynadure forefoot.

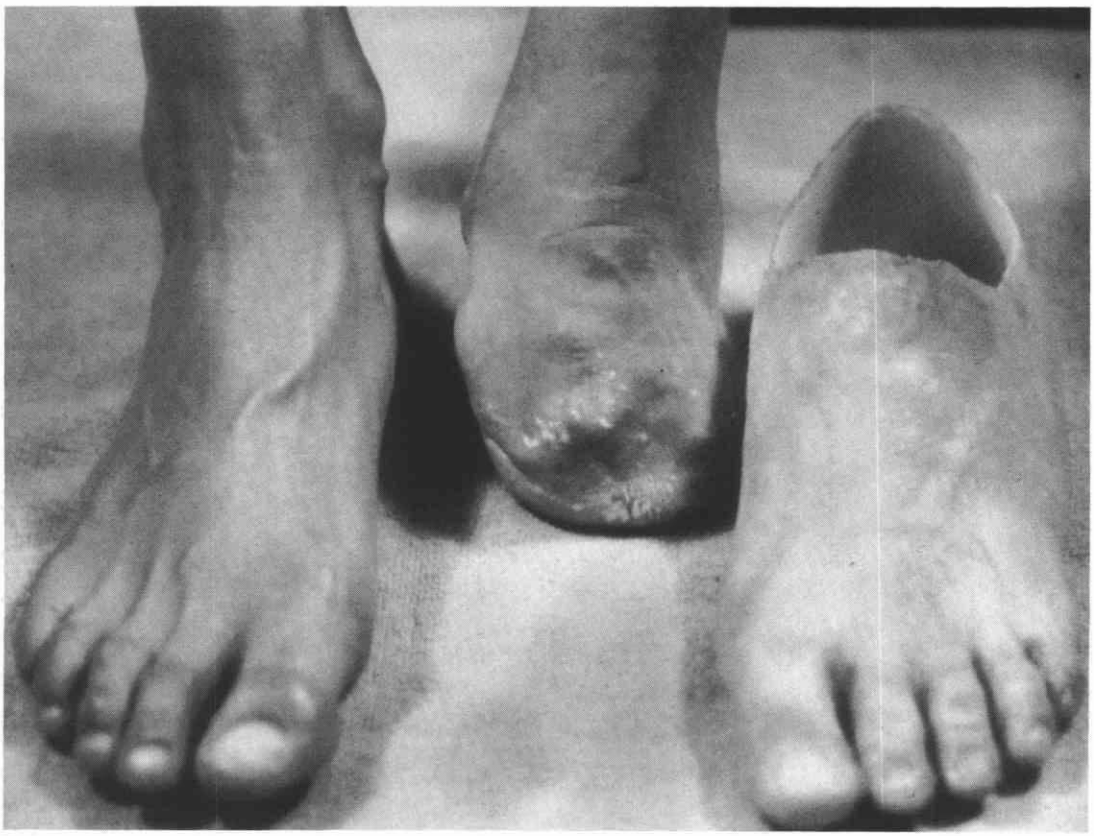

Figure 4. Reinforced silicone slipper type prosthetic foot. See Figure 2 for earlier fitting.

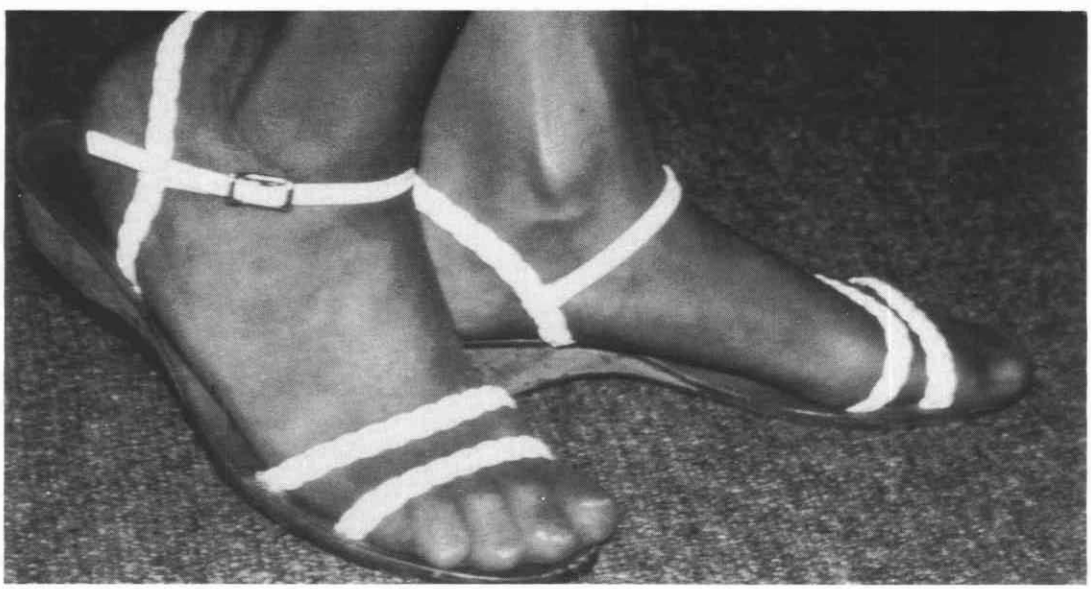

Figure 5. Cosmetic functional silicone foot prosthesis.

metic restoration has not yet been evaluated; however, it is probable that this has some influence on the functional acceptability of the prosthesis by the patient. Many of the patients fitted with a flexible silicone cosmetic prosthetic foot have previously been fit with partial foot prostheses of the types previously described. Mechanical comparisons of function of these designs would be valuable, but to my knowledge, have not yet been done.

Summary

A balanced foot is almost a necessity for successful fitting of any of the prosthetic systems. Trauma related amputations apparently do well with the slipper-type prosthesis, and the developer of the silicone system reports successful fitting in diabetic patients as well. The need for the prostheses to extend above the ankle appears to be limited to those patients with very short amputations, but successful fittings have been demonstrated with the slipper-type, sometimes using an ankle strap for suspension.

There is no definitive statement that I can make recommending any one system over another. It appears that many partial foot amputees are being successfully managed with prostheses that do not extend above the ankle. It also appears that a higher rate of success is occurring when semi-flexible and flexible prostheses are being fit. It is believed by many that partial foot amputation can offer significant functional improvement over Symes level amputations and the use of this surgical technique needs to be reevaluated in light of the new technologies and materials available today for providing the partial foot amputee with a functional prosthesis.

Acknowledgements

A number of talented individuals have contributed to the information and materials presented in this paper, and in order to avoid inadvertently omitting someone's name, I wish to thank them all as a group for their assistance.

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[1] Lynadure, Medical Center Prosthetics, Inc., Houston, Texas.

[2] Calthane 1900, Cascade Orthopedic Supply, Inc., Chester, California.

[3] Mr. H. Buckner, C.O.T., Life-Like Laboratory, Dallas, Texas.

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Clinical Prosthetics and Orthotics, Vol. 12, No. 1, pp. 19–23

A Partial Foot Prosthesis for the Transmetatarsal Level

by Jack N. Collins, C.P.O.

Introduction

Traditionally prosthetists and orthotists have faced the problem of partial foot amputations with the skills, materials, and observations gained from past experiences or from others in the field. The author is not aware of any extensive research in prosthetics for partial foot amputations. Attempts to provide a suitable prosthesis have ranged from a simple toe filler with arch support, to an ankle immobilizer at P.T.B. level, and lace-on fillers of many descriptions. In the author's observation, any prosthesis that goes above the ankle results in the buildup of unwanted forces.

The late Charles Childs, C.P.O.,[1] made the greatest breakthrough in partial foot prostheses. I attended his seminar in late 1978 and was very impressed with the entire approach demonstrated, especially the cosmesis and fit at shoe level height. Unfortunately, after a few weeks wear, the rubber material used in the fabrication of the prosthesis did not retain its shape and support against the extreme forces exerted in walking. The forces developed on the short lever arm, the foot, in walking are greater than at any other level of amputation. These forces applied in walking and running are not confined to the plantar surface of the residual foot, but are transmitted in part to the entire surface of the prosthesis. In turn, some of these forces are applied to whatever footwear is worn. Thus, the footwear applies a resistant force to the prosthetic appliance, quite often to the detriment of the appliance and the residual foot.

It must be stated at this point that the prosthesis about to be described has not been evaluated with foot amputations at the Lisfranc or Chopart level, but only on transmetatarsal level. And from our limited experience, developed over the past 7 to 8 years, a mid-transmetatarsal amputation presents fewer problems in toe-off than amputations at a greater or lesser length. With this in mind, the evaluation, casting, and fabrication techniques used will be described.

Evaluation, Casting and Fabrication

Evaluation is made in routine manner, for amputation level, range of motion at ankle, contractures, cut bone covering, abrasions, callosities and sensitive areas.

With patient seated in a chair, invaginate a casting balloon over the residual foot with a short piece of plastic tubing on the dorsum of the foot. Mark with indelible pencil all boney prominences, callosities and sensitive areas (Figure 1). Very carefully roll on a 4″ roll of plaster in a manner to cover the entire foot to the inferior edge of the lateral malleoli and with a thickness sufficient to retain its shape on removal. While the plaster is still soft, have the patient place his foot on the floor, with the knee at 90°, foot in neutral position (not in valgus), and with the weight of the leg on the plaster. Make marks with indelible pencil on the cast at 90° across the plastic tube. With a cast saw cut down the tube to remove the cast. If care is taken in applying the plaster, you will have a

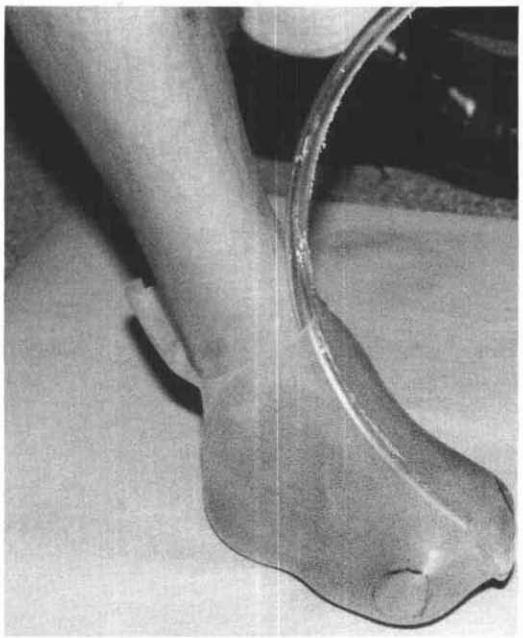

Figure 1. Foot ready for casting with casting balloon and plastic tubing in place.

very smooth and detailed cast on removal (Figure 2).

Close the cast carefully with plaster wrap, apply the release agent, and pour the cast with mandrel in place about 45° to vertical. This makes it easier to apply P.V.A. and stockinette. Remove the plaster wrap from the model.

Very little modification should be necessary. Add about ⅛″ plaster buildup over the boney prominence at the distal end and over any callosities or other sensitive areas. It is not necessary to modify as in the U.C.B.L. Shoe Insert casting method. Using a Scarpas knife, remove about 3/16″ to ¼″ plaster from the plantar surface ½″ proximal to the metatarsal ends, the width of the metatarsals, and taper in the direction of the heel about 1″ to 1½″ depending on the size of the foot. The anterior edge of cut should have a 5/16″ radius (Figure 3). Dry or seal the model.

Pull on one layer of nylon stockinette to allow for the patient's sock. Pull the P.V.A. over cast for vacuum. Tailor a piece of 1 oz. Dacron felt to cover the plantar surface. The felt should extend over the anterior distal end, laterally to cover the base of the 5th metatarsal,

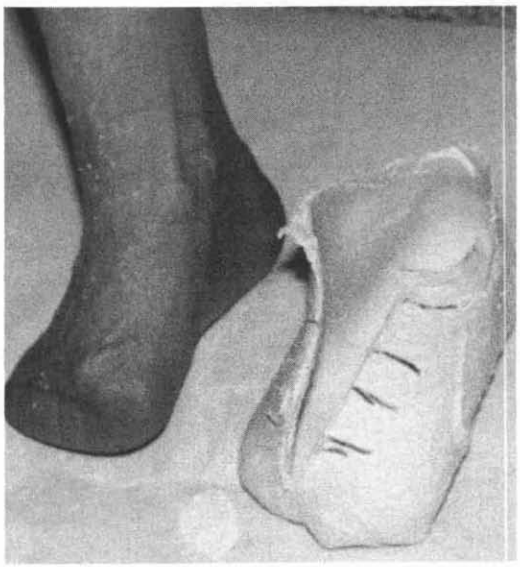

Figure 2. Cast removed

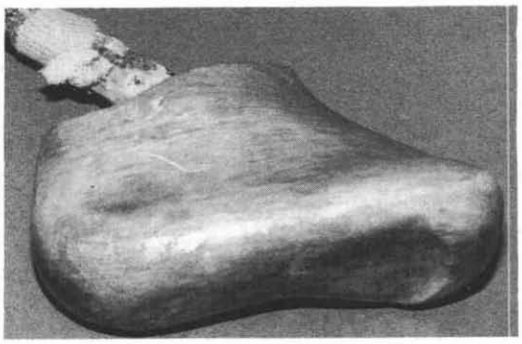

Figure 3. Modified positive model

and medially to cover the scaphoid prominences. Sew one end each of four lengths of nylon stockinette and pull on the model with the Dacron felt in place. On heavier more active patients, one layer of woven glass reinforcement is added between the felt and stockinette. When pulling on the stockinette, take care not to pull out the stretch of the stockinette. The stretch needs to be retained in the silicone laminated areas to allow donning. Take two 4″ P.V.A. sleeves and cut 12″ long pieces from the small end of each to make feeder tubes. Apply a 6″ moist P.V.A. sleeve to the model so as to give a smooth surface all over. Do not tie off the ends, but do dry with a heat gun. Use a tongue depressor to push the small end of one of the feeder tubes under the P.V.A. sleeve at the heel of the model. The tube should

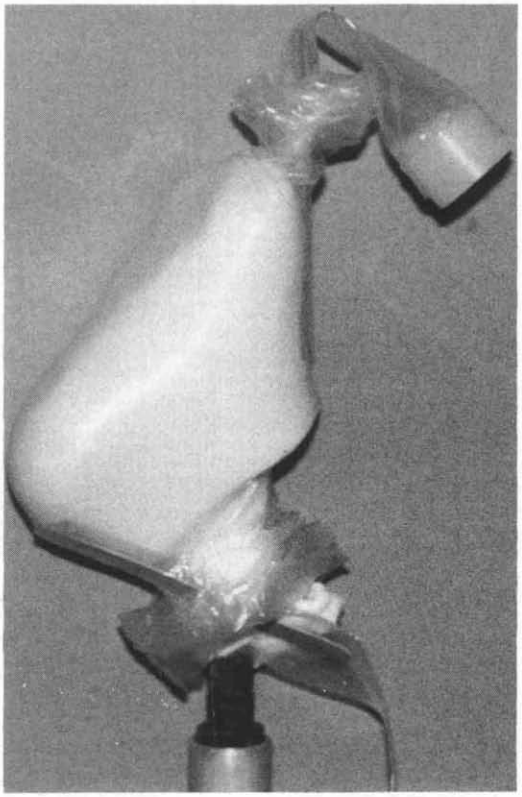

Figure 4. Completed layup with P.V.A. sleeve and feeder tubes in place

be about 3/8" from the plantar surface of the heel. In the same manner, position the remaining feeder tube under the P.V.A. sleeve over the dorsum of the model. The tube should be about 3/8" from the proximal edge.

Roll a 1" wide by 6" long piece of 1/16" thick polyethylene into a funnel and place in the open end of one of the tubes (Figure 4). Mix 80 grams of Dow Corning 382 silicone with 2 or 3 drops of appropriate color and catalyze as directed by Dow Corning, pour into the funnel and very carefully squeeze into the stockinette. On the dorsum of the foot, laminate the section the shoe lace will cover, or a little more area. Squeeze with your finger tips to get a thorough and even penetration working the Silastic, laterally, and distally down to, but not onto the plantar surface. Working with the fingers gives better penetration without spreading the resin to unwanted areas. After this has cured, repeat in the same manner posteriorally. The posterior

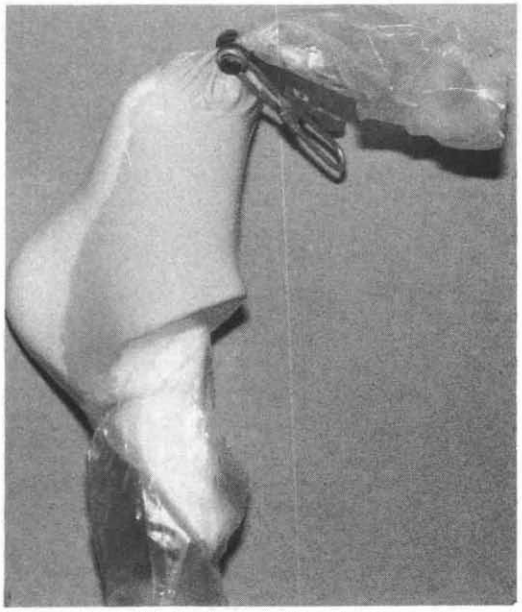

Figure 5. Initial phase of lamination. Dorsum and proximal border of socket have been laminated with Dow Corning 382 Silastic.

portion should extend distally down the back of the heel to the sole and anteriorally along the proximal trimline for a width of 1" distal of the trimline so that it meets the posterior border of the anterior lamination medially and laterally (Figure 5). When the posterior portion has cured and both feeder tubes have been removed, tie off the pipe end of the 6" P.V.A. sleeve and pour in 150 grams of 4110 Laminac that has been catalyzed and pigmented. Saturate the remaining lamination and maintain it under a vacuum until cured. While the polyester is still warm, trim to the shoe top level and remove the prosthesis from model (Figures 6A and 6B). The prosthesis is now ready for fitting.

In weight bearing, check for comfort, undue pressure, and position of the foot. More than likely it is in some valgus, as any foot amputated proximal to the head of the first metatarsal loses its medial support. With small wooden wedges, you can determine the amount of posting needed under the distal end of the first metatarsal to hold the foot in a neutral position. When this has been done, mix a small amount of thickened polyester and add it to the distal plantar surface of the first metatarsal area to establish the desired position. When comfort and

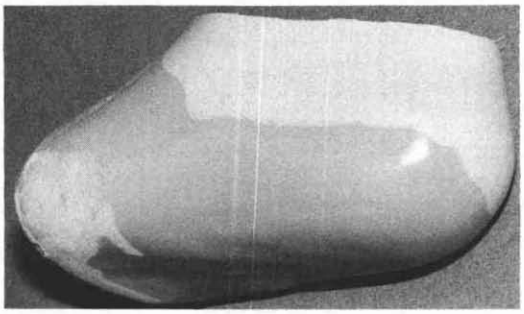

Figure 6A. Socket completed and removed from model, medial view

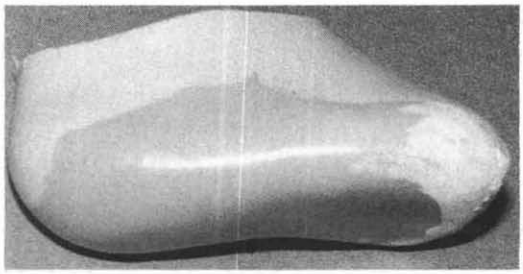

Figure 6B. Lateral view

fit have been achieved, the prosthesis is ready to be completed.

Obtain a shoe from the patient for foot sizing. Take a plaster wrap of the distal portion of an appropriately sized S.A.C.H. foot. When the plaster on the S.A.C.H. foot has cured, remove it from the foot, and inspect the inside for smoothness. Fill any voids and smooth nicely. Dry the plaster and paint the inside with ambroid or celluloid. Spray the inside of the toe cast with silicone release agent.

Rivet with two #12 copper rivets, a 11″ long by 1½″ wide .0035 thick blued steel spring, that has been shaped to the contour of the inside surface of the shoe sole, to the plantar surface of the socket. Shear off the distal portion of the spring so it ends about 1″ from the toe. Drill a hole for a #12 copper rivet and rivet on a small "U" shaped piece of leather to act as an anchor for the silicone toe piece (Figure 7). Drill ½″ hole in the distal plantar surface of the toe cast. Wipe the anterior surface of the prosthesis with acetone. It must be clean. Fit the plaster shell over the spring and anterior portion of the prosthesis as far proximal as necessary to obtain proper foot length. Be sure the spring or leather anchor does not come in contact with the inside

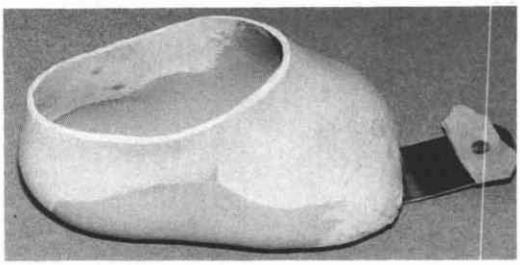

Figure 7. Socket with toe spring and leather anchor rivetted in place

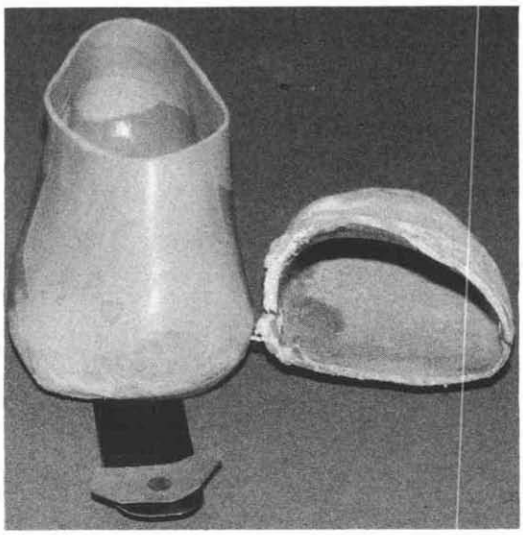

Figure 8. Socket and plaster toe mold

of the plaster mold. When properly positioned, solidly tape the plaster wrap to the prosthesis (Figures 8 and 9).

Mix 65 grams of Dow Corning #382, 5 grams Dow Corning Q74290 Prosthetic Foam, and 2 or 3 drops of appropriate pigment. Catalyze and pour slowly into the ½″ hole in the toe. Stand the assembly on the back of the heel, toe up, and support it in this position until foamed and cured. When the foam has cured, carefully use a thin instrument to pry the silicone toe gently loose from the plaster. It should come off with little effort. Depending on the smoothness of your plaster toe mold, the release agent used, and the foam mixture, the prosthesis should be very presentable (Figure 10). If it is rough and has air holes, sand it smooth and paint on a coat of Pigmented Dow Corning #382.

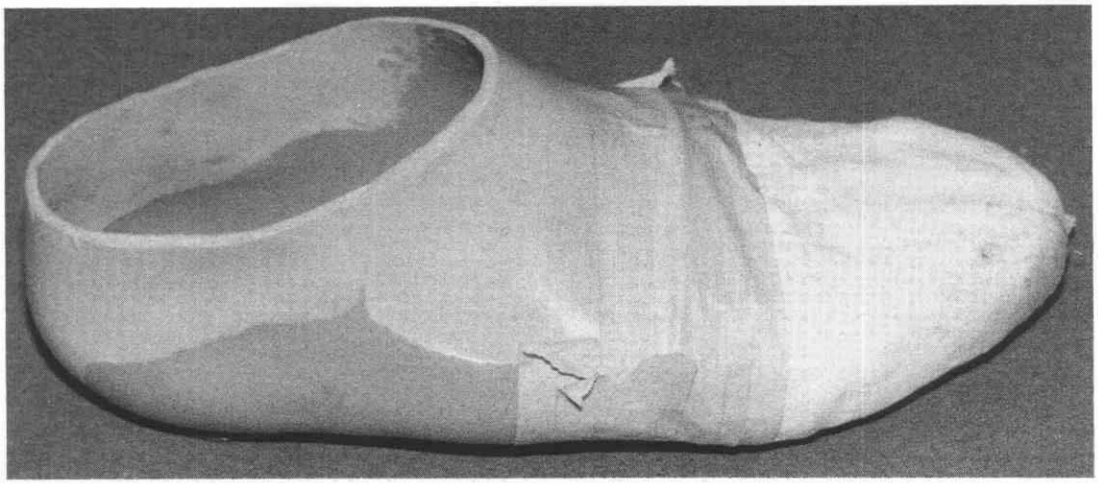

Figure 9. Toe mold taped in place

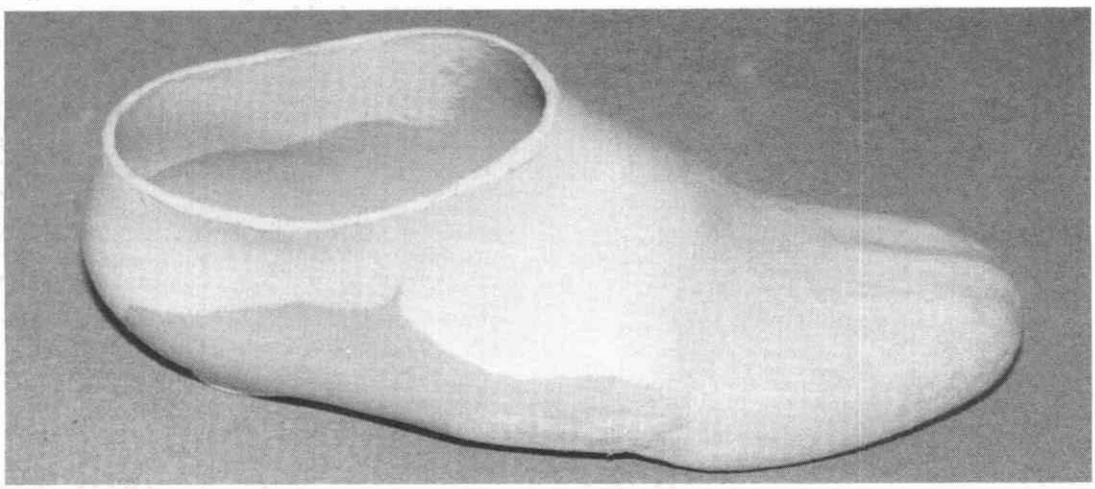

Figure 10. The completed prosthesis

Summary

The rigid control of the residual foot, yet flexible entry and toe off, together with good patient acceptance, cosmesis, and wearibility makes this type prosthesis our choice in the prosthetic management of transmetatarsal amputations. We call this the C.O.S.I. Partial Foot Prosthesis (Collins Orthopedic Service, Inc.).

Addendum

It is the author's opinion that Lisfranc and Chopart level amputations could be approached in a similar manner by extending the distal support and point of toe off to a more normal position. However, this opinion is not based on personal experience with using the C.O.S.I. Partial Foot Prosthesis to fit these level amputations. This would require some thought and quite a bit more effort in the lamination procedure.

Reference

[1] Childs, Charles, Pacific Orthotic and Prosthetic Services, 111 East First Street, Medford, Oregon 97535.

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Clinical Prosthetics and Orthotics, Vol. 12, No. 1, pp. 24–28

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 copolymer1 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 calcaneous 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 calcaneous 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 calcaneous. 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

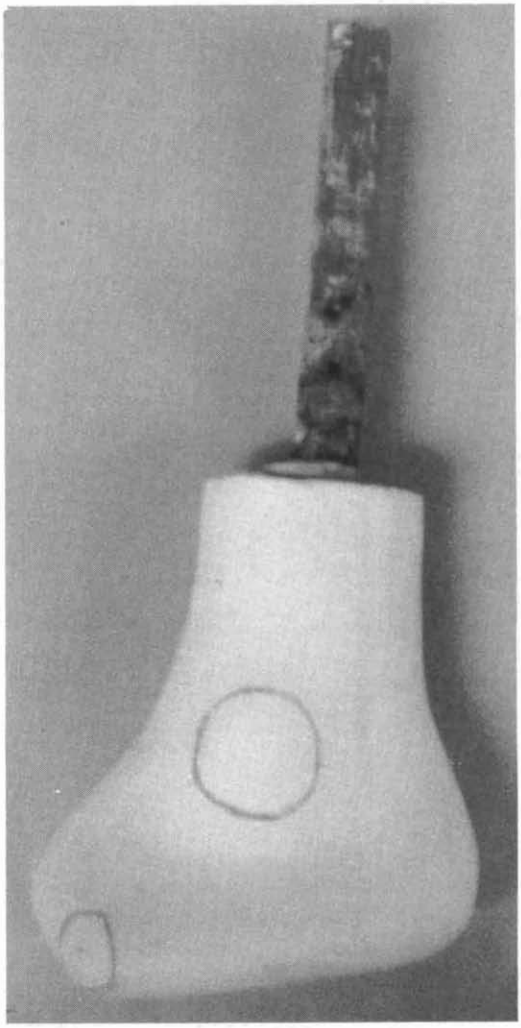

Figure 1. A modified positive model.

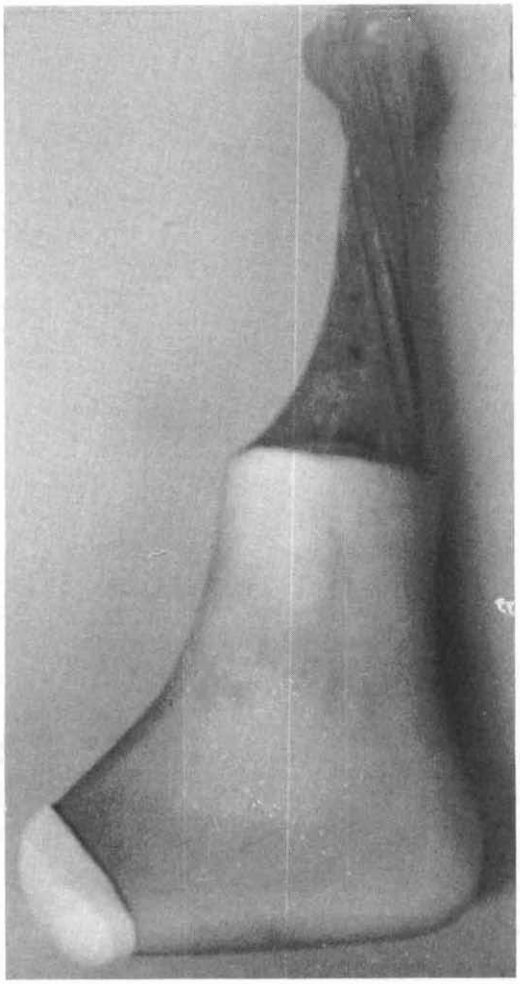

Figure 2. The positive model with distal cap in place.

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

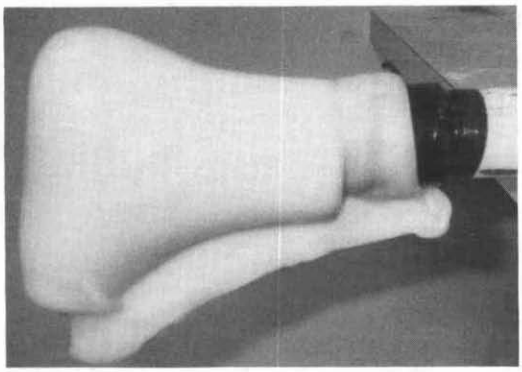

Figure 3. A vacuum-formed heel cup.

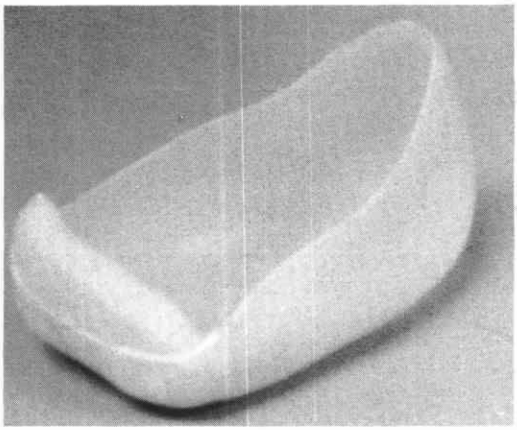

Figure 4. A heel cup with distal end cap.

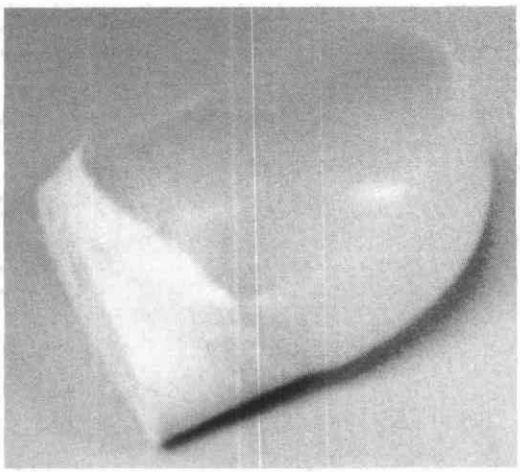

Figure 5. A heel cup with distal end built up and flattened.

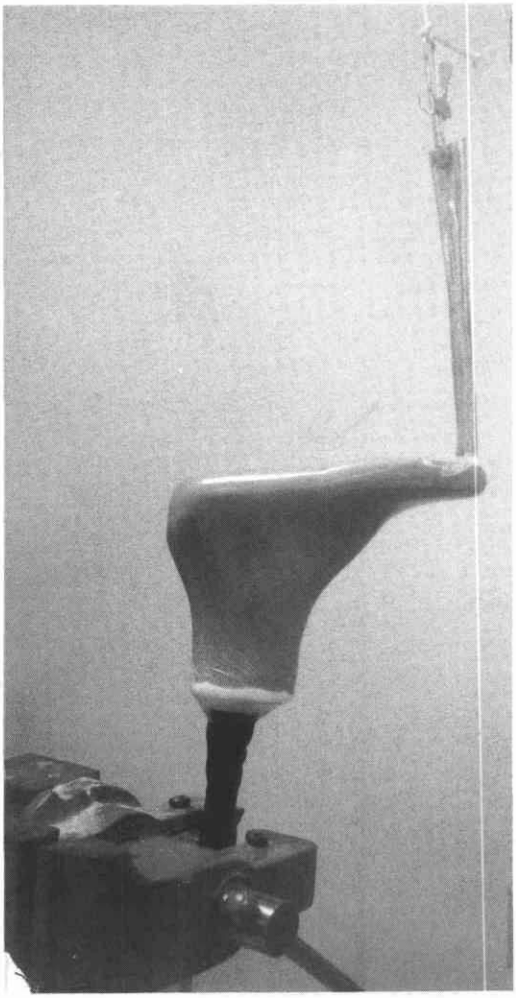

Figure 7. Lynadure lamination.

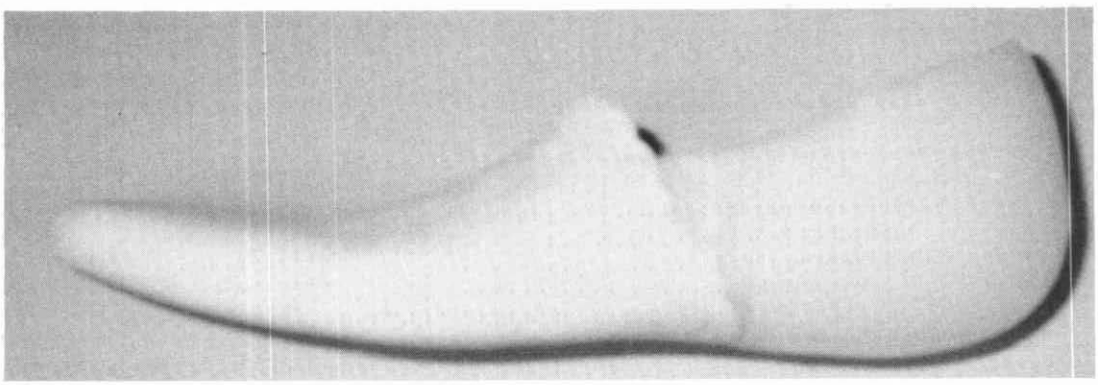

Figure 6. Toe extension.

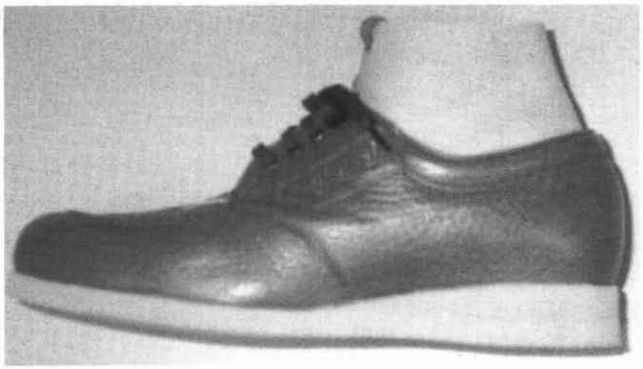

Figure 8. The prosthesis in the patient's shoe.

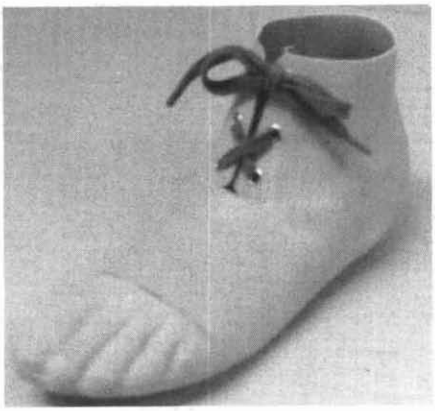

Figure 9. The finished prosthesis.

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, Colyene: Orthotic Prosthetic Enterprises, 1316 Sherman Avenue, Evanston, Illinois 60202.

Lynadure: Medical Center Prosthetics, 6955 Almeda

Road, Houston, Texas 77021.

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

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Clinical Prosthetics and Orthotics, Vol. 12, No. 1, pp. 29–32

The Total Contact Partial Foot Prosthesis

by Richard LaTorre, C.O.

The purpose of this paper is to present a prosthetic fitting procedure for a "Partial Foot" level amputation. The "Transmetatarsal," "Lisfranc," "Chopart," and "Pirogoff" type amputations are all treated with this procedure with some modification, mainly in length of forefoot. The partial foot as a category presents more anxiety among physicians and prosthetists and clinics, than is generally realized. For the avascular patient, a "toe filler" is not adequate, no matter how cosmetic it appears. Classically, patients who are diabetics and have been given toe filler type prostheses tend to develop eversion, a tightening of the Achilles tendon, and are usually doomed to perforating ulcers on the distal plantar anterior or distal anterior portion of the residual foot.

The solution presented here is an ultra-lightweight prosthesis, one that removes stress (caused by torque on the leg), protects the extremity from shock at heel strike and toe off, controls plantar and dorsi-flexion, controls eversion, controls edema, and still is cosmetically acceptable. This style prosthesis has been in use since March, 1974. By 1977, 62 prostheses of this type had been successfully delivered. The largest group of patients was between 45 and 65 years of age and almost equally divided between males and females. The next largest group was geriatrics (over 65) and only four patients were in the 20 to 45 age group. Only one patient went on to further amputation.

As a result of wearing this type of prosthesis, the residual limb is usually warm, free of ulcers, callosities, and edema. When compared to the contra-indicated extremity, it appears to be generally healthier and most patients state "it feels better than my other leg."

By 1984, this type of prosthesis was being fabricated at the rate of one every three weeks. At present, the average is one every two weeks.

"Lower Profile" partial foot prostheses are also fitted, but only after the patient has successfully worn this two piece design for at least six months. This insures, if trouble starts with a Low Profile prosthesis, there is no "down time" for the patient; they simply go back to "old faithful."

Incidentally, we have also developed three different styles of the Low Profile partial foot prosthesis (that we have not described in the literature), but have never been able to develop a series of four or more successes for each design.

Evaluation and Casting

Prior to casting, a prosthetic evaluation is made to determine joint limitations, noting mainly inversion/eversion and degree of plantar flexion/dorsi-flexion. Old scars are noted, as is the condition of skin over bony prominences and any possible weeping of draining areas. The patient's weight, height, and occupation are included in the evaluation before casting. Determination of material, usually polypropylene, thickness of material selected, and length of the prosthesis to be fitted is made at this time. The negative cast is usually taken with the patient in the sitting position. Any scab or draining area is covered with Saran

Wrap® or its equal. Stockinette is then applied to the extremity from the toe to the supra-condylar area. With indelible pencil the malleoli, anterior crest of the tibia, head of the fibula, old scars, and any extremely sensitive-to-touch areas, as well as those that may cause future problems, are marked.

Casting is a two step procedure. The residual foot should be barely touching the floor and the foot to tibia relationship should be 90°. Splints of plaster of Paris are laid on the anterior tibia from a point approximately 2 cm. distal of the level of the tibial tuberosity distally to the point of floor contact. If it has been decided to weight-relieve the ankle complex, the well known P.T.B. casting procedure is used at this point.

The extremity is now wrapped with Coban bandage. Coban is a plastic seersucker type material that acts as a waterproof Ace bandage and will not adhere to plaster. This technique enables the practitioner to make a thin-walled cast that is easier to remove from the tender extremity. The ''Coban Technique'' gives an eggshell hard cast, because it compresses the plaster, thus enabling the user to use less plaster and still obtain a firm satisfactory cast.

As soon as the extremity is wrapped, it is replaced in the original position, (i.e. foot to tibia relationship of 90°). After the cast has sufficiently hardened, the bandage is removed and rerolled for future use.

The already cured plaster and stockinette are now coated with K-Y Jelly. Plaster strips 4″ × 12″ are applied vertically to the posterior and lateral aspects of the extremity, overlapping the anterior cured cast from ¾″ to 2″. The extremity is wrapped once again with the Coban bandage and returned to the sitting position. The Coban bandage is removed and reference lines are horizontally laddered across the cast overlapping areas when the posterior section has hardened. The exterior cast is carefully removed, the stockinette is cut away posteriorly, and the anterior ''shell'' carefully removed. Both sections are quickly re-oriented to each other and sealed together.

In the laboratory, the negative cast is rinsed with a solution of soap or detergent, the surplus is poured out, the cast is placed in a sandbox, and the positive model is poured with bulk plaster. A pipe is placed in the cast and held in place until the plaster has set.

Fabrication

When the model is hard, the negative cast is stripped away. The model is held in a bench vise, sanded smooth, and plaster is added to problem areas noted at the time of casting. The amount added is 6–7 mm. at both malleoli, fibular head, and along the tibial crest. A 3mm. buildup over any scar or weeping area is sufficient. At this point, the model is covered with a layer of stockinette.

An appropriately cut section of sheet polypropylene is placed in an oven at 400°F for ten minutes. The material is draped over the anterior portion of the model. The material will have the consistency of taffy when removed from the oven. If any wrinkles appear, the plastic must be discarded and a new piece cut and molded. Sometimes several trials are necessary until satisfactory results are achieved.

When cooled, the anterior portion is removed from the model, trimmed, and all edges smoothed to the touch. The plantar trimline is just anterior of the os-calcis. The medial and lateral trim lines are on the midlines viewed in the sagittal plane. The original technique has been modified so as to provide a more posterior plantar trim line that now encompasses the os-calcis. This reassembles an inverted ''T'' shape.

The model, minus the anterior molded shell, is further prepared by tacking a leather innersole that fits the patient's shoe (or opposite foot pattern inverted) to the plantar surface of the model. One inch nails are driven into the anterior portion of the positive model to provide an anchor for the plaster to be added next.

The cast with the innersole attached is placed on a casting board. This is usually done with the aid of a vertical alignment jig, but can be accomplished manually without a jig if great care is exercised. This aligns the model to simulate the normal contour of the shoe relative to ball and heel. Bulk plaster is now applied to the innersole and built up onto the anterior foot portion. When firm, the plaster is trimmed to the edges of the innersole.

The model is placed back in the vise horizontally and rotated so the posterior surface faces the fabricator. Appropriate size plastic is laid out and cut, and the molding process is repeated.

Once cooled, the posterior shell is removed

from the model. The forefoot is trimmed away laterally so all that remains, from midfoot running distally, is an innersole-like projection (i.e., it resembles a molded polypropylene solid ankle-ankle-foot orthosis).

The anterior buildup of plaster is now removed from the original model. The polypropylene anterior shell snaps back on the model and the posterior shell goes over it. A Velcro® closure is attached to the proximal portion and a filler is cemented onto the innersole portion to simulate the forefoot and fill the shoe. The material used is plastazote bonded with barge cement.

This version was used until 1983 when a woodsman who complained that "the toes lose their spring" was encountered. This was found not to be a problem with other patients. To satisfy this patient, roughly ten modifications of the forefoot section were tried. Unsuccessful were thicker polypropylene, metal reinforcement (spring steel), "double soling" the forefoot, and many other less involved changes. All met with patient displeasure. Success came with the fabrication of a forefoot "box section."

To fabricate one, bulk plaster is poured into a shoe box top to provide a mold. Polypropylene is molded over this. The molded plastic is cut into quarters and the four corner pieces are arranged in such a manner that the corners fit together forming a three dimensional cross shape. Place them onto the anterior "sole" of the prosthesis. Trim to fit the edges of the sole. Rivet the two anterior (left and right) sections to each other and then to the toe section of the prosthesis. Next, rivet the remaining two pieces together and place this section against the anterior shell. Trim and fit it until a ⅝" gap is formed between it and the "anterior box" section. Rivet the remaining loose box section to the sole (Figure 1). The ⅝" gap between the two "box" sections is filled with foam rubber (Figure 2). The durometer selected depends on how firm a toe break is desired. This design has provided the more agressive patient with a toe action that simulates the push-off activity of the contralateral foot.

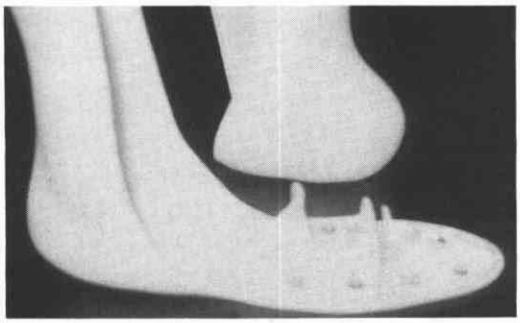

Figure 1. Box sections rivetted in place. Anterior shell shown in the back ground.

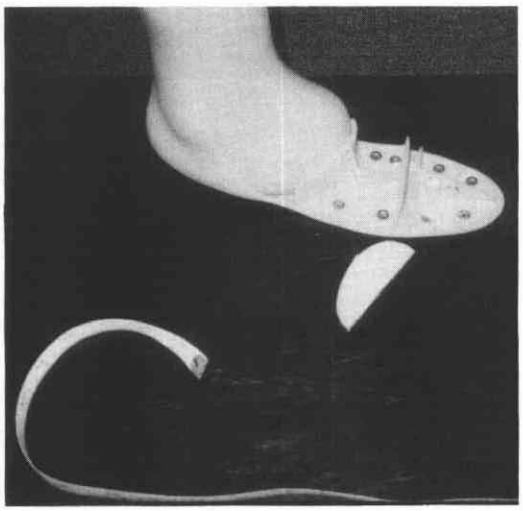

Figure 2. Foam rubber bumper laying beside forefoot section. Anterior shell in place.

Fitting

The prosthesis is now ready for fitting. Shoes used have usually been of the double depth type with removable innersole. This type is preferred because it gives extra depth inside the shoe for the affected extremity and allows room for, and needed balancing of, the remaining foot. Most often the patient has been fit with the extra depth shoes and they later purchase ordinary footwear and manage without incident.

It is felt that the total contact principle that has been so beneficial to other amputees has been adopted successfully in the design of this prosthesis. By encapsulating the extremity, edamatous problems have been prevented and circulation boosted, or so the patients have reported. The skin texture is soft and warm by comparison to the contraindicated limb. In fact, many patients have remarked that the extremity

had always felt cold but now the other leg feels cold by comparison. This prosthesis prevents the problem of distal end friction that can result in further amputation.

It is not possible for a shoe to cause friction to any part of the residual limb. One patient, who is a farm machinery repairman, has also found that it prevents the problem of bruising of the shin he encountered in his occupation.

This style prosthesis, for all its length and function, weighs little more than the toe-filler type prostheses and is certainly lighter than other versions. It is relatively more expensive than most toe-fillers, but considerably less expensive than other types of prostheses, such as a conventional Chopart.

On heel strike, the material ''puckers'' slightly, cushioning the impact. On foot flat, as well as at toe-off, the action of the foresection simulates the norm. In many patients, better gait on the affected extremity than on the contra-indicated limb has been observed.

The gaits of all patients fitted have improved dramatically and some are undetectable to the eyes of even trained personnel.

Conclusion

Experience to date is that the above described prosthesis provides superior gait, less cost, less weight, and better patient acceptance than other types of Chopart protheses. The material will torque with the extremity and does cause friction to tissue of poor quality.

This material was originally presented in 1974 and not submitted for publication because it was thought that it would be outdated within a year or two. Evidently, this was a wrong assumption. With an ever increasing number of surgeons doing more distal amputations, there have been more and more requests for this information.

Acknowledgments

We thank Siegfried Paul, C.P.O., for awakening us to thermoplastics, Thorkild Engen, C.O., for introducing us to polypropylene, and Dr. Richard Jacobs for being all that a great physician should be.

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The Rancho Syme Prosthesis with the Regnell Foot

by Michael J. Quigley, C.P.O.
Sam E. Hamontree, C.P.
Joe Antorietto

The Syme amputation has been with us since 1842, when James Symes developed it for three reasons, "(1) the risk to life will be smaller, (2) a more comfortable stump will be afforded, (3) the limb will be more seemly and useful for ambulation."[1] Since then, the major improvement in the surgical technique has been the introduction of the two stage Syme amputation,[2,3] which was developed to increase the success rate in dysvascular and infected patients. Wagner further refined the technique at Rancho Los Amigos Hospital, and increased his success rate to 95% by the use of Doppler ultrasound to determine adequate blood flow.[4] Wagner also advocates removing the flares of the tibia and fibula during the second stage to narrow the distal end and provide better cosmesis.

The advantages of the Syme level of amputation are many (Figure 1), but the design of the prosthesis has been a constant challenge for prosthetists (Figure 2). The Syme level amputee is typically more active, walks at a faster pace, and expends less energy than the below-knee amputee;[5] for these reasons the demands on the prosthesis are greater. Breakage of Syme prostheses has been a constant problem, especially with prosthetic designs that have openings (medial opening, posterior opening, etc.). Syme prostheses that have no openings must allow enough room for the bulbous end of the leg to pass through, giving a "stovepipe" appearance to the leg. In addition, the "no opening" designs had other advantages, i.e., the silastic bladder expandable wall design was not durable and tended to delaminate, the full insert type added additional bulk to the pros-

Syme Amputation

Advantages

- Natural weight bearing surface
- Some patients can walk a few steps without a prosthesis
- Less energy expenditure than B/K level
- Higher gait velocity than B/K level
- Fewer gait deviations, less therapy than B/K level
- For patients who may lose other leg in the future, the Syme will become the "sound" side
- Fewer prosthetic fitting problems due to discomfort than B/K level

Disadvantages

- Slow healing for many patients
- Bulky distal end-poor cosmesis
- Many patients cannot walk on distal end
- Breakage problems if prosthesis with opening is used

Figure 1.

Syme Prosthesis Design Requirements[6]

1. Transmission of body loads
2. Lightweight
3. Supply foot and ankle function
4. Compensate for leg length discrepancy
5. Distribution of forces developed around ankle
6. Rotational stability
7. Shock absorption
8. Self suspension
9. Ease of donning
10. Adjustabiity for pressure relief
11. Cosmesis
12. Durability

Figure 2.

thesis, and the removable pad design needed constant adjustment.

The Rancho expandable wall prosthesis eliminates many of the problems inherent in other designs. This prosthesis was first described in the AAOS Atlas of Limb Prosthetics although fabrication was not detailed at that time. The Rancho expandable wall prosthesis incorporates the following features:

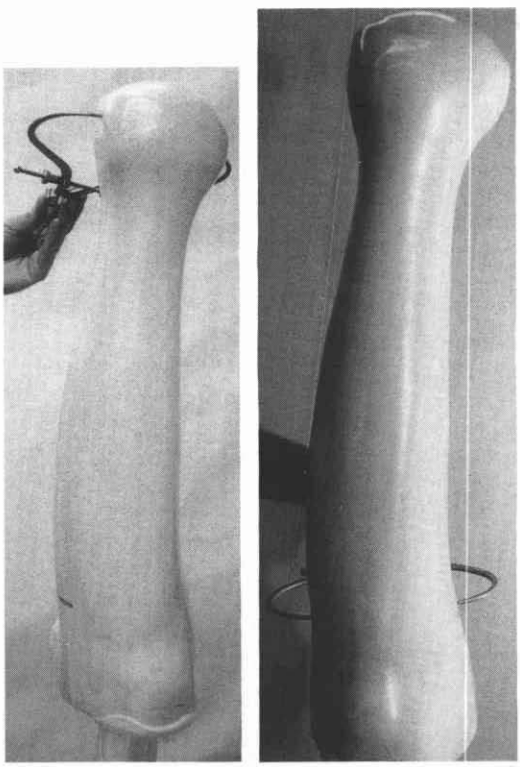
1) **Strength**—The ''no opening'' design laminated to the Regnell foot provides maximum strength and durability.
2) **Expandable liner**—A durable elastic window sewn in a thin flexible inner liner eliminates problems with silastic or Pelite™ inserts, which will tear or add excess bulk.
3) **Cosmesis**—No buckles or straps are required. No line or seam at ankle joint. Bulk is kept to a minimum with thin wall thickness.
4) **Ease of adjustment**—Although the expandable inner is bonded in place permanently, it can be left unbonded for the first month of wear to allow for adjustments.
5) **Can accommodate large distal ends**—Two expandable windows can be made in the flexible liner to allow for large distal ends.

Negative Impression Procedure and Measurements

The plaster negative impression is taken in the conventional manner. Reliefs are made over the bony prominences by the use of ⅛″ padding before the impression is taken. The circumferences of the distal end and the narrowest part of the ankle should be compared. Maximum cosmesis is attained when the malleoli have been trimmed and the largest circumference at the distal end is about ¾″ greater than the smallest ankle circumference.

Fabrication

After the necessary modifications are made to the positive model, measure the M-L at the distal end, then move the calipers proximally



Figures 3A & 3B. Measure distal end with M-L calipers and move proximally until the same M-L is found to determine the length of polyethylene panels and the buildup needed on the inner socket.

until the model has the same M-L. This will determine the length of the elastic panel (Figures 3A and 3B). If the circumference of the distal end is 1¼″ or greater than the narrowest part of the model, two elastic panels will be necessary.

To allow space for the elastic panel, polyethylene "inserts" (Figures 4A and 4B) are cut to the length determined above, and are inserted between two nylon stockinettes for the expandable liner. The polyethylene inserts are laminated into the nylon using a 80% flexible, 20% rigid resin.

The PVA bag is left on the lamination and a polyurethene foam buildup is made over the lamination (Figure 5); this is then measured and shaped down to ¼″ less than the circumference of the distal end. A PVA bag is pulled over the foam and an outer shell of 6 nylon is laminated using rigid (90-10) resin (Figure 6). After the resin sets, a hole is drilled in the distal end and the outer lamination is forced off the model using compressed air (Figure 7). The polyurethene foam buildup and PVA bag are then removed from the inner lamination.

Remove the polyethylene inserts by drilling small holes in the center of each end and slitting the outer nylon with a razor (Figures 8 and 9). Most of the laminated nylon covering the

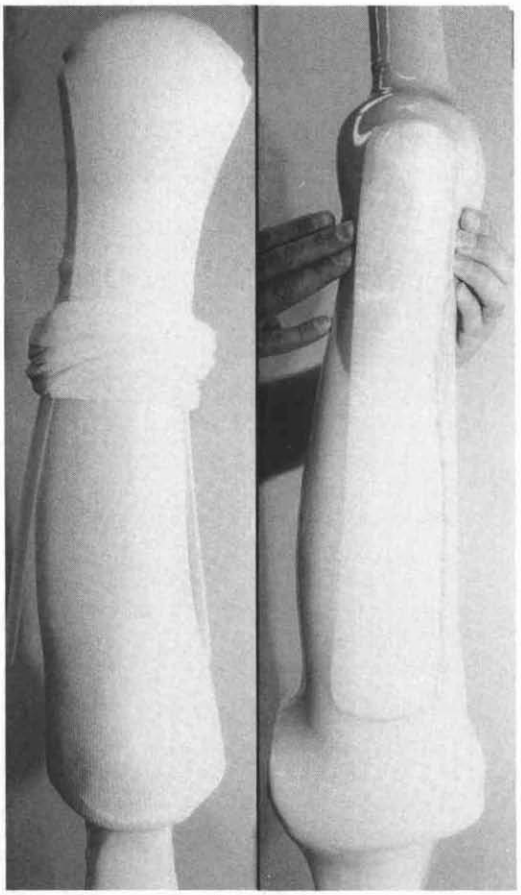


Figure 4A. Medial/lateral polyethylene inserts are inserted between the two points made by the calipers. 4B. Inserts are laminated into expandable bladder using 80% flex and 20% rigid.

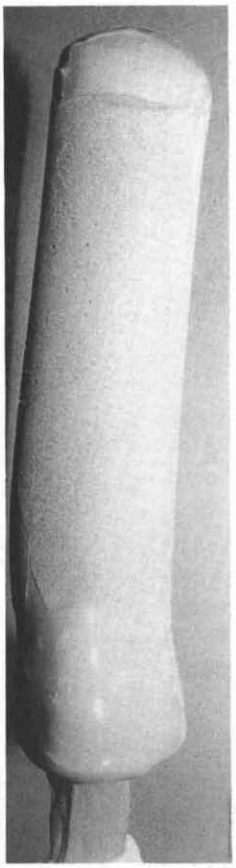


Figure 5. Foam buildup which results in the void necessary for the expandable bladder to open, allowing the patient to don the prosthesis.

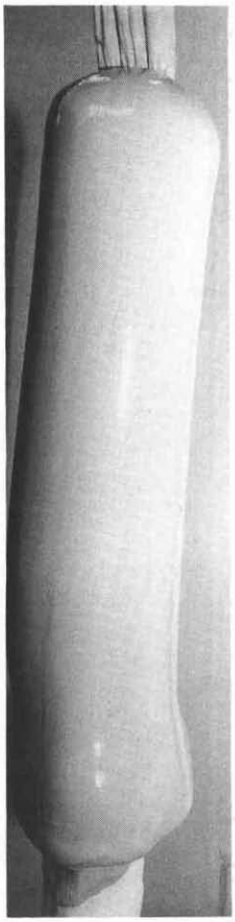


Figure 6. Laminated outer shell over the expandable bladder with the foam buildup.

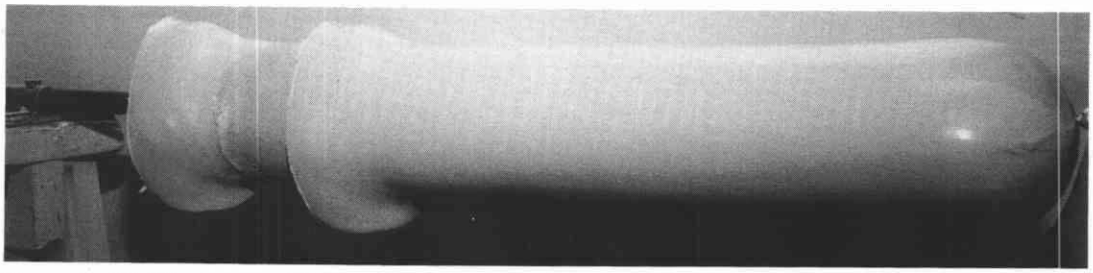


Figure 7. Bladder being pulled out of the laminated outer shell.

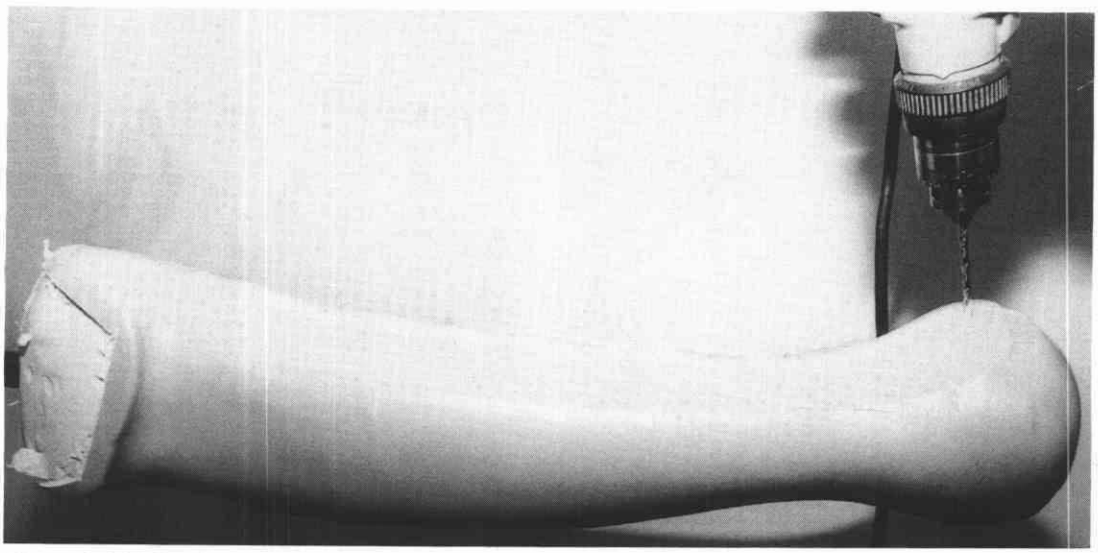


Figure 8. Drilling holes at widest proximal and distal points to properly position the slit in the bladder for the elastic panels.

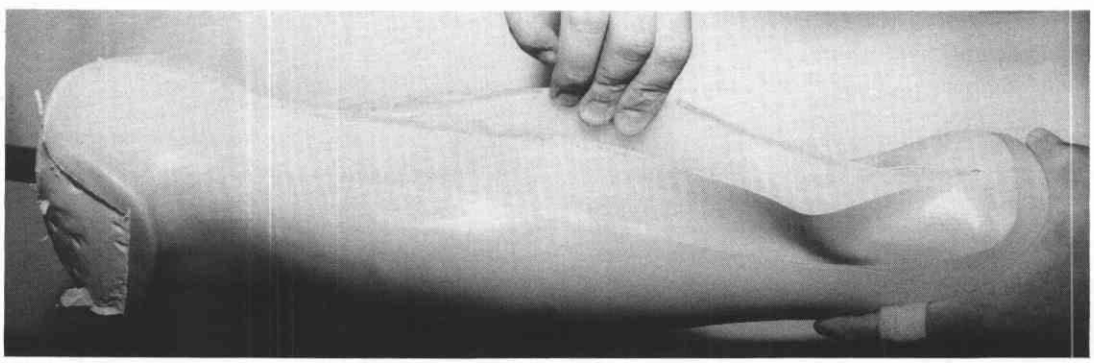


Figure 9. Slit the lamination with a razor vertically to connect the drill holes. The polyethylene panels are used to determine the shape and size of the elastic panels that have been trimmed to size and are to be inserted into the bladder.

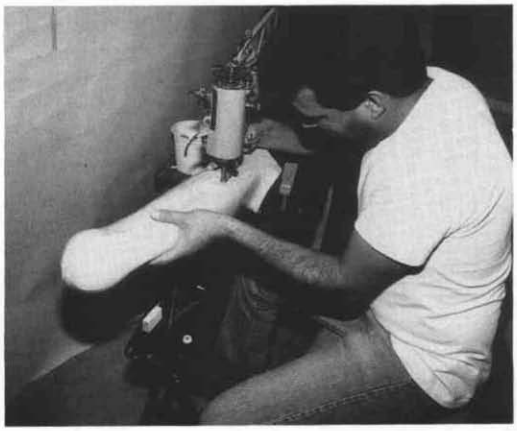


Figure 10. The elastic panels are inserted; it helps to tape them in temporarily at the proper width in preparation for sewing in the elastic.

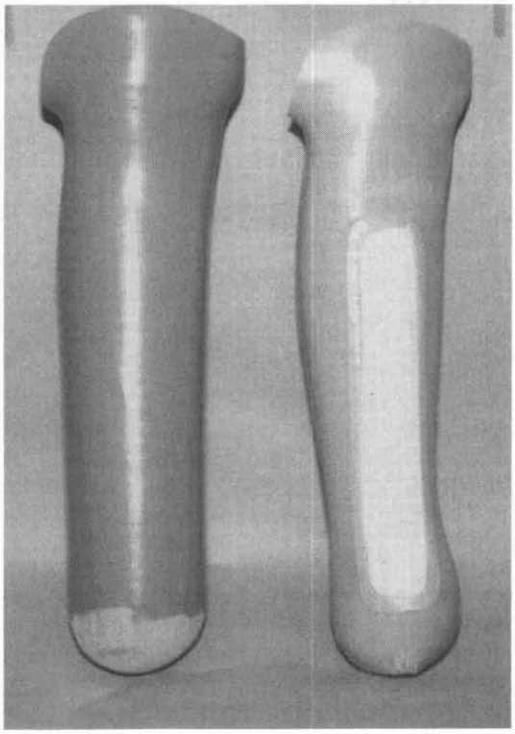


Figure 11. (right) Outer socket and inner expandable socket with elastic panels sewn in place.

outside of the polyethylene sleeve is removed, leaving a ¼″ overlap to hold the stitching for the elastic panel. A single vertical razor slit is made on the inside of the liner to allow expansion. Use the polyethylene sleeves as patterns to cut out one-way stretch elastic. The proper elastic for this procedure, called grip-net, is difficult to find, as it must have a heavy durable weave and comes in a wide roll (8″ or greater).

The elastic panels are temporarily taped in place and then sewn in place in a long arm patcher sewing machine (Figure 10). The liner may have to be folded and/or lubricated with silicone to allow the machine to reach the end of the insert. The prosthesis is now ready for static alignment on the Regnell foot (Figure 11).

The Regnell foot is an external keel design specifically suited for Syme prostheses because the distal end of the socket can be placed very close to the floor: a thin sole and heel cushion take little space under the prosthesis. No ankle bolt is needed, and the finished laminated external keel provides good cosmesis. The toe break is located and designed to allow for more optimum A-P alignment of the socket, resulting in smoother functional rollover and more cosmetic shaping.

Static Alignment

Static alignment can be set up by either sinking the socket into the keel of the foot, or by cutting off the top of the foot with a bandsaw, leaving only the amount equal to the leg length discrepancy (Figure 12). The socket is then sunk into the block cut-off of the foot and tack glued to the prosthesis (Figure 13). The second method allows the prosthetist easier M-L and A-P and toe-out adjustments by simply moving the block on the prosthesis and regluing. Dynamic alignment is achieved in the usual manner.

Finishing

Following dynamic alignment, the socket is shaped to blend into the foot and roughed up. All soft parts of the foot are taped off and the final lamination of 2 nylon is made. The sole of the foot is not removed during lamination (Figure 14). The lamination is then trimmed away, leaving the sole and toe break free (Figure 15).

The expandable liner is inserted into the outer shell. If no adjustments are anticipated, the liner is bonded to the outer shell at the proximal border with sealing resin.

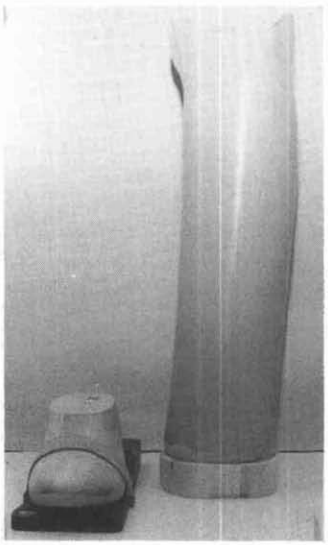


Figure 12. Socket is set into the block, aligned, and glued to the Regnell foot.

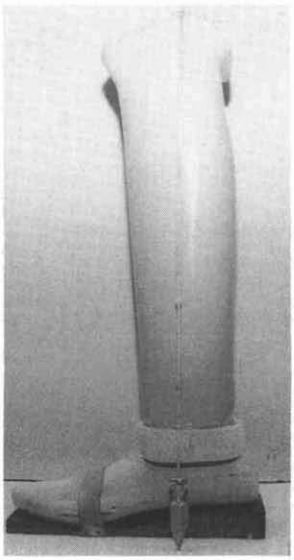


Figure 13. Lateral view of static aligned prosthesis ready for fitting.

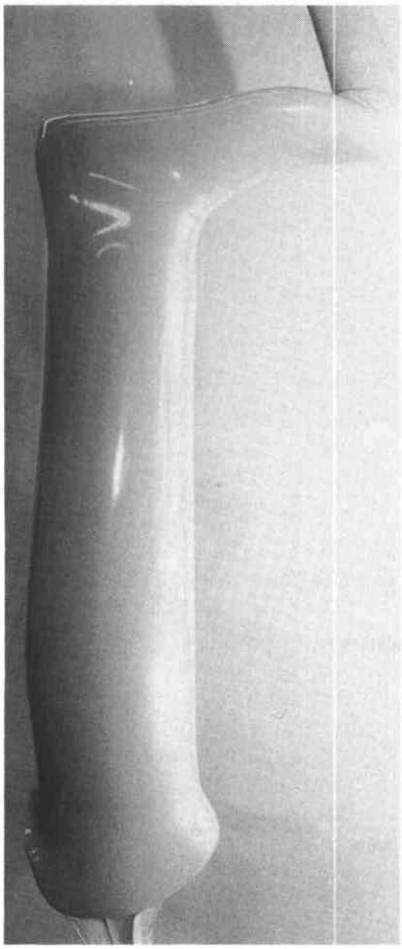


Figure 14. Following dynamic alignment with the patient, the socket is shaped to the foot and made ready for finishing of the outer prosthesis. Two nylons are used with rigid laminate with the sole in place and taped off.

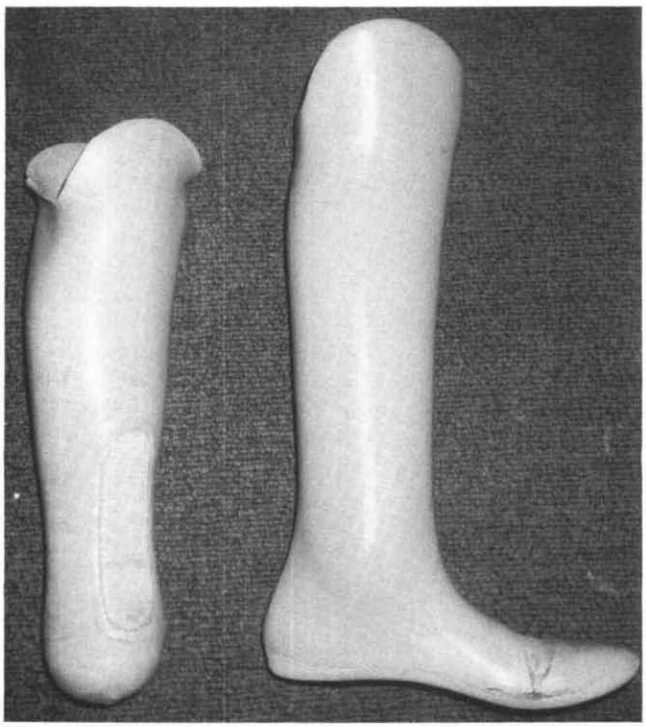


Figure 15. The finished, laminated prosthesis. Expandable liner must be permanently bonded to the outer socket at same point, but can be left separate initially to allow for adjustments.

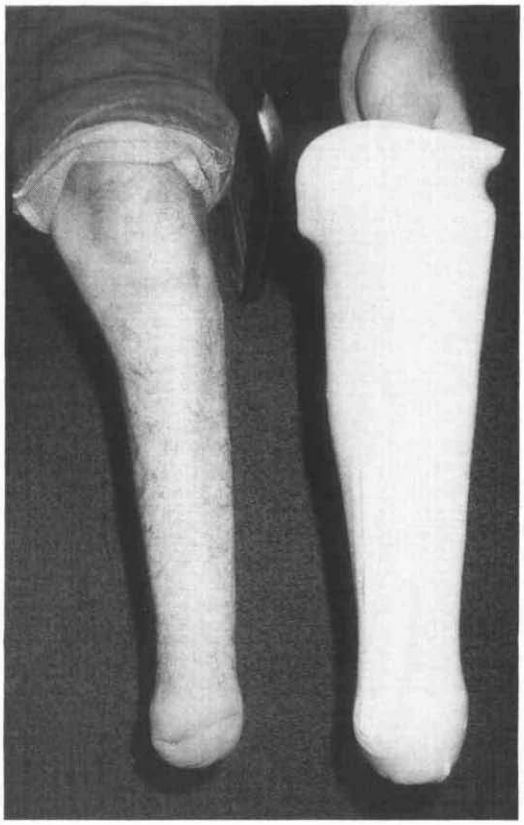


Figure 16. Syme patient holding expandle liner.

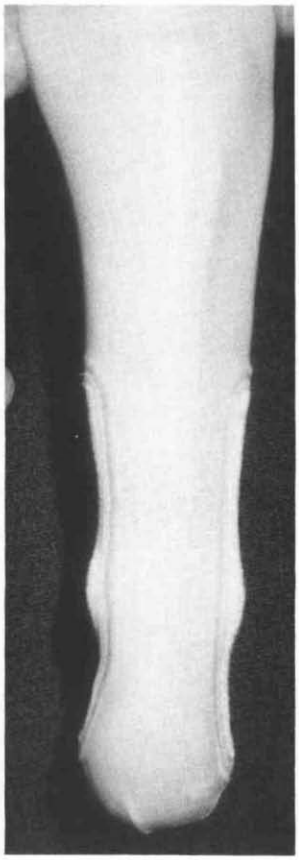


Figure 17. Syme patient pulling on the liner. Note the expansion of the elastic panels; normally this would not be seen as the liner would be bonded to the outer socket.

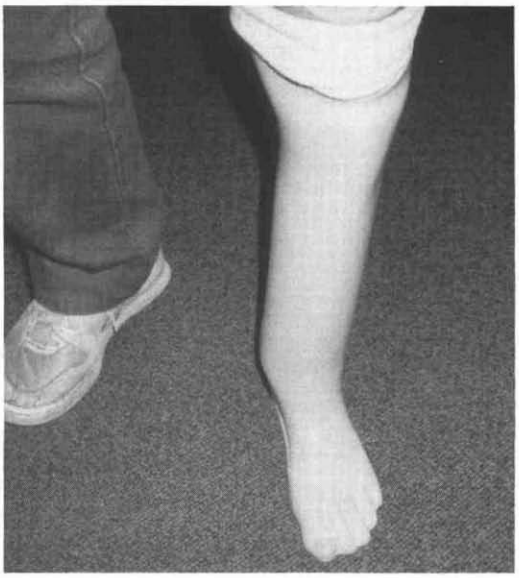


Figure 18. Patient standing on the finished prosthesis.

Summary

The Rancho expandable wall Syme prosthesis, when used with a Regnell foot, provides a very practical solution to the problems existing in other Syme prostheses. Many of the durability and cosmesis problems have been eliminated. Whenever possible, prosthetists should encourage physicians to perform more Syme level amputations, and to try to achieve less bulky distal ends when these amputations are performed.

Acknowledgments

The prosthesis described here was developed in response to the needs of Richard Voner, C.P., of Orthomedics and William Wagner, M.D., of Rancho Los Amigos Hospital, Downey, CA.

The fabrication procedure was developed by Orthomedics Central Fabrication, which also provided the fabrication photos.

References

[1] Syme, J. "Amputation at the Ankle Joint," *London Edinburgh Monthly J. Medical Science*, 2, 1843, p. 93

[2] Harris, R.I. "Syme Amputation," *J. Bone and Joint Surgery*, 38B, 1956, p. 614.

[3] Spitther, A.W., J.J. Brennen, and J.W. Payne, "Syme Amputation Performed in Two Stages," *J. Bone and Joint Surgery*, 55A, 1973, p. 568

[4] Wagner W., "The Syme Amputation," *AAOS Atlas of Limb Prosthetics*.

[5] Waters, R.L., J. Perry, D. Antonelli, and H. Hislep, *Energy Costs of Walking of Amputees, The Influence of Level of Amputations*.

[6] Voner, R., "The Syme Amputate: Prosthetic Management," *AAOS Atlas of Limb Prosthetics*, pp. 334–340.

Authors

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Clinical Prosthetics and Orthotics, Vol. 12, No. 1, pp. 41–43

Technical Note: Fabrication of the Syme Prosthesis

by Robert Gilley, C.P.

I first became familiar with this method of fabricating a Syme prosthesis in 1981, when I was transferred to Snell's of Memphis from Nashville. The technique had been in widespread use there and in the Memphis area for sometime, with every evidence of satisfactory service. I am describing the procedure here for it has proven to be not only durable, but a most practical and simple method of fabrication.

A Syme socket is set in a foot block (Kingsley catalog, #K1910) slightly behind the anterior-posterior centerpoint (Figure 1). Care should be taken to set it in the proper angle of flexion and adduction.

An ordinary Kingsley Syme SACH foot (Catalog #K07) is taken and sectioned horizontally below the level of the proximal surface of the keel (Figure 2). This leaves the distal portion with a flat proximal surface.

The foot and socket are then positioned together in the proper bench alignment. The height is checked and corrected by removing material from the socket block. Bench alignment is reestablished and the position of the bolt hole is marked on the distal surface of the socket block. The bolt hole is drilled and a recess for the adapter nut is counterbored in the distal end of the socket. This is done with an improvised counterbore made from a ⅜"-16 bolt and adapter nut. The adapter nut is set in place, and thickened resin is used to secure it there and smooth the surface. The foot and socket are assembled and excess material is removed from the socket block (Figures 3 and 4), leaving some to allow for any adjustments in toe-out. The foot bolt should be cut to length.

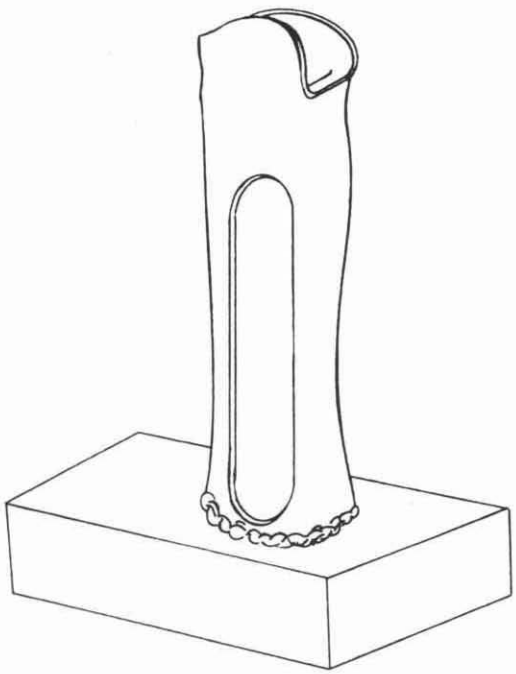

Figure 1. Socket set in block.

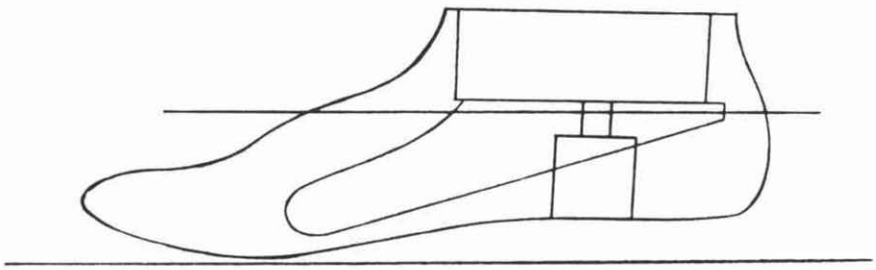

Figure 2. Cross sectional diagram of Syme SACH foot, showing cut line.

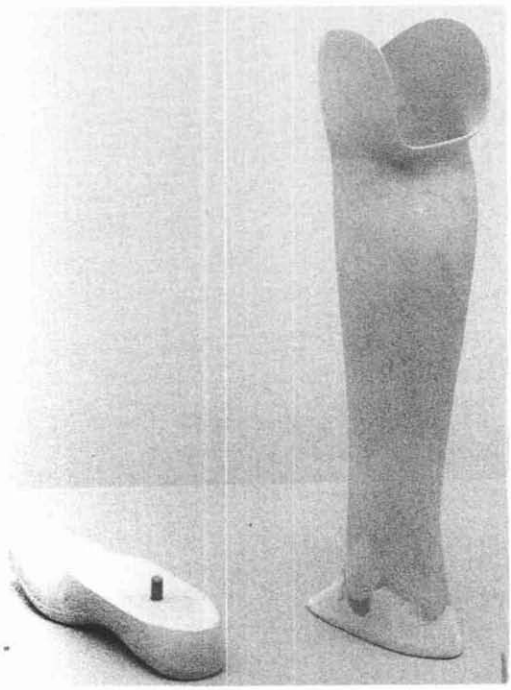

Figure 3. Foot and socket unassembled.

Following completion of dynamic alignment, the prosthesis is laminated and finished in a manner identical with that employed to finish the shin of any below-knee or above-knee prosthesis (Figure 5).

To recapitulate, the technique offers the prosthetist an efficient and expeditious method of fabricating a Syme prosthesis with good cosmetic results. It has the added advantage that foot replacement, should it become necessary, is facilitated.

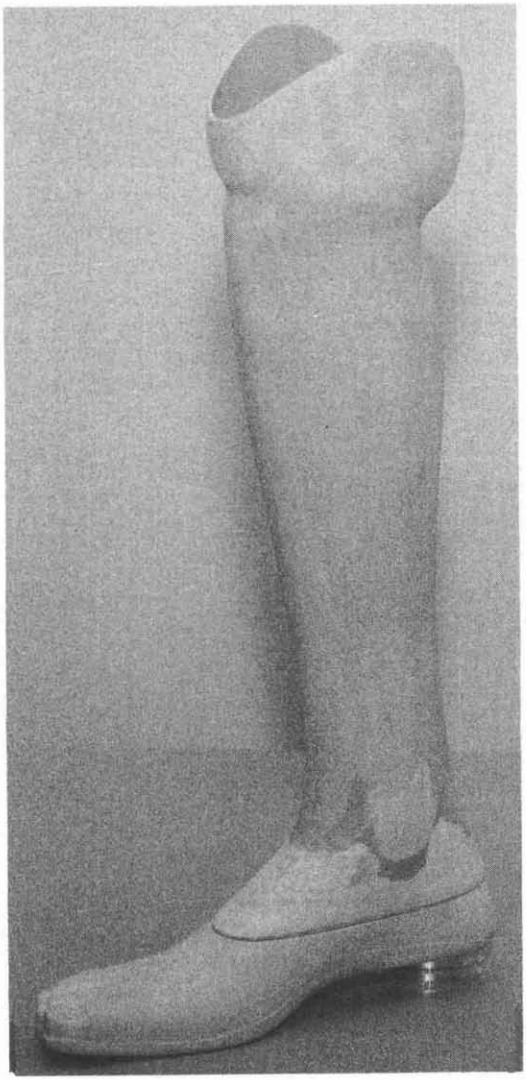

Figure 4. Foot and socket assembled.

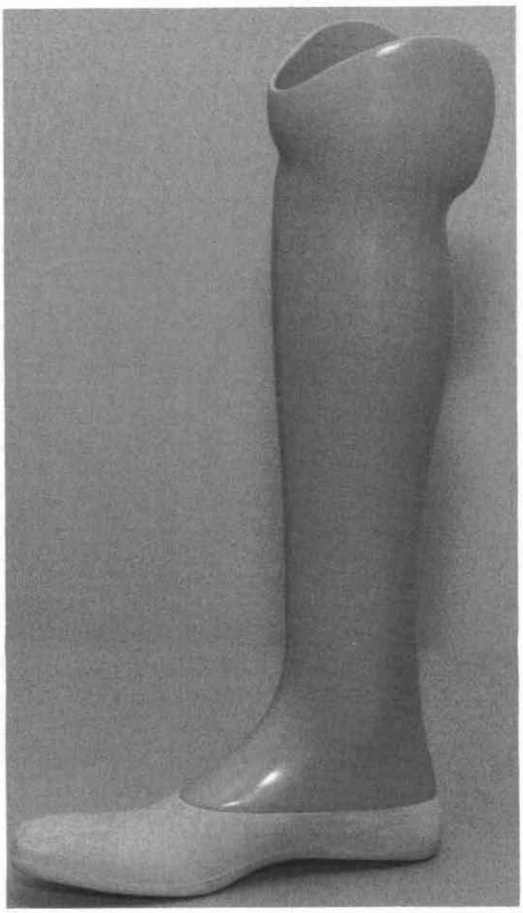

Figure 5. The finished prosthesis.

Author

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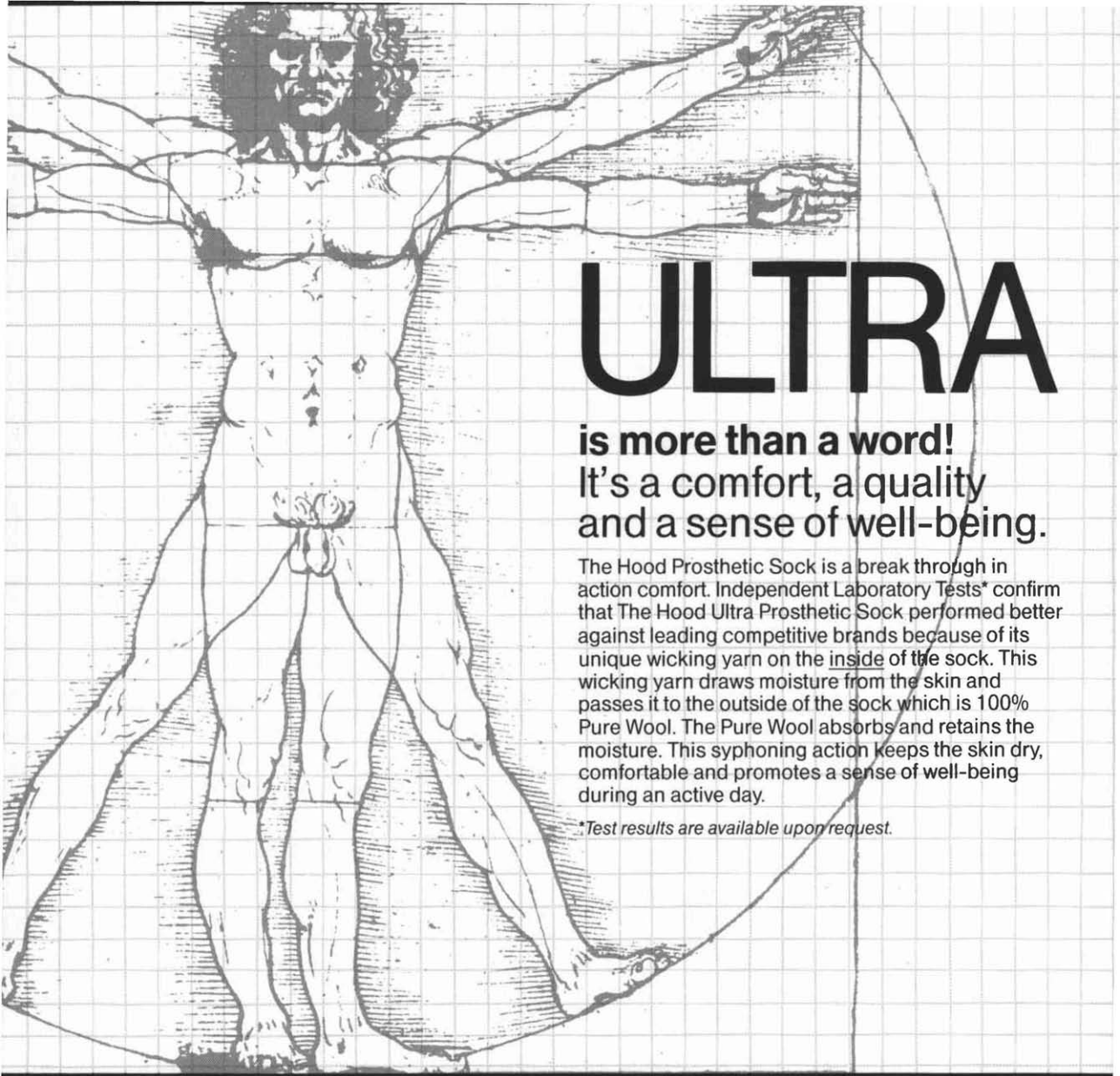

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THE 14TH ACADEMY ANNUAL MEETING AND SCIENTIFIC SYMPOSIUM

Schedule of Events

TUESDAY — January 26

8:00 a.m.–2:00 p.m.	Academy Board of Directors Meeting
8:00 a.m.–5:00 p.m.	ABC Board of Directors Meeting
2:00 p.m.–4:00 p.m.	NEW Academy Board of Directors Orientation

WEDNESDAY — January 27

8:00 a.m.–12:00 noon	Academy Board of Directors and Chapter Presidents Workshop
8:00 a.m.–12:00 noon	ABC Board of Directors Meeting
1:00 p.m.–5:00 p.m.	Orthotics and Prosthetics National Office Board of Directors Meeting and National Council on Orthotics and Prosthetics Meeting
1:00 p.m.–5:00 p.m.	ABC Workshop
1:00 p.m.–5:00 p.m.	Speaker Ready Room Open
2:00 p.m.–4:00 p.m.	*Exhibits Set-up*
3:00 p.m.–7:30 p.m.	*Registration*
4:00 p.m.–4:30 p.m.	Exhibitors Meetings
6:30 p.m.–7:30 p.m.	*Exhibits Open*
6:30 p.m.–7:30 p.m.	Exhibitors Reception

THURSDAY — January 28

7:30 a.m.–5:00 p.m.	Speaker Ready Room Open
8:00 a.m.–4:00 p.m.	*Registration*
8:00 a.m.–5:00 p.m.	*Exhibits Open*
8:00 a.m.–5:00 p.m.	Scientific Sessions
8:30 a.m.–4:00 p.m.	Tour of the Famous Lawry's California Center (Luncheon included)
9:00 a.m.–5:00 p.m.	Ladies Hospitality
11:30 a.m.–1:30 p.m.	Past Presidents' Luncheon
TBA	Consumer Program
1:30 p.m.–5:00 p.m.	Academy College Fund Board of Trustees and Advisory Board Meeting
5:00 p.m.–6:00 p.m.	ISPO Membership Meeting

JANUARY 25–31, 1988

FRIDAY — January 29

7:30 a.m.–5:00 p.m.	Speaker Ready Room Open
8:00 a.m.–8:30 a.m.	Voter Registration for Annual Business Meeting
8:30 a.m.–10:00 a.m.	Academy Annual Business Meeting
8:00 a.m.–2:00 p.m.	*Exhibits Open*
9:00 a.m.–5:00 p.m.	Ladies Hospitality
10:30 a.m.–5:00 p.m.	Scientific Sessions
TBA	Consumer Program
9:30 a.m.–3:30 p.m.	Tour of New Multi-Million Dollar Performing Arts Center (Includes Lunch, Fashion Show, and Boutique Shopping at Lido Marina Village)
2:00 p.m.–4:00 p.m.	Exhibits Tear Down
6:30 p.m.–7:30 p.m.	Members Reception
7:30 p.m.–Midnight	Academy Banquet/Dance

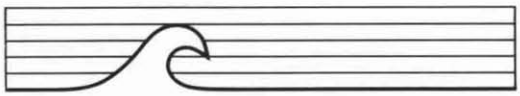
SATURDAY — January 30

7:30 a.m.–5:00 p.m.	Speaker Ready Room Open
8:00 a.m.–3:00 p.m.	Registration
8:00 a.m.–5:00 p.m.	Scientific Sessions (Concurrent Sessions)
10:00 a.m.–12:00 noon	Continental Breakfast and Ladies Auxiliary Meeting
12:00 noon–2:00 p.m.	ABC Report Luncheon

SUNDAY — January 31

(tentative)

9:00 a.m.–5:00 p.m.	AOPA Executive Committee Meeting



Scientific Program (Tentative)

THURSDAY — January 28

8:00 a.m.–8:05 a.m.	Introduction of President Terry J. Supan, CPO *Scientific Symposium Chairperson*
8:05 a.m.–8:20 a.m.	Presidential Address Wm. C. Neumann, CPO *President* American Academy of Orthotists and Prosthetists
8:20 a.m.–8:30 a.m.	Announcements and Introduction of Keynote Speakers Terry J. Supan, CPO
8:30 a.m.–9:45 a.m.	**Combined Session**
8:30 a.m.	Management of CP: High Tech Approach James R. Gage, MD Robert Lin, CPO *Newington Children's Hospital*
9:30 a.m.	Post-Operative Clubfoot Orthosis William Barringer, CO Gary Trexler, CO David Yngve, MD William Turner, MD Greg Smits *O'Donoghue Rehabilitation*
10:00 a.m.–10:30 a.m.	Coffee Break (Call to order at 10:20 a.m.)
10:30 a.m.–12:00 noon	**Special Needs of the Pediatric Amputee** **Moderator: Joseph M. Leal, CP**

10:30 a.m. Overview of the Availability of Components for Pediatric Prosthetics
David Jendrzejczyk, CP
Newington Children's Hospital

10:45 a.m. Protocols Especially for Pediatric Prosthetics
Mary Healy, CPO
R G P Orthopedic Appliance Co. Inc.

11:05 a.m. Meningococemia and the Child Amputee
Eric Baron, CPO

11:30 a.m. Pressure Distributions for Quad and Narrow ML Sockets
David Jendrzejczyk, CP
Newington Children's Hospital

12:00 noon– Lunch Break (Reconvene in Combined Session)

1:30 p.m.– 3:00 p.m. Developments Outside The United States

Moderator: Douglas S. Potter, CPO
Kootenai Prosthetic Orthotic Services

1:30 p.m. Prosthetics and Orthotics in Bolivia
John W. Michael, CPO
Duke University Medical Center

1:50 p.m. Prosthesis of Low Cost and High Efficiency
Gerardo Raul Angarami, CP

2:10 p.m. Hemipelvectomy: Improved Function Through Flexible Socket
V.K. Sharma
T. John, MD
F.R. Fisher, MD, and staff
Royal Ottawa Regional Rehabilitation Centre

2:30 p.m. Prototype Hybred Orthosis for Paraplegics Incorporating Reflexive Control and Sensory Feedback
Brian Andrews, Ph.D.
VA Medical Center

3:00 p.m.– 3:30 p.m. Coffee Break (Reconvene in Combined Session)

3:30 p.m.– 5:00 p.m. ISPO International Lectures

Moderator: Maurice LeBlanc, MSME, CP
Rehabilitation Engineering Center
Children's Hospital at Stanford

3:30 p.m. Prosthetics and Orthotics in Developing Countries
Professor John Hughes
National Center for Training and Education in Prosthetics and Orthotics
Strathclyde University

"American Perspective of Third World Orthotic and Prosthetic Services"

4:00 p.m. Prosthetics and Orthotics In Madagascar and Nicaragua
J. Martin Carlson, CPO
Gillette Children's Hospital

4:10 p.m. Prosthetics and Orthotics in India
Barnard Strom, RPT
NIDRR International Consultant

4:20 p.m. Prosthetics and Orthotics in the Pacific Basin
Melvin Stills, CO
Division of Orthopedics
University of Texas Health Sciences Center

4:30 p.m. Prosthetics and Orthotics—The Geriatric Patient
Brian Kemp, PhD
Co-Chief, Gerontology Service
Rancho Los Amigos Hospital

4:45 p.m. Prosthetics and Orthotics—The Child Population
Yoshio Setoguchi, MD
Director, Child Amputee Prosthetics Project
University of California at Los Angeles

FRIDAY January 29

8:30 a.m.–10:00 a.m. AAOP Annual Business Meeting

10:00 a.m.–10:30 a.m. Coffee Break (Reconvene at 10:30 a.m.)

10:30 a.m.–12:00 noon Computerization of Orthotics and Prosthetics

Moderator: Gretchen Hecht, CO
Wright & Filippis

10:30 a.m. The Development of a Scandinavian CAD/CAM-System for Prosthetics and Orthotics
Kurt Oberg
Doctor of Medical Science Biomechanics Laboratory

10:50 a.m. Computer Assisted Design in Orthotics
James Fezio, CO
Newington Children's Hospital

11:10 a.m. The Mechanical Response of the IPOS, SFS, and ISNY Frame to Load
David Jendrzejczyk, CP
Newington Children's Hospital

11:25 a.m. The Role of the Orthotist and Prosthetist in the Field of Electrical Stimulation
Philip Muccio, CPO
VA Medical Center

11:45 a.m. Conventional Feet vs. the Flex-Foot™: A Pilot Study of Oxygen Consumption
Donald Shurr, MA
Ken Meier, CP
David Nielsen, PhD
Jane Golden, MS
American Prosthetics, Inc.

12:00 noon–1:00 p.m. Lunch

1:00 p.m.–5:00 p.m. Dynamic Feet for Dynamic Patients

Moderator: Joan C. Weintrob, CPO
Durr-Fillauer Medical, Inc.

1:00 p.m. Energy Storing Feet: A Clinical Comparison
John W. Michael, CPO
Duke University Medical Center

1:15 p.m. A Brief History and Biomechanics of Artificial Feet
Jerome P. Voisin, CP
Acadian Prosthetics and Orthopedic Aids, Inc.

1:30 p.m. Dynamic Alignment Options for the Flex-Foot™ Prosthesis
Michael Schuch, CPO
University of Virginia Medical Center

1:45 p.m. *Carbon Copy II*
John W. Michael, CPO
Duke University Medical Center

2:00 p.m. Dual-Ankle Springs (D.A.S.) Foot-Ankle System
Jerome P. Voisin, CP
Acadian Prosthetics and Orthotics and Orthopedic Aids

2:15 p.m. Infectious Diseases and Protection of the Health Care Providers
Llorens J. Pembrook, M.D.

3:00 p.m.– 3:15 p.m.	Break
3:15 p.m.	Understanding Safety, Avoiding Injury with Hazardous Chemicals and Materials Dale Berry, CP(C) *Daw Industries, Inc.*
3:45 p.m.	Lower Extremity Management of Post-CVA Timothy Porcelli, C.Ped. *Rehabilitation Institute of Chicago*
4:30 p.m.	Academy College Fund—Where Do We Go From Here? Kurt Marshall, CP(E)

SATURDAY — January 30

8:45 a.m.– 10:15 a.m.	**Concuurent Sessions** **"A" Session** **Moderator: Dennis E. Clark, CPO**
9:00 a.m.	Dynamic Ankle Foot Orthosis David Sanchez, CO Charlene Sanchez, PT
9:15 a.m.	The Use of an Adjustable Shoe Orthosis in Treatment of Metatarsus Adductus Andrew H. Meyers, CPO *Prosthetic & Orthotic Associates*
9:30 a.m.	Total Contact Compression Casting Technique David Sanchez, CO Charlene Sanchez, PT
9:45 a.m.	The Multi-Podus Splint Robert Lonardo, CO Penny Hajj, LPT *L'Nard Associates Inc.*
	"B" Session **Moderator: Michael Schuch, CPO** *University of Virginia Medical Center*
9:00 a.m.	The Steeper Servo Control System R.A. Cooper B.A. Fazackerley, BA R. Luff R. Bayford *Hugh Steeper Ltd.*
9:15 a.m.	Non-Myoelectric Control of Externally Powered Devices Stephen S. Dillon *Universal Artificial Limb Co.*
9:30 a.m.	Current Status of Effort to Improve Body-Powered Upper-Limb Prostheses Maurice LeBlanc, MSME, CP *Rehabilitation Engineering Center* *Children's Hospital at Stanford*
9:45 a.m.	The Development and Assessment of a New Powered Terminal Device R.A. Cooper M. Kemp M. Neal B.A. Fazackerley *Hugh Steeper Ltd.*
10:00 a.m.	The Proper Use of a Stump Shrinker Keith E. Vinnecour, CPO *Beverly Hills Prosthetics-Orthotics Inc.*
10:15 a.m.– 10:30 a.m.	Break
10:30– 12:00 noon	**Concurrent Sessions**

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and Tennis Club
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(714) 640-4000

"A" Session **Improved B/K Techniques**

Moderator: Dennis E. Clark, CPO

10:30 a.m. Experience with the Silicone Suction Socket (3SO) Technique for Below-Knee Amputees
Charles H. Pritham, CPO
Carlton Fillauer, CPO
Karl Fillauer, CPO
Durr-Fillauer Medical, Inc.

11:00 a.m. The UCLA Experience with Total Surface Bearing Suction BK Prosthesis
David Littig, CP
Prosthetic-Orthotic Laboratory
University of California at Los Angeles

11:30 a.m. Consumer Perspective and Professional Care
Mary Point Novotny, RN, MS
LaRabida Children's Hospital

"B" Session **Care of the Spine and Shoulder**

Moderator: Melvin L. Stills, CO
Division of Orthopedics
University of Texas
Health Science Center

2:00 p.m. Narrowing Indications for Orthotic Management in Scoliosis
Robert D. Fitch, MD
Duke University Medical Center

2:30 p.m. The GCO and UFLSI Techniques—Successful Low Temperature Spinal Orthotics
Juan A. Martinez, CO
Martinez Rehabilitative Orthopedic Services/Shands Teaching Hospital

2:45 p.m. The Custom Cuirass Ventilator—An Alternative for the Ventilator Dependent Client
Patricia Hazard, CO
S. McGinnis
Rehab Engineering Center

3:15 p.m. Orthotic Management of Brachial Plexus Injuries
Arthur W. Guilford, CO
Applied Orthotic Systems Limited

3:45 p.m. Orthotic Control of the Shoulder Complex in Sports
Andrew H. Meyers, CPO
Prosthetic & Orthotic Associates

4:00 p.m. Orthotic Treatment for Fractures About the Knee
Walter L. Racette, CPO
Orthomedics, Inc.

4:30 p.m. Closing Remarks by Incoming President
Al Pike, CP
President-Elect
American Academy of Orthotists and Prosthetists

"B" Session **Orthotic Management of Sports Injuries**

Moderator: Michael Schuch, CPO
University of Virginia Medical Center

10:30 a.m. Knee Orthosis Efficacy in Protecting the Medial Colateral Ligament: Comparative Testing and Design Analysis
J. Martin Carlson, CPO
Gillette Children's Hospital

11:00 a.m. A Dynamic Rotating Functional Knee Orthosis: Scientific Basis and Clinical Testing
Dwain R. Faso, CO
James Montgomery, MD

11:15 a.m. Sports Orthotics at the University of Oklahoma
William J. Baringer, CO
Gary S. Trexler, CO
O'Donoghue Rehabilitation Center

11:45 a.m. Airpene: An Innovation to Neoprene—A Preliminary Report
Jack Schwartz, CO
Max Lerman, CO
Larry Lerman
Lerman and Son

12:00 noon Lunch Break & ABC Luncheon

"A" Session

Moderator: Charles H. Pritham, CPO

2:00 p.m. Report from the International Workshop on AK Fitting & Alignment Techniques
Michael Schuch, CPO
University of Virginia Medical Center

2:45 p.m. The Anatomical Above-Knee Prosthesis: A Systematic Socket Analysis
Christopher S. Hoyt, CP
UCLA Prosthetics Education Program

3:15 p.m. Geriatric Prosthetics: Design & Develoment of an Improved Above Knee Socket
V.L. Houston, PhD, CPO
H.R. Lehneis, PhD
M.A. Garbarini, MA, RPT
New York University Medical Center—RIRM

3:30 p.m. An Interpretation of a Swedish AK Casting Technique
V.K. Sharma
T. John, M.D.
F.R. Fisher, MD, and staff
Royal Ottawa Regional Rehabilitation Centre

3:45 p.m. Prescription Criteria for the Above Knee Running Prosthesis
Albert F. Rappoport, MA, CP
Prosthetics Research Study

4:15 p.m. Closing Remarks by Incoming President
Al Pike, CP
President-Elect
American Academy of Orthotists and Prosthetists

FOR YOUR PLEASURE . . .

EXHIBITOR'S RECEPTION

Wednesday, January 27

The traditional Exhibitor's Reception is the "Kick Off" for the Annual Meeting. Of course, it is also the formal opening of our exhibit area. It's a wonderful occasion for you to greet old friends and to tour the Exhibits.

LAWRY'S CALIFORNIA CENTER TOUR

Thursday, January 28

Departing the hotel by bus on Thursday, January 28th you will soon discover Lawry's California Center. You will go behind the scenes and see how more than 110 Lawry's products are made. Following a multi-media theater presentation you will visit their test kitchens, production facilities and laboratories. Lawry's is famous for their "Lemon Pepper, Salad Sprinkles" and many other spices.

There will be free time for you to visit the Wine & Gourmet Shop where you can find many specialty foods and cookware, and where you may also enjoy the Tea and Wine Bar. Also available for you to enjoy is a Gift and Patio Shop and a clothing boutique.

At noon, lunch will be served in the lovely gardens (weather permitting) or in one of the special dining rooms. It is said that Lawry's serves the most marvelous frozen Margaritas and a fine selection of California wines, of course.

PERFORMING ARTS CENTER TOUR

Friday, January 29

This will be a fun day! Orange County boasts a new multi-million dollar Performing Arts Center where you will receive a tour of the facilities, see the behind the scenes action and then be treated to coffee and croissant before reboarding the

bus. This Performing Arts Center is celebrating its first anniversary and has been lauded as one of the most beautiful and expensive in the world.

You will travel to the Lido Marina Village in Newport Beach where you will have lunch at the Warehouse Restaurant, which faces the turning basin for the Newport Harbor and while dining you will be treated to an informal fashion show. All the fashions will be from the Lido Village area. After lunch, you will have time to shop at the many shops in the quaint village. The cobblestone streets, yacht harbor, fashion boutiques, "one of a kind" shops and art galleries are always a favorite. Before returning to the hotel you will stop for wine and cheese, or coffee or tea if preferred. You won't want to miss this one!

MEMBERS RECEPTION and BANQUET/DANCE

Friday, January 29

The reception and banquet always prove to be a highlight of our meeting and this year will be no exception. In fact, this year it's going to be better than ever because following your banquet meal you will have the opportunity to hear the All-American Boys Chorus, under the direction of Fr. Richard Coughlin. This group is as fine a boys chorus as you will hear anywhere in the world.

CONTINENTAL BREAKFAST MEETING FOR THE LADIES

Saturday, January 30

Saturday morning from 10:00 am to 12:00 noon all our ladies are invited to a continental breakfast and some friendly conversation.

ABC REPORT LUNCHEON

Saturday, January 30
12:00 Noon

All ABC certified practitioners are invited to attend this traditional luncheon meeting when ABC Officers provide an update on their programs for certification and accreditation. This meeting is the occasion also when newly elected Officers and Directors for ABC are seated.

THE ALL-AMERICAN BOYS CHORUS

under the direction of Fr. Richard Coughlin

Friday, January 29

The American Academy of Orthotists and Prosthetists is pleased and proud to present for your entertainment during the Academy Banquet/Dance, The All-American Boys Chorus, under the direction of Fr. Richard Coughlin.

Right away we'd like to dispel any notions you might have about a "boys chorus" performing at *your* Academy Annual Meeting. Forget terms like "cute," "very good," and "nice to see and hear." THE ALL-AMERICAN BOYS CHORUS has been described as "the best entertainment we've ever had," "outstanding and a joy beyond all expectations," "dynamic and exciting," "thoroughly polished and professional," "they stole the show and everyone's hearts as well."

They have performed for the Metropolitan Life Insurance Co. Convention, the Oldsmobile Convention, The National Convention of the American Red Cross, and The National Association of Television Program Executives, where they shared billing with Steve Allen. This past March the Chorus opened the American Society of Association Executives Convention in Anaheim, where they received a standing ovation from over 1,700 ASAE members!

They have done shows with such stars as Bob Hope, Rich Little, John Ritter, and Bobby Goldsboro to name just a few. They have been heard in concernt throughout the United States and Canada and around the world.

This is sure to be a *super* evening. *BE SURE TO HAVE TICKETS!*

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Calendar

Please notify the National Office immediately concerning all meeting dates. It is important to submit meeting notices as early as possible. In the case of Regional Meetings, check with the National Office prior to confirming date to avoid conflicts in scheduling.

1988

January 25–31, Academy Annual Meeting and Scientific Symposium, Newport Beach Marriott Hotel and Tennis Club, Newport Beach, California. Contact: Academy National Office, (703) 836-7118.

February 4–9, American Academy of Orthopedic Surgeons Annual Meeting, Atlanta, Georgia.

March 5, Academy Midwest Chapter Spring Scientific Seminar/Social Event. Contact: Mark Edwards, CP, (312) 908-8006.

March 12, Academy Northern California Chapter Seminar, Oakland, California. Contact: Robert A. Bangham, CO, c/o Hittenbergers, 1117 Market Street, San Francisco, California 94103.

March 18–19, Academy Continuing Education Conference 1-88 and Midwest Chapter Combined Meeting "Current Clinical and Technical Concepts in Lower Limb Prosthetics and Orthotics," Howard Johnson O'Hare International Hotel, Chicago, Illinois. Contact: Academy National Headquarters, (703) 836-7118

April 11–15, 10th Congress of the International Federation of Physical Medicine and Rehabilitation, Sheraton Hotel, Toronto, Ontario. Contact: Secretary, 545 Jarvis Street, Toronto, Ontario M4Y 2H8, Canada.

April 28–29, Region IV Meeting, Hyatt Regency Hotel, Memphis, Tennessee.

May 13–14, Academy Continuing Education Conference 2-88 and New York State Chapter Combined Meeting "Current Clinical and Technical Concepts in Lower Limb Prosthetics Management," Albany Marriott Hotel, Albany, New York. Contact: Academy National Headquarters, (703) 836-7118.

May 13–15, AOPA Region IX, COPA, and the California Chapters of the Academy Combined Annual Meeting Rancho Miranda, Palm Springs, California.

May 19–21, AOPA Region V Annual Meeting, Charleston, West Virginia.

June 8–11, AOPA Regions II and III Combined Annual Meeting, Trump Plaza Hotel and Casino on the Boardwalk, Atlantic City, New Jersey.

June 15–18, AOPA Regions VII, VIII, X, and XI Combined Annual Meeting, Seattle, Washington.

June 23–26, AOPA Region VI and the Academy Midwest Chapter Joint Educational Seminar, Pheasant Run, St. Charles, Illinois. Contact: Phil Tirimacco, CP, (312) 342-7200, ext. 2828.

July 15–16, Academy Continuing Education Conference 3-88 "Clinical Practice Management—Ethical and Legal Considerations," Vanderbilt Plaza Hotel, Nashville, Tennessee. Contact: Academy National Headquarters, (703) 836-7118.

July 16–18, AFI-ENDOLITE Prosthetic Certificate Course, "Endolite High Technology Prosthesis," Miami Lakes Inn & Country Club, Miami, Florida. Contact: Karen Hewitts, Registrar, AFI-ENDOLITE, 2400 West 82 Street, Hialeah, Florida 33016; (305) 823-8300.

August 13–15, AFI-ENDOLITE Prosthetic Certificate Course, "Endolite High Technology Prosthesis," Miami Lakes Inn & Country Club, Miami, Florida. Contact: Karen Hewitts, Registrar, AFI-ENDOLITE, 2400 West 82 Street, Hialeah, Florida 33016; (305) 823-8300.

September 3–5, AFI-ENDOLITE Prosthetic Certificate Course, "Endolite High Technology Prosthesis," Miami Lakes Inn & Country Club, Miami, Florida. Contact: Karen Hewitts, Registrar, AFI-ENDOLITE, 2400 West 82 Street, Hialeah, Florida 33016; (305) 823-8300.

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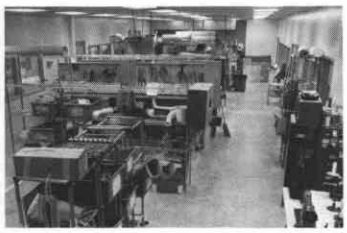

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September 5–9, 16th World Congress of Rehabilitation International, Keio Plaza Inter-Continental Hotel, Shinjuku, Tokyo, Japan. Contact: Secretary General, 16th World Congress of Rehabilitation International, c/o the Japanese Society for Rehabilitation of the Disabled, 3-13-15, Higashi Ikebukuro, Toshima-Ku, Tokyo 170, Japan.

September 23–24, Academy Continuing Education Conference 4-88 "Spinal Orthotics and Seating," Holiday Inn at Kansas City International Airport, Kansas City, Missouri. Contact: Academy National Headquarters, (703) 836-7118.

September 24, Academy Northern California Chapter Seminar, San Francisco, California. Contact: Robert A. Bangham, CO, c/o Hittenbergers, 1117 Market Street, San Francisco, California 94103.

October 15–17, AFI-ENDOLITE Prosthetic Certificate Course, "Endolite High Technology Prosthesis," Miami Lakes Inn & Country Club, Miami, Florida. Contact: Karen Hewitts, Registrar, AFI-ENDOLITE, 2400 West 82 Street, Hialeah, Florida 33016; (305) 823-8300.

October 25–30, AOPA Annual National Assembly, Sheraton Washington Hotel, Washington, D.C. Contact: AOPA National Headquarters, (703) 836-7116.

November 12–14, AFI-ENDOLITE Prosthetic Certificate Course, "Endolite High Technology Prosthesis," Miami Lakes Inn & Country Club, Miami, Florida. Contact: Karen Hewitts, Registrar, AFI-ENDOLITE, 2400 West 82 Street, Hialeah, Florida 33016; (305) 823-8300.

November 21, Southern California Chapter of the Academy Fall Seminar, Marriott Hotel, Anaheim, California. Contact: Marmaduke Loke, 7910 Frost Street, San Diego, California 92123.

1989

January 31–February 5, Academy Annual Meeting and Scientific Symposium, Stouffer Orlando Resort, Orlando, Florida. Contact: Academy National Office, (703) 836-7118.

February 9–19, American Academy of Orthopaedic Surgeons Annual Meeting, Las Vegas, Nevada.

May 10–13, International Trade Fair and Congress for Orthopaedics and Rehabilitation Technology. Contact: NMA Nurnberg Messe- und, Ausstellungsgesellschaft mbH, Objektleitung, Messezentrum, D-8500 Nurnberg 50, West Germany.

May 12–14, AOPA Region IX, COPA, and the California Chapters of the Academy Combined Annual Meeting.

May 18–20, AOPA Region V Annual Meeting, Hotel Sofitel, Toledo, Ohio.

May 18–20, The Second S.M. Dinsdale International Conference in Rehabilitation, "Visions and Controversies in Rehabilitation," hosted by the Royal Ottawa Regional Rehabilitation Centre, Ottawa, Ontario. Contact: Information Department, (613) 737-7350, ext. 602.

October 2–8, AOPA Annual National Assembly, Bally's Grant Hotel, Reno, Nevada. Contact: AOPA National Headquarters, (703) 836-7116.

November 12–17, International Society for Prosthetics and Orthotics VI World Congress, Kobe Convention Center, Kobe, Japan. Contact: VI ISPO World Congress, Secretariat, c/o International Conference Organizers, Inc., 5A Calm Building, 4-7, Akasaka 8-chome, Minato-ku, Tokyo, 107 Japan.

1990

January 22–28, Academy Annual Meeting and Scientific Symposium, Hyatt Regency Hotel, Phoenix, Arizona. Contact: Academy National Office, (703) 836-7118.

February 8–13, American Academy of Orthopaedic Surgeons Annual Meeting, New Orleans, Louisiana.

May 11–13, AOPA Region IX, COPA, and the California Chapters of the Academy Combined Annual Meeting.

September 11–16, AOPA Annual National Assembly, Sheraton Boston Hotel, Boston, Massachusetts. Contact: AOPA National Headquarters, (703) 836-7116.

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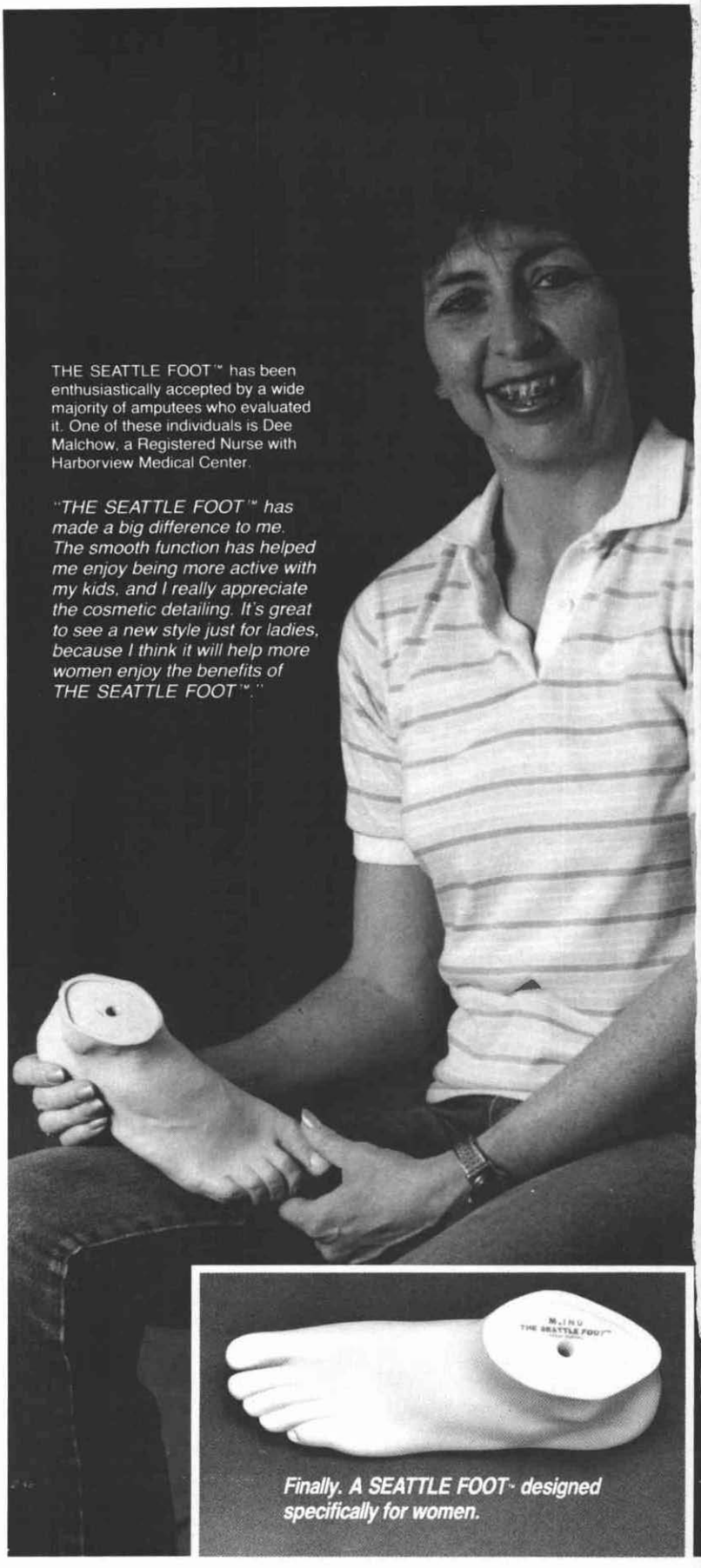

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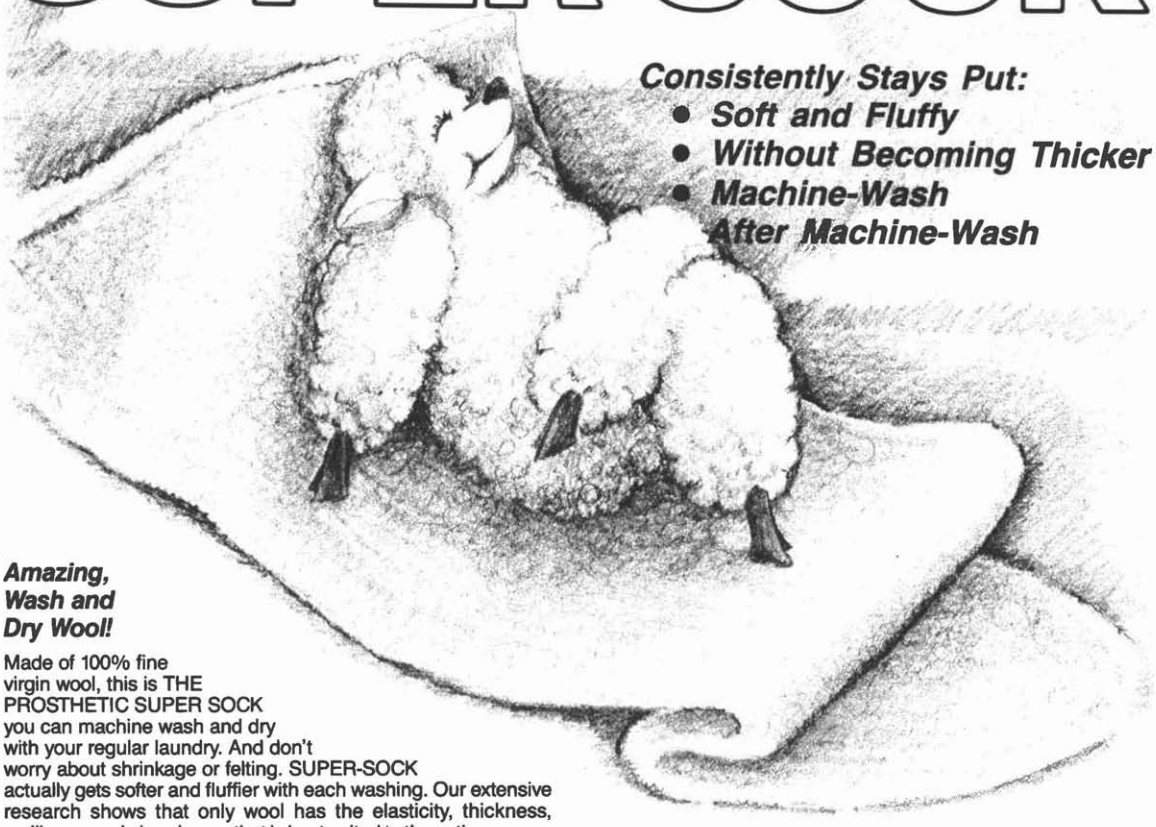

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