DECEMBER 1973

Orthotics and Prosthetics

FOUNDED 1917

Orthotics and Prosthetics

VOLUME 27, NUMBER 4 DECEMBER 1973

Orthotics and Prosthetics is issued in March, June, September and December. Subscription price, payable in advance, is $7.00 a year in the Western Hemisphere. Rate elsewhere is $8.00 a year. Single issues, $2.00 each. Publication does not constitute official endorsement of opinions presented in articles. The Journal is the official organ of the publisher, The American Orthotic and Prosthetic Association in collaboration with the American Academy of Orthotists and Prosthetists, and serves as the U.S. organ for Interbor. All correspondence should be addressed to: Editor: **Orthotics and Prosthetics,** 1440 N St., N.W., Washington, D.C. 20005. Telephone, Area Code 202, 234-8400.

Orthotics and Prosthetics is indexed by Current Contents/Clinical Practice.

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(US ISSN 0030-5928)

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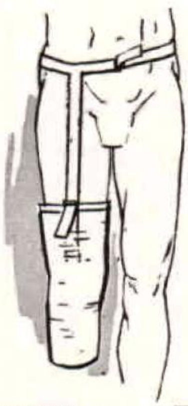

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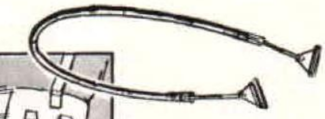

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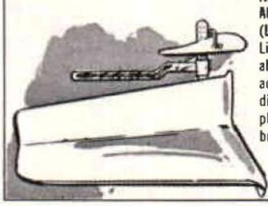

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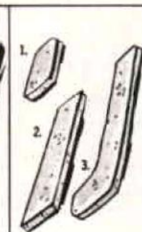

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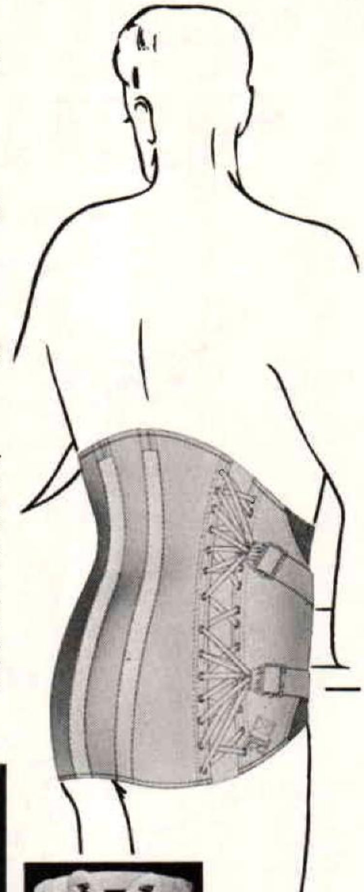

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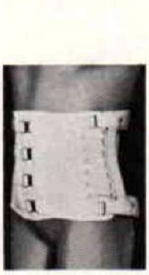

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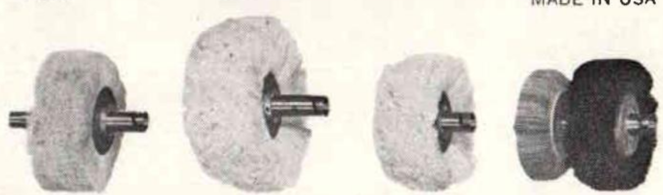

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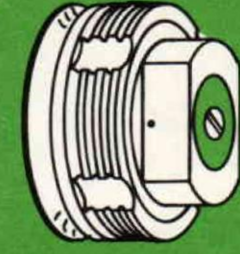

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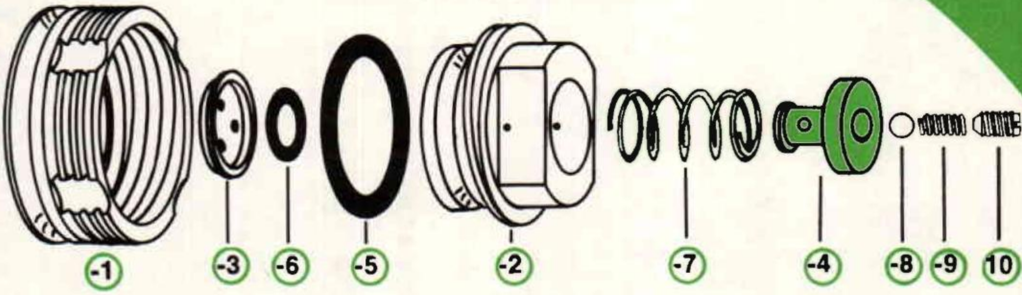

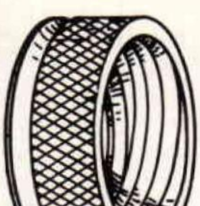

-1-A

-1 **Plastic housing**
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-3 **Cover** -4 **Push button**
-5 **"O" ring .937 O.D.**

"O" ring .375 O.D.
Spring 7/16" dia.
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Spring 1/8" dia.
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Example No. 1 2L 188-1 / Example No. 2 2L 189-1-A

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PER ARDUA AD ASTRA

Only three years ago a small number of the nation's leading orthotists and prosthetists sat together in St. Louis to organize a professional body to be called the American Academy of Orthotists and Prosthetists. This humble beginning was a long way, indeed, from the stars but it certainly generated a great deal of work. Represented were practitioners who sought new and special skills in their professions and those who demanded the privilege to do more because they had earned their standing as specialists in their respective fields. Among those responsible for the birth of the Academy are individuals who have been very active in AOPA and ABC. Without formalization by means of hairsplitting documents, a common bond among the three groups is well understood. It is expressed in the form of a mutual agreement to pool efforts for the benefit of all. Through this troika, every man now has a means of contributing to the advancement of the art and science of his specialty, and a voice in the affairs directing his destiny.

Our prosthetics and orthotics health care delivery system finds itself confronted with an ever-increasing demand for services. The field is characterized by rapidly advancing technology; therefore it is difficult to pursue continuing education at a leisurely pace that may have been acceptable in the past. We charge the Academy with this responsibility but, mirror-like, it reminds us that *we* are the Academy and the products of its functions are merely reflections of our actions. Lip service is useless, and financial assistance alone is not enough for the monumental task ahead—to devise ways and means for continually sharpening our skills, renewing our faith in our contribution to society, and learning to share freely with our colleagues. To do less is to penalize your Academy, and is a form of self-punishment, since it stands for the free exchange of knowledge and the advancement of our professional posture.

A concerted effort of the combined resources of the Association, Board, and Academy is being marshaled to maintain an open avenue of current information through this journal, newsletters, other publications, seminars, and meetings where a free exchange of information is encouraged. He is guilty of wrongdoing who fails to share freely of his knowledge with his fellow practitioner; and thus he is not discharging properly his responsibilities to his profession.

All of us are quite ready to accept the title of "professional." But many fail to realize that this title carries not only authority but responsibility as well. A primary responsibility is to contribute to the annals and literature of your professional field. Such exchanges will help us recognize our own limitations and the capabilities of our colleagues. This should aid us in directing those special patients who present unique problems to the practitioner most qualified to render the best service. In this way, we can stand united in the pursuit of knowledge and excellence, and thus improved service to our patients. The road to excellence is indeed arduous but it leads to the stars.

Henry F. Gardner

A MESSAGE FROM THE EXECUTIVE DIRECTOR (ORTHOTICS AND PROSTHETICS)

Long time readers of "Orthotics and Prosthetics" can appreciate that a number of significant changes have been made in its publication format during 1973. The journal has been enlarged to conform to a size more typical of allied publications in the health field. Its cover design and page layout have been upgraded. Paper quality has been improved. Readability has been made easier through use of more legible type fonts. And so on.

In short the editors, in collaboration with AOPA's National Office which handles the business affairs of "O&P", have endeavored to make this a more interesting, professional appearing journal worthy of innovating reporting and readership. Indications are that these objectives have been achieved.

More is in the offing. Principally, the composition of the Editorial Board has been revised for 1974 to include equal representation by members of AOPA and the American Academy of Orthotists and Prosthetists who have a lively interest in publication matters. It is planned, too, that the new Editorial Board will meet more frequently with the Editor in order to keep abreast of new technology and related areas that may warrant more emphasis. Further, the Editor has signified his willingness to include a "Letters" column so that readers may comment on published material and also communicate on minor technical innovations that may be of interest to others.

A major new addition for Academy members will be the installation (next issue) of a new low cost "Positions Wanted" employment column. Starting immediately, members of AAOP who wish to advertise their availability on a signed or unsigned basis may do so at a cost of only $5.00 per five line insertion in each issue. Each additional line will cost $1.00. Otherwise, the regular advertising rates will continue to apply for non-Academy members or for those Academy members who wish to advertise their availability in a more prominent manner.

Not unexpectedly, "O&P" has been caught up in the surging national economy. As a consequence, the base subscription price effective January 1, 1974 for all subscribers in the Western Hemisphere (other than AOPA/ABC/AAOP members and certifees) will be $10.00. The price for foreign subscribers will be $11.00, and for those AOPA members who wish to provide gift subscriptions to professional associates, the rate will be $7.00. All current subscribers have been informed of these changes and given an opportunity to continue their subscriptions at the current rate, provided such orders are received by December 31, 1973.

Both the Editors and the National Office continue to be interested in receiving readers' comments on all aspects of the journal so that it may well serve as the premiere publication for the orthotic and prosthetic professions in the U.S.

David A. H. Roethel

ISCHIAL-THIGH-KNEE-ANKLE ORTHOSIS

Richard R. LaTorre, C.O.[1],
Michael Richards[2], and
Sooklall Ramcharran[2]

We will be unorthodox and make our acknowledgments at the beginning of this article rather than at the end. We will not use space unnecessarily by providing a long list of references because there are so many that could be cited. However, we would like to thank Arthur Guilford and Jack Greenfield of Rancho Los Amigos Hospital (3) and Siegfried Paul of Newington Children's Hospital. Siegfried Paul provides an excellent example by doing what most of us just talk about. Our acknowledgments also go to Richard Lehneis of New York University for the Advanced Orthotics Course, held there in 1971 and to Thorkild Engen who was an instructor in that course when he introduced us to the TIRR ankle-foot orthosis and polypropylene (1) (2).

To all of these practitioners, the staff and our patients are extremely grateful.

Fresh from the course at NYU, we fabricated many versions of the TIRR ankle-foot orthosis. While mastering the technique of working with this material in our own facility, we had many laughs over our mistakes.

We had polypropylene stuck to the oven, polypropylene stuck to our gloves, and we spent too long a time molding one area while creating wrinkles in another area. Many results of the first attempts found their way to the trash can before our staff became proficient in working with this material.

The corrugations provided by tacking Teflon rods over the surface of the plaster positive model in differing patterns gave us some interesting results. All of the polyester below-knee orthoses (AFO) we had been making for rigid ankles for the previous four or five years are now being replaced with polypropylene orthoses with ribs or corrugations placed anteriorly and posteriorly over the malleoli.

We also have converted all of our polyester pretibial shells on new above-knee orthoses with ones made of polypropylene and have found no problem in using copper or steel rivets to fasten this material to other parts.

The next step, to fabricate an above-knee orthosis completely from polypropylene, seemed logical, but as a private facility we were hesitant because of the necessity of "close follow-up" of the patient and the responsibility we must bear should anything go wrong.

Our decision was made when a patient we have served for nine years presented herself. She is a post-poliomyelitis patient, has a severe valgus condition at the knee and the ankle, and is overweight. She has had one pregnancy (with future ones possible) which had caused great problems while wearing her previous orthosis because of the increased girth in her thigh followed by a decrease in circumference in the post-pregnancy period.

Her prior orthosis, an AKO, consisted of an ischial ring, cam-lock knee joints (bail lock), a limited-motion ankle joint, and a molded leather sandal with metal foot plate.

With an eager patient and a cooperative and responsive physician, we proceeded.

Our goals were:

1. An orthosis that would be cosmetically more acceptable, just as the TIRR AFO was to the BK patients.
2. More comfortable fit and feel for the patient.
3. Lightness when compared to the conventional, previous orthosis.

At this time, we had two young orthotists who were preparing for the examinations given by the American Board for Certification, and who

[1]La Torre Orthopedic Laboratory, 55 N. Brandywine Avenue, Schenectady, N.Y.

[2]Resident Orthotists, La Torre Orthopedic Laboratory.

also were eager to show the prosthetists of our facility something evolutionary in orthotics.

When we finished, the orthosis weighed 3½ pounds. The result delighted the patient as well as our staff. The orthosis is completely washable, the patient is even able to shower while wearing the orthosis by wrapping a "Coban" bandage[3] over the foot and ankle complex. This secures the foot, as the shoe would, and presents a slip-resistant plantar surface.

The medial wall of the ischial socket was provided with a flare which made the polypropylene more rigid at the proximal aspect. We were not proficient in welding polypropylene, so we decided to simply lap the anterior aspect. This provided us with an interesting time during the fitting stage.

The patient was stable in the socket and we were made aware that the socket clung to the thigh in the push-off and swing phase of gait; and, on heel-strike, the seat acts as a shock absorber rather than as a source of shock to the ischial tuberosity and associated tissues. The comfort experienced in stance and swing phase of gait was very gratifying.

We also elected to keep the socket as a lapjoint in order that it might expand with increase of weight and, in so doing, not give the feeling of constriction.

The only fastener on the orthosis is the posterior closure of the pretibial shell.

We did make mistakes. Our first was to make an overzealous manual correction of the valgus knee. At the fitting we gave way to patient comfort, and sacrificed esthetics by allowing some valgus at the knee.

Another mistake was in not providing horizontal ribs in the proximal third of the femur section, and, in order to provide rigidity to assure maintenance of joint alignment, an inverted "U-type" reinforcement of stainless steel was needed. This arrangement is very similar to that used in the Fillauer prefabricated ischial sockets. This, of course, means that an orthosis constructed without this reinforcement will weigh even less than 3½ pounds.

After delivery we noted a slight "plastic-squeak" on the anterior part of the ischial thigh shell. This was solved by fastening a piece of ⅛-inch thick Plastizote with Barge cement under the surface that was offending. This does not detract from the original appearance because it acts as an interface.

For our first try it would have been easier to have a patient who preferred drop locks. Cosmetically, the bail lock detracts from the beauty of this orthosis, especially when using an inverted "V" elastic strap to close the bail.

We, in our laboratory, have dubbed this the polypropylene Ischial-Thigh-Knee-Ankle (ITKA) orthosis.

FABRICATION

A plaster negative cast from the ischium to the plantar surface of the foot is made, and in turn a positive model is made. We found that it was not necessary to use casting brims. By using the Fillauer A-P measuring stick, closing it with "just firm" pressure and holding it while it is wet and still on the patient until the plaster has set, a good usable cast can be obtained. After any necessary corrections are made to the positive

Fig. 1. Polypropylene foot-ankle section.

[3]Made by 3M Company. "Coban" is similar to an Ace bandage but is made of plastic fibers.

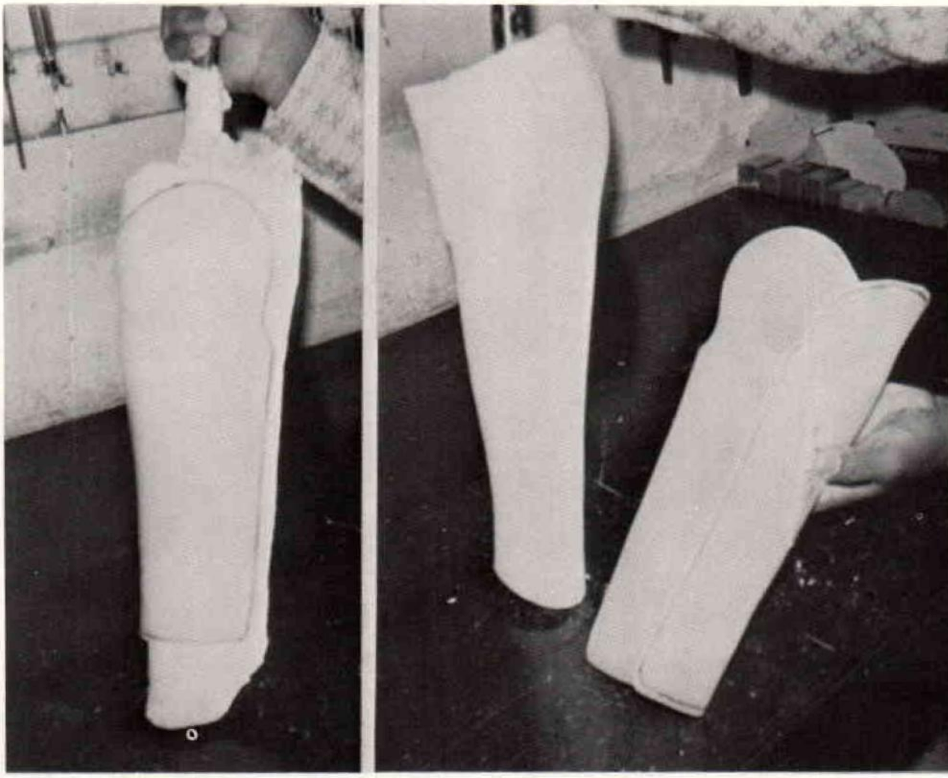

Fig. 2. *Left*, molded pretibial shell on positive model; *right*, same shell removed from the positive model.

model, the fabrication can be initiated even over a wet cast.

The BK section is made in accordance with the instructions given in an article by Engen in the December 1972 issue of Orthotics and Prosthetics (2) and in his manual on application of the TIRR orthosis (Fig. 1).

Fig. 3. Vertical anterolateral line on the positive model.

After the ankle-foot part has been finished, the pretibial shell is molded (Fig. 2).

Molding of the ischial thigh section should be done by starting the polypropylene on a vertical line anterolaterally (Fig. 3) and pulling medially, then posteriorly, following around the circumference until the originating edge is met. At this time, and very quickly, an assistant generously powders the anterior section already completed and to be overlapped so that the polypropylene will not adhere to itself. The polypropylene is brought around to meet a vertical line that dissects the medial third of Scarpa's triangle (Figs. 4 and 5).

The positive model and the three polypropylene sections are shown in Figure 6. Each of the three sections is trimmed and placed back on the cast (Fig. 7). Any of the jigs developed for cast bracing may be used in shaping the uprights.

After the plastic components are placed back on the positive mold in the original position, a

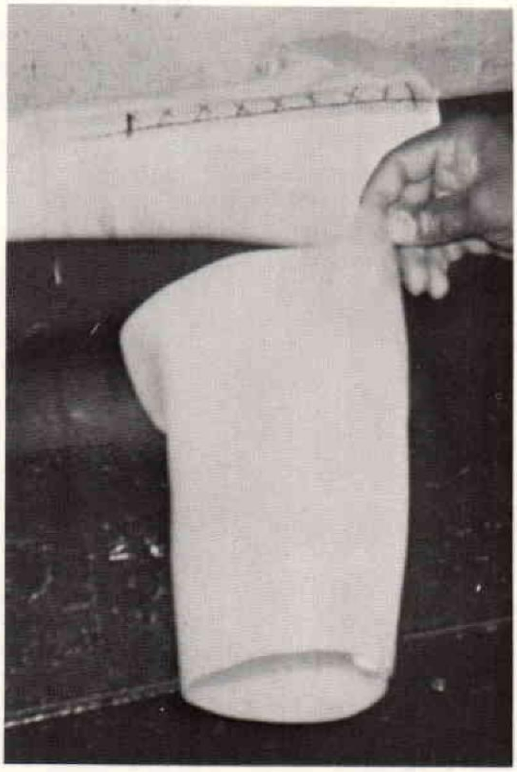

Fig. 4. Molded ischial thigh shell.

Fig. 5. The spring-like tension qualities of ischial thigh shell are shown here.

Fig. 6. Positive model with plastic components shown on the bench.

Fig. 7. The three plastic sections replaced on the model after completion.

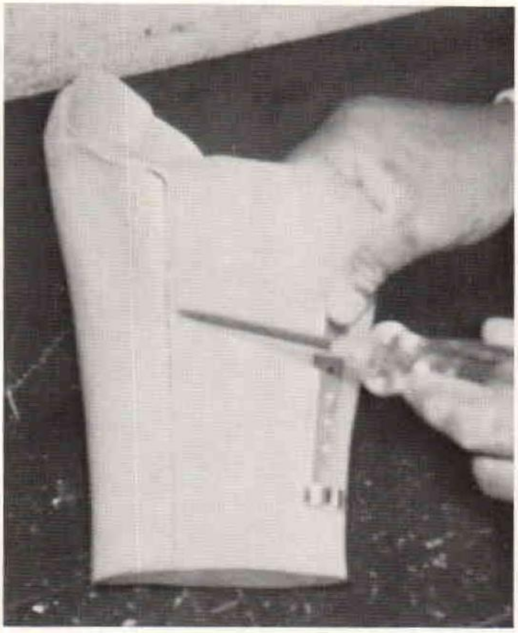

Fig. 8. Anterior view of ischial thigh socket with overlap.

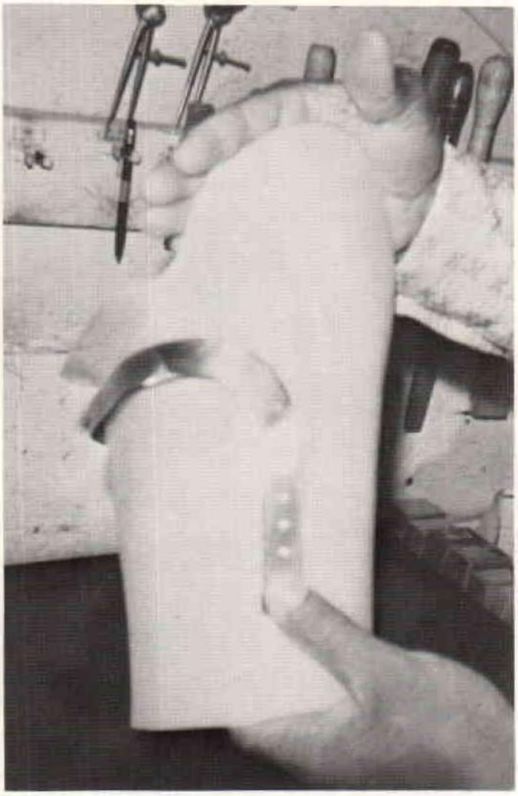

Fig. 9. Lateral view of socket with inverted "U-type" reinforcement piece.

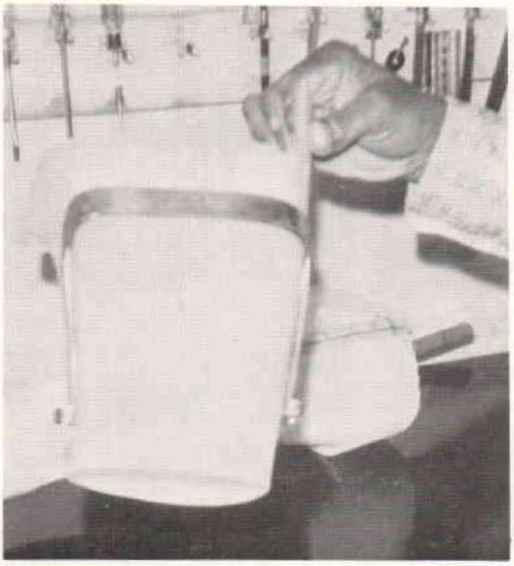

Fig. 10. Posterior view of socket and reinforcement parts.

Fig. 11. Completed plastic sections on model alongside of the metal frame.

pattern is made for the inverted "U-type" reinforcement made of stainless steel. After shaping the straps over the plastic socket, it is attached temporarily with two rivets only. In the definitive orthosis four rivets have been found to be adequate (Figs. 8, 9, and 10). Of course, corrugations in the polypropylene should eliminate a need for the inverted "U" strap.

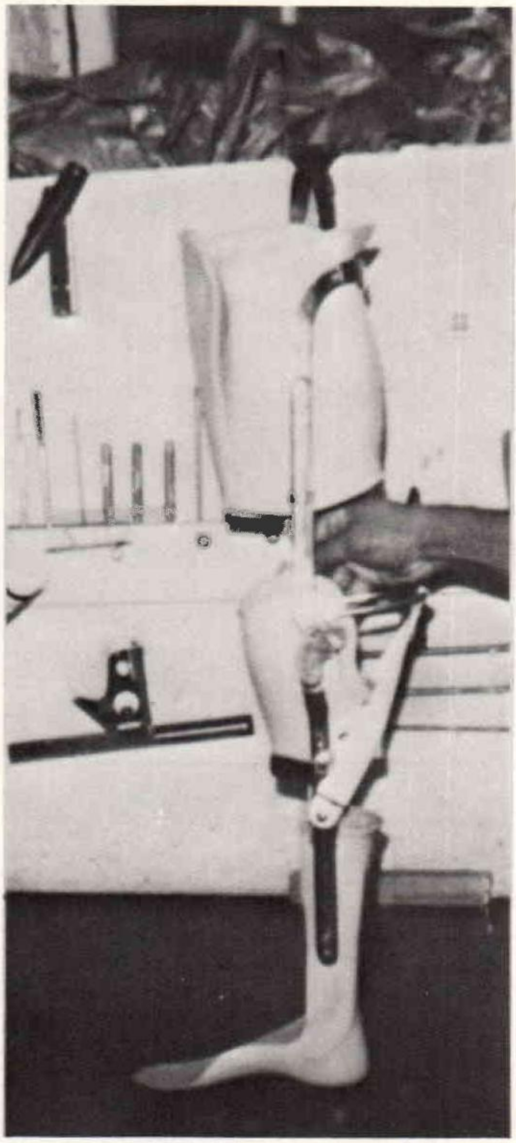

Fig. 12. Completed ITKA orthosis.

Small diameter copper rivets are used to attach the uprights temporarily to the three sections for fitting purposes. After the initial fitting all components are rechecked and an anterotibial band is made and riveted to the exterior surface of the uprights. The metal frame is now complete (Fig. 11).

All plastic sections are riveted to metal uprights. The alignment of the knee joint is rechecked to insure proper function of the bail lock. An inverted "V" elastic strap is attached to the bail and secured to the below-knee uprights with screws (Fig. 12).

A Velcro strap is used to provide closure of the pretibial shell on the orthosis. The only padding used was a piece of ⅛-inch thick Plastizote on the ischial thigh socket as mentioned earlier to prevent plastic squeak, and another piece on the Velcro strap used to close the posterior of the pretibial shell.

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REPORT OF WORKSHOP ON BELOW-KNEE AND ABOVE-KNEE PROSTHESES[1]

OPENING REMARKS

Mr. Joseph H. Zettl, Chairman of the Workshop, introduced Mr. William Stonebraker, Administrator of the Seattle Veterans Administration Hospital. Mr. Stonebraker welcomed the Workshop participants on behalf of the VA Hospital, which had made its facilities available for the meeting. He noted that although the hospital, opened in 1951, was not the largest in the country, it did have an excellent prosthetics workshop and that Dr. Ernest Burgess had contributed significantly to the development of this workshop. All participants were invited to tour the limb facility, if they so desired.

Dr. Burgess welcomed the gathering on behalf of the Prosthetics Research Study. He stated that significant changes in amputation surgery had occurred over the past ten years, resulting in improvement in the configuration of the stump, which called for changes in prosthetics design. The surgeon was now taking his rightful role as a partner to the prosthetist, doing better amputations and providing better stumps. Dr. Burgess emphasized that the modern stump is at the below-knee level and calls for a total-contact, end-bearing type of fitting.

Mr. Zettl reminded the participants that the focus of the present Workshop was on AK and BK prostheses and fittings. He recalled that the last BK workshop had been held in 1968, and the last AK workshop even further back than that. Hence, the plan of the present Workshop was to conduct a comprehensive review of both amputation levels in accordance with the agenda.

A list of participants is included at the end of this report.

REPORT OF MEETING AT ASCOT, ENGLAND

Mr. Anthony Staros stated that the Ascot meeting had been sponsored by the Ministry of Health, United Kingdom, and was primarily concerned with modular lower-limb prostheses. The United Kingdom, apparently, has a serious problem in the delivery of services to patients. It was hoped that the findings and recommendations of the meeting would help solve these problems. A report of the conference at Ascot will be published this spring and will contain a number of the papers presented, together with recommendations of the various syndicates or work groups. At the Ascot conference it was agreed that patients were entitled to quick service and improved cosmesis, and that there was need for an aggressive research effort to accomplish the desired improvement in cosmesis. Improved test standards for modular prostheses were desirable, but requirements should not be made so rigid as to inhibit innovation design.

BELOW-KNEE PROSTHESES

CASTING

Three-Step Plaster-Wrap Technique

Mr. Carlton Fillauer stated that he had developed the three-step casting procedure because of dissatisfaction with the conventional plaster-

[1]This report of a workshop on below-knee and above-knee prostheses, organized by the Committee on Prosthetics Research and Development, National Academy of Sciences, and held in Seattle, Washington, January 27-29, 1973, was prepared by June D. Newman and Hector W. Kay as part of the work under Contract V101 (134) P-75 between the Veterans Administration and the National Academy of Sciences, and Contract No. SRS 72-6 between the Social and Rehabilitation Service, Department of Health, Education, and Welfare, and the National Academy of Sciences.

wrap technique. He contended that the conventional wrapping procedure tends to convert the cross section of a BK stump, which is typically triangular, to a circular configuration. The three-step procedure provides an accurate reproduction of critical areas of the stump. The first of the three steps in the procedure involves the formation of a rigid splint cast over the bony anterior half of the stump; the second, a circumferential wrap over the first splint to a level just below the patella; and the third, splint casting of the anterior, medial, and lateral supracondylar areas. Details of the procedure are to be found in the article, "A Patellar-Tendon-Bearing Socket With a Detachable Medial Brim," that appeared in the December 1971 issue of *Orthotics and Prosthetics* (3).

According to Mr. Fillauer, this method of casting produces a mold which requires very little modification.

Utrecht Dilatancy Technique

Mr. Wilson described briefly the stump-casting technique developed at the Institute of Medical Physics TNO, in Utrecht, The Netherlands. This technique had been viewed in its developmental stages by American visitors to the Institute, and a report has recently been written entitled "Equipment for Evacuated Grain Impressing," by M.W. Koster (6). A rubber sheath is applied to the stump, which is then inserted into a container partially filled with fine casting sand. To facilitate entry of the stump, the sand is fluidized by blowing air into it. The air is then evacuated from the container, leaving the negative mold of the stump sharply defined in the sand. The amputee may exert a desired amount of weight-bearing on the stump prior to the evacuation of air from the container. The negative mold is filled with plaster of Paris; fabrication then proceeds in the usual manner.

VAPC Technique

Mr. Thomas Pirrello reported that VAPC was seeking to develop a suction-socket BK prosthesis and had been experimenting with many methods of cast-taking. It was believed, he said, that present stump-casting methods do not provide sockets which meet all the requirements of comfort, control, and suspension because of the many physiological changes that occur in the stump. In an effort to compensate for these variables, the VAPC is currently seeking to combine "proven" socket fabrication methods with several innovations in fitting all levels of lower-limb prostheses.

Fig. 1. Closed-wall Syme's prosthesis with Cordo-Plastazote liner.

Mr. Pirrello itemized the following concepts which are being applied to modular and endoskeletal prostheses wherever possible:

- A soft insert liner to provide a more comfortable stump receptacle.
- A suction-socket valve to reduce the relative motion between stump and socket.
- Total contact to improve support of body weight.
- Air cushioning to minimize stump displacement and improve socket comfort.
- An insert liner which will permit donning of, first, the liner, and then the shell of a suction socket in the sitting position.
- A removable liner to facilitate minor socket adjustments.

The recent development of a thin-walled, closed socket for the Syme's prosthesis has been found to be superior in strength to the type with open walls, i.e., posterior or medial windows and panels (Fig. 1). The removable Cordo-Plastazote liner reduces the overall size and weight of the

Fig. 2. Cordo-Plastazote liner with suction valve for BK prosthesis.

prosthesis and provides a method of obtaining the effects of suction-socket suspension without the use of a valve.

Mr. Pirrello further reported that the below-knee socket liner was also being fabricated in Cordo-Plastazote with controlled flexibility. The liner is held to the stump by means of an air-expulsion (suction) valve located in the distal socket (Fig. 2). The patient gains access to the liner in the same manner as for an above-knee suction socket. Since the liner is flexible and has a reasonable degree of elasticity, it remains in contact with the stump for longer periods of time and compensates for minor volumetric stump changes. The outer surface of the liner is contoured to "key" into the rigid socket shell and lock the liner in place (Fig. 3). The rigid socket is deeper than the liner, thus providing an air chamber in the socket beneath the liner. The liner end is free to expand and contract with stump volume changes. A second valve is placed in the outer socket wall, opening into the chamber beneath the liner. The resistance settings of the two valves are adjusted to maintain a lower positive pressure in the air chamber beneath the liner, producing an air cushion. The external valve is easily depressed through the foam to release the liner from the socket.

Fig. 3. Liner inserted into rigid BK socket.

The above-knee socket liner is fabricated in the same method as the below-knee, except that the liner walls are heavier. The liner may be supported distally by the rigid socket. Where the liner is in contact with the rigid socket, an opening is made in the socket wall for access to the valve. If air cushioning is desired, a second valve is installed in a space below the liner in the same manner as for the below-knee use. In both methods the outer surface of the liner is "keyed" into the socket walls for retention.

Prosthetics Research Study (PRS) Pre-Modification Technique

Mr. Zettl described the pre-modified casting technique developed at the Prosthetics Research Study for the patellar-tendon-bearing prosthesis. This technique has been written up in considerable detail elsewhere. He cited such references as "The Management of Lower-Extremity Amputations" by Burgess, Romano, and Zettl (1), and "Pre-Modified Casting for the PTB Prosthesis," by Zettl and Traub (17). According to Mr. Zettl, the pre-modified casting procedure can be used with relatively minor modifications for the supracondylar or the supracondylar-suprapatellar (PTS) prosthesis with wedge suspension.

The pre-modification technique involves the application of a heavyweight sock, together with suitable sized and shaped pressure-relief pads. A second (lightweight) cast sock is then applied, very wet, and provision is made for hamstring-tendon relief by the use of special pads. Compression pads are then glued to the stump sock over pressure-tolerant areas. Beginning at the distal-lateral aspect of the stump, an elastic plaster-of-Paris wrap is applied in a prescribed sequence. When the wrapping is completed, the below-knee PRS-model casting fixture is used to define the patella.

SOCKETS

Clear Sockets

Mr. Snelson described the work being done at Rancho Los Amigos with transparent BK sockets made of the polycarbonate material, "Lexan." He proposed that the prime application of these sockets should be as "check" or "study" sockets. Breakage had been experienced when attempts had been made to use these sockets on a long-term basis. He mentioned the difficulties experienced in handling the polycarbonate sheets and the need to dry them out thoroughly. Drying time and temperatures apparently varied in different climates. The Rancho Los Amigos procedures on the fabrication and fitting of transparent polycarbonate sockets are described in the March 1972 issue of *Orthotics and Prosthetics* (7).

Soft Sockets

Mr. Nitschke expressed the opinion that a BK socket with a soft insert was easier to fit—and easier to adjust in order to maintain good fit—than was a hard socket. For more than two years he had been using inserts made of "Cordo," a polyvinyl chloride compound. A detailed description of the procedures followed, using Cordo, is contained in Mr. Nitschke's article entitled "Cordo: A New Material in Prosthetics and Orthotics," in the September 1972 issue of *Orthotics and Prosthetics* (9).

Silicone Gel Sockets

Dr. Koepke described the BK prosthesis developed at the University of Michigan, especially designed for the fitting of difficult stumps. Essentially, the item involves a standard patellar-tendon-bearing prosthesis with a SACH foot, modified by substituting silicone gel in an envelope of lightweight horsehide for the conventional Kemblo socket liner. Cotton, wool, or nylon stump socks are applied to the stump before the prosthesis is donned. The prosthesis is suspended by a rubber thigh sleeve. The silicone gel below-knee prosthesis is more fully described in the September 1971 issue of the *Inter-Clinic Information Bulletin* (5).

The Wellington Socket

Mr. Titus reported on experiences at Duke University in evaluating the Wellington foam-fitting technique on three patients who had experienced excessive shrinkage in standard PTB hard-socket prostheses, so that they were wearing at least two 5-ply stump socks over the entire stump, with up to five 5-ply socks over the distal end. All the stump socks were removed, then one thin 3-ply cotton stump sock was put on and a rubber balloon pulled over the stump and sock. The so-called "Wellington foam" was then mixed and poured into the bottom of the socket. (The "Wellington foam" is a polyurethane formula made by Cooke Paint Co. of New Orleans.) The stump was inserted into the socket, and an attempt was made to stabilize it while the material was foamed around between the stump and the wall of the socket. Two-pound foam was used in two sockets and 10-lb. in one.

However, after the sockets were formed, the patients could not tolerate them because of discomfort to their stumps caused by the rough texture of the foam material. Mr. Titus indicated he would make a further effort with the technique, using the 10-lb. foam which seemed the more promising of the two.

University of Miami Sockets

Mr. Sinclair described the University of Miami experiences with sockets made of Tazlon. This intermeshed material conforms to the shape of the stump. It is applied as a sleeve and tied off at the end. Considerable experimentation over a period of more than a year had failed to produce a satisfactory application in that patients complained of too much distal pressure on the stump.

Mr. Sinclair also spoke of working with other thermoplastic materials, particularly polypropylene, which he thought easier to work with than polyurethane.

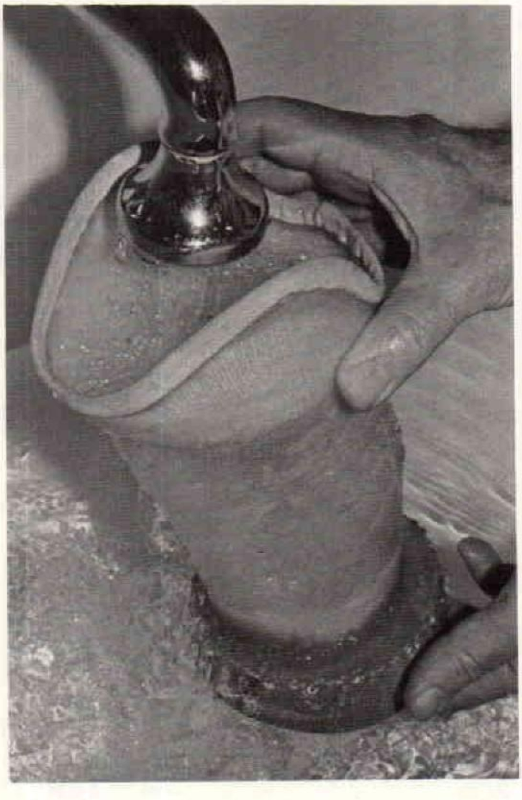

Fig. 4. Demonstration of the porosity of Lightcast socket.

The NPRL Socket

Mr. Asbelle described the Navy Prosthetics Research Laboratory's experiences with the use of "Lightcast" as a socket material. More recently, Merck, Sharp and Dohme have arranged with Solar Laboratories (who developed Lightcast) to develop and promote "Lightcast II." A special company, MSD Orthopaedics Company, Inc., of West Point, Pennsylvania, was formed for this purpose. Sockets of Lightcast II are formed directly on the stump. Two BK stump sockets were displayed, one made with the original Solar Laboratories system, the other with Lightcast II. The finer, closer structure of the older material provides a smooth inner socket surface. The newer material has a more open fiber glass construction, but both offer a satisfactory structure promoting ventilation for stump tissues (Fig. 4). The most significant change is in the ultraviolet light and the increased speed of polymerization—the combination of the newer type of light plus the more open structure of the fabric completes polymerization in three minutes. The new lamp is more easily adjusted to positions required, and after three minutes the Lightcast II socket is sufficiently hardened for immediate use (Fig. 5).

Disadvantages of Lightcast II include surface roughness and irregularity of the inner socket surface because of the more open structure of the material; the problem of dust and exposure of the fiber glass to contact with the skin when cut edges are filed; and difficulty in cleaning the stump sockets. These areas require further work on the part of the Navy Prosthetics Research Laboratory.

Mr. Zettl, also, spoke of his experience with direct molding of Lightcast. Mr. Dillee spoke of the superior qualities of Pe Lite as a material for socket liners and reported that use of Pe Lite had been included in the BK course at NYU. Pe Lite is described in *ISPO Bulletin* No. 1, January 1972 (10).

SUSPENSION

The Detachable Medial Brim

Mr. Fillauer indicated that in his practice the insert or removable wedge-suspension mechanism for the supracondylar BK prosthesis had been almost entirely supplanted by the use of the removable medial-brim technique. This technique had been described in *Orthotics and Prosthetics*, December 1971 (3), and had been summarized in *Newsletter . . . Amputee Clinics*.

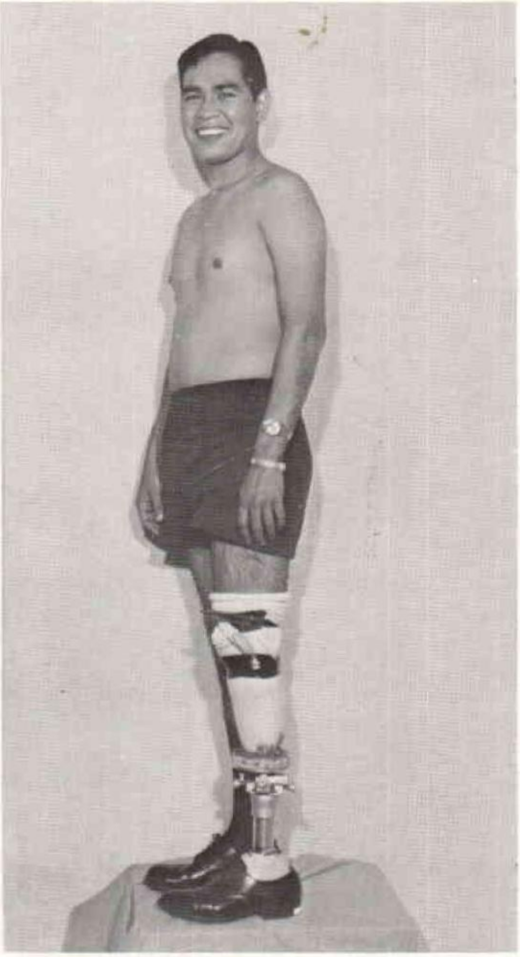

Fig. 5. Lightcast socket on adjustable prosthesis.

August 1972 (8). Essentially, the mechanism involved the fabrication of the prosthesis so that the proximal medial portion could be detached (and replaced) at about the level of the medial-tibial plateau. The separation mechanism (Fig. 6) involves a stainless-steel bar laminated into the detachable brim, then inserted into a channel laminated into the lower portion of the socket. The channel has a spring-ball assembly for retention of the upper bar. With this method of suspension, no additional straps or accessories were required.

8½"

Cordo-Plastazote Wedges

Mr. Nitschke remarked that he couldn't completely agree with Mr. Fillauer in the use of the detachable medial brim, which was essentially a hard laminated segment over the medial condyle. He felt that some softness and flexibility in the wedge area was necessary for comfort, particularly for older amputees. In his own practice, therefore, Mr. Nitschke said he had been using a Plastazote wedge over the area of the medial femoral condyle. This wedge was covered with the required layers of gauze, saturated with Cordo and allowed to dry overnight. The insert was then taken off the cast and allowed to dry for two additional days. When dry, the insert was again placed on the cast for the completion of fabrication. In his experience, Mr. Nitschke said, adjustments to the Cordo insert can be made more easily than with any other type.

Modified Supracondylar Suspension System

Mr. Zettl reported that, since 1967, the Prosthetics Research Study in Seattle has incorporated a custom-fitted supracondylar wedge suspension for both supracondylar and supracondylar-suprapatellar below-knee prostheses (Fig. 7). While the hard-socket, hard-end type of prosthesis is advocated and used routinely at this Center, this system can be used successfully in conjunction with any type of soft insert.

The wedge is fabricated on the positive stump model, using a laminate lay-up of nylon stocki-

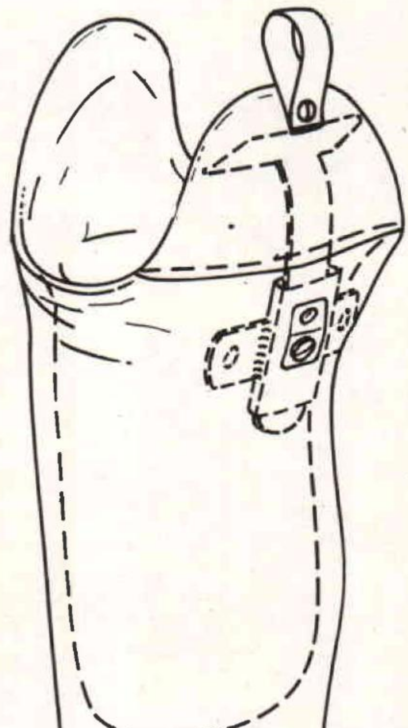

Fig. 6. Fillauer removable brim suspension system for BK prostheses.

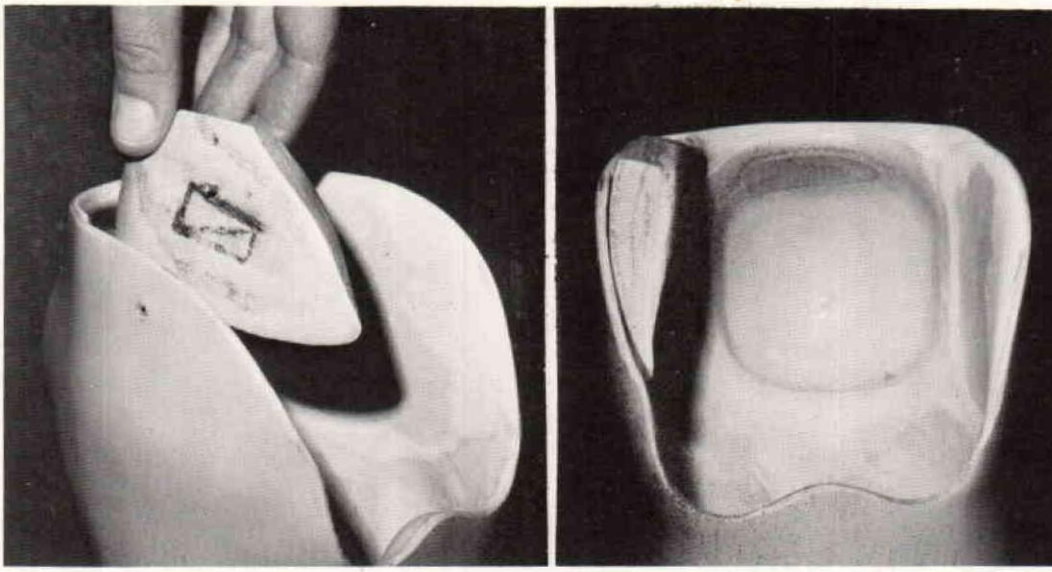

Fig. 7. Two views of the Seattle supracondylar wedge-suspension system.

nette and dacron felt saturated with No. 4110 polyester resin and Solka Floc mixture. Thickness of the wedge is predetermined by measuring the difference between the mediolateral dimensions at the epicondyles and the supracondylar thigh. Bulk is held to an absolute minimum, the proximal socket shell being made just large enough to allow donning and doffing of the prosthesis. Two protruding stainless steel pins (⅛ in. stainless steel rivets) are incorporated into the laminate wedge lay-up, and corresponding holes are drilled into the medial proximal socket brim, locking the wedge securely in place.

Active knee flexion during gait, including muscle activity, not only results in a minimal amount of atrophy in the tissue under the wedge, but also occasionally causes chafing of the skin. By eliminating one of the two suspension pins, the wedge is allowed to rotate during swing or extreme stump flexion when the patient is seated, thus providing a more comfortable stump positioning which avoids chafing and discomfort.

Since a proximal brim retention lip is not required in this system, the bulk of the resulting proximal medial socket is minimal. This suspension wedge can be readily adjusted to accommodate atrophic stump changes. Soft sponge or rubber can be added to suit individual patient requirements or preferences.

Inflatable Wedges

Mr. Staats described a method of supracondylar suspension developed at the UCLA Prosthetics-Orthotics Program by Lincoln Baird, an inventor and amputee. The "inflatable wedge suspension system" (Figs. 8 through 11) consists of two fluid-filled bladders connected by a piece of tubing with a needle valve between the two bladders. One bladder is wedge-shaped and serves as the suspension bulb, while the other is the inflation bulb, or reservoir. The casting procedure and fabrication of the inflatable wedge system are similar to those of the Fillauer hard-wedge variant. The major difference is that the inflatable wedge is not as critical as the hard wedge in terms of placement about the knee, partly because of the tendency of the inflating wedge to conform to the shape of the condyle. Prototype models of the inflatable wedge fitted to amputees showed that the wedge provided secure, comfortable, reliable suspension with a built-in adjustment not available in other suspension methods. Development is continuing. Additional material on this technique may be found in the March 1973 issue of *Orthotics and Prosthetics* (14).

8¼"

University of Miami Soft Wedges

Mr. William Sinclair reported that he had tried the Fillauer supracondylar wedge system for the suspension of BK prostheses. However, in Miami a move had been made to the use of soft wedges. Generally, these wedges were made of polyurethene and, in fact, were carved from the material used in the construction of heels for SACH feet. A piece approximately the size of a

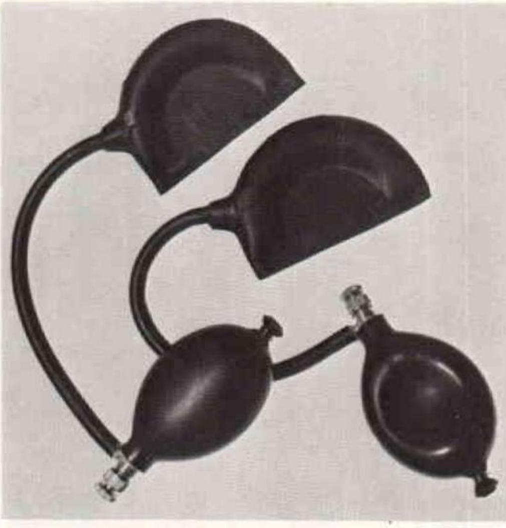

Fig. 8. Inflatable wedge prototypes.

Fillauer wedge and ⅜ to ⅛ in. in thickness is shaped and attached to the supracondylar "ear" of the prosthesis. In approximately 80 percent of the cases, a medial wedge only is found to be necessary, but, in some cases, both medial and lateral wedges are used. In supracondylar-suprapatellar-type fittings, wedge material is also added anteriorly above the patella.

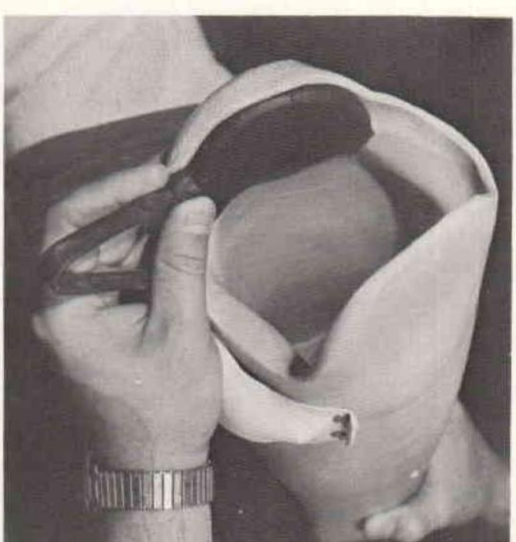

Fig. 9. Medial condyle placement, similar to Fillauer wedge.

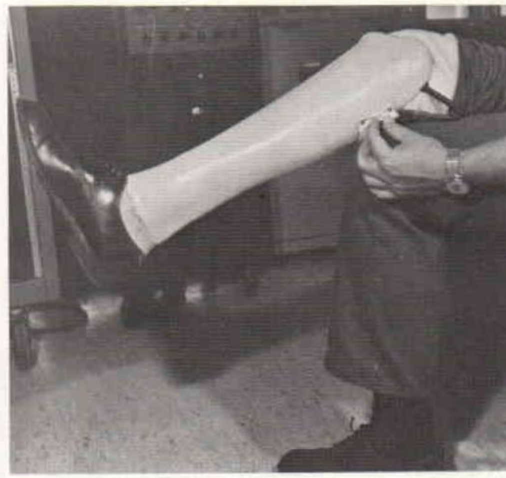

Fig. 10. Inflating wedge using knee pressure.

CONSTRUCTION

Report from Ascot Meeting

Mr. Muilenburg presented a number of points from the Ascot meeting which he thought were of particular significance:

- Modular and endoskeletal systems enable prosthetists to supply continuous treatment.
- All parts of prostheses should be interchangeable within a period of 24 hours.

Fig. 11. Inflated bulb is buried in depression made in gastrocnemius bulge area.

- The socket is one part that cannot be prefabricated; it must be custom-made or "bespoke."
- There was probably a place for both heavy-duty and light-duty modular or endoskeletal systems.

A considerable discussion ensued concerning the strength and durability of current endoskeletal prostheses. Failure of systems to hold up had been a problem with some prosthetists, although Mr. Muilenburg stressed that breakdown was minimal when the devices were correctly applied. However, he indicated that he used them primarily for female patients.

Mr. Foort urged that modular systems be taught in the schools. He felt that, with increased use, present problems would be eliminated.

The Indian Method

Mr. A. Bennett Wilson, Jr., described some of the features of the below-knee prostheses being made at the Christian Medical Hospital in Vellore, Southeast India. (The components of these limbs are made by craftsmen who understand very little about the principles of prosthetic alignment.)

- The heel height in the SACH foot used is lower than standard in order to accommodate the local footwear, so this configuration allows the patient to walk short distances without shoes.
- For the patellar-tendon-bearing prosthesis fitted, a hollow laminated polyester shell is used with a wooden ankle block laminated into it.
- In place of the standard PTB cuff a ½ meter length of 25 mm (1 in.) wide tape is used. This tape is passed in a figure 8 around the knee through slots in the prosthesis, and then tied with a knot at about the level of the patellar tendon bar.

The Indian techniques are more fully described by Girling and Cummings in *Prosthetics International* (4).

Barredo/USN Method of Fabricating Ultra-Lightweight Below-Knee Leg

Mr. Wilson reported that Dr. Joseph Barredo, a physicist and below-knee amputee (traumatic), believes that weight in the below-knee prosthesis is very important and, with the cooperation of the U.S. Naval Hospital, Philadelphia, has fabricated a completely crustacean PTB-type below-knee prosthesis that weighs in the neighborhood of 19 oz. Certainly a reduction in weight makes suspension less of a problem. The method used is similar to that described by Wollstein in *Prosthetics International,* Vol. 4, No. 2, 1972 (16), but Barredo relies on the shape of the "foot," rather than elastic material, to provide function. Force-plate data on various foot configurations will be obtained at Moss Rehabilitation Hospital, and attempts will be made to fabricate the crustacean prosthesis of polypropylene or some other sheet plastic, using the vacuum-forming equipment. It is felt that this type of prosthesis might very well be appropriate for the geriatric patient, if not for others.

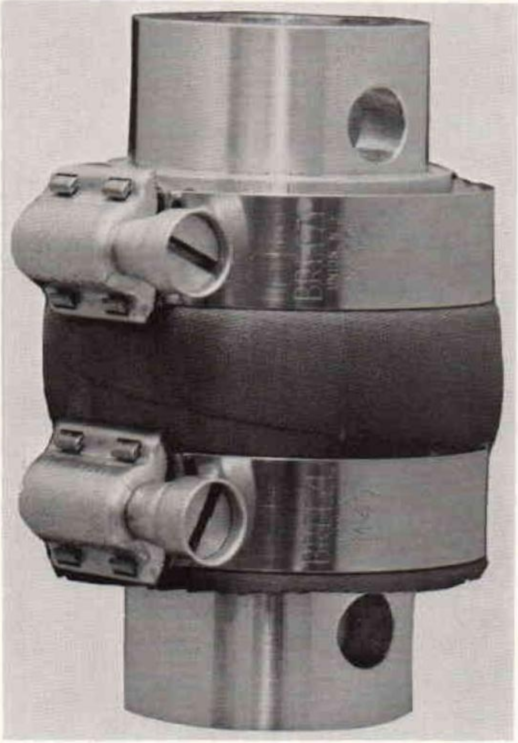

Fig. 12. The Weber-Watkins rotator.

The PVC Tube and the Weber-Watkins Rotator

Mr. Staros reported on two items that the VA was following with interest.

The first of these was the use of a polyvinyl chloride (PVC) tube by Mr. Lehneis of the Institute of Rehabilitation Medicine as a substitute for aluminum in some light-duty temporary prostheses (Fig. 12). Mr. Lehneis had made a number of applications of these tubes and reported that assembly was quick and easy. Postfitting changes in alignment could be made simply by heating and bending the tube. Mr. Staros commented that,

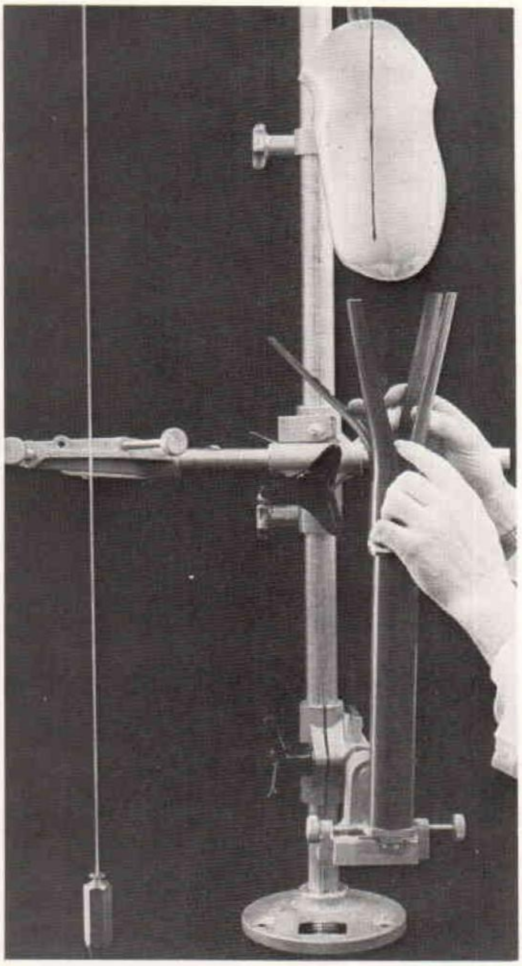

Fig. 13. Use of a PVC tube as a supporting structure (shank) for a below-knee prosthesis.

for heavy-duty use, aluminum would probably have to be substituted for the PVC, or a laminate layer would have to be laid over the plastic tube would have to be laid over the plastic tube to provide the needed strength.

The second item was the Weber-Watkins rotator which consists of two thrust bearings connected to each other by a piece of rubber hose and several hose clamps (Fig. 13), In rather limited applications to date, this system has proved to be quite durable. Mr. Nitschke has fitted two patients, and VAPC is following up on three units which have been in service for periods of up to eight months. These three units are being worn by two unilateral above-knee amputees and one below-knee amputee who is a golfing enthusiast. Mr. Staros mentioned that the rotator weighed 700 grams, which was excessive. However, a change in materials might help to reduce the weight significantly. It was also necessary to check whether the rotation capability in each direction would produce instability during normal walking, the possible benefits of a reduction in shear between stump and socket, as well as any benefits the rotator might have for the amputee's golf game.

Vacuum Forming

Mr. Snelson remarked that additional experience needed to be gained with some of the newer materials, such as polyethylene and polypropylene for use in prosthetic sockets. However, vacuum-forming techniques lend themselves extremely well to the central fabrication concept. There is evident need for a continuing exchange of information between the people who are experimenting and working in the field of vacuum forming. With an increasing number of centers possessing vacuum-forming apparatus, a small workshop for an exchange of "know-how" between the various centers would be useful.

FOOT AND ANKLE

Mauch Modified Ankle

Mr. Mauch reported that the basic design of the modified ankle had been completed, and it included the following features:

- The hydraulic system proper. The 5-deg. forward motion of the shank to initiate the dorsiflexion stop had been eliminated. The dorsiflexion stop will now be produced solely by the application of the amputee's weight to the ankle unit. Technical details concerning the hydraulic mechanism are contained in the Quarterly Progress Report of Mauch Laboratories, Inc., for the period ending December 31, 1972 (12).

  The basic configuration of the modified design is much simpler than the previous one, but it is still so similar in shape that the existing castings can be used, with some modifications, for the prototypes of the new design.
- Foot attachment and eversion/inversion. The control principle for eversion/inversion has been changed. Eversion will be blocked to provide stability in the mediolateral direction, and inversion will be permitted against a moderate elastically yielding resistance. Toe pick-up can be varied by the prosthetist by the rearrangement of leather washers.
- Shank attachment and transverse rotation control. Elimination of the anterior/poster-

ior adjustability has simplified the design considerably and permits the installation of the ankle system in standard small-diameter pylons (down to 1 in. I.D.). The design change also allows the prosthetist to either block or permit transverse rotation to accommodate preferences of amputees.

All in all, the new design of the foot and shank attachments is much simpler, less expensive, less noise-prone, easier to install, and probably more durable and maintenance-free than the previous design, without loss of significant functional features. Test wearing of the prototype unit will resume shortly.

COSMESIS

Otto Bock Modular Systems

In discussing the Otto Bock modular prostheses, Mr. John Hendrickson mentioned that design objectives of the company, in order of importance, were (1) cosmesis, (2) comfort, (3) operational safety, and (4) function. The Otto Bock endoskeletal system had been introduced to the United States in the fall of 1970, and from January 1971 until March 1972, six instructional seminars were conducted with close to 100 prosthetists attending. They were instructed in the correct alignment and fabrication procedures for this new type of prosthesis.

Mr. Hendrickson reported that improvements were constantly being made to the Otto Bock system as the result of experiences in the field. One of these improvements was an improved extension assist and the provision of the modular system hip joints in two models, one with lock and one without, the devices being interchangeable. Moreover, when the Bock system was first offered, it included only a single-axis, constant-friction knee that could be used with or without an extension assist and a SACH foot. Currently, two knee units are offered: (1) a single-axis, constant-friction knee and (2) a single-axis, constant-friction knee with a manual lock and improved mechanical swing-phase control, and a choice of three foot-ankle mechanisms—SACH, single-axis, and five-way. A prototype yielding-friction knee similar in function to the Bock safety knee has been designed, fabricated, and is scheduled for production in the near future. Plans are also being made for a polycentric knee unit and a swing-phase control unit that will provide the same functions as present pneumatic or hydraulic units, or better.

Hosmer BK Modular Prostheses and Soft Covers

In the absence of Mr. Cecil Benton who was called away from the meeting, Mr. Leigh Wilson reported on the Hosmer/Dorrance below-knee modular prostheses and the Prosmetic soft covers. More than 300 stock sizes and shapes of the soft BK covers are now considered to provide the ultimate in prosthetic cosmesis. These covers are said to be lightweight, tough, and exceptionally durable, and their composition of urethane and integrated skin provides a natural appearance and softness.

The soft covers are for use with plastic sockets laminated to the PSL-100 adjustable pylon or with the so-called "modular two-stage system" where the plastic socket is dynamically aligned on an adjustable leg and then transferred into a duplicating jig. The special attachment plate of the PPK 200 fixed pylon is then laminated into the aligned socket with the pylon in the correct M-L and A-P positions. These applications are more fully described in the Hosmer/Dorrance *Prosthetic Hotline*, Vol. 48, Series 1-71 (11).

Kingsley Items

Mr. Kenneth Kingsley presented two items of fairly recent development at the Kingsley Mfg. Co. He called one of them the "sculpted-toe ladies' foot" (Fig. 14). This item had been developed for a secretary at the insistence of Roy Snelson, Project Director of the Amputee and Problem Fracture Service, Rancho Los Amigos Hospital, Downey, California. The second item was the so-called "flat foot" (Fig. 15). Originally designed for barefoot ambulation

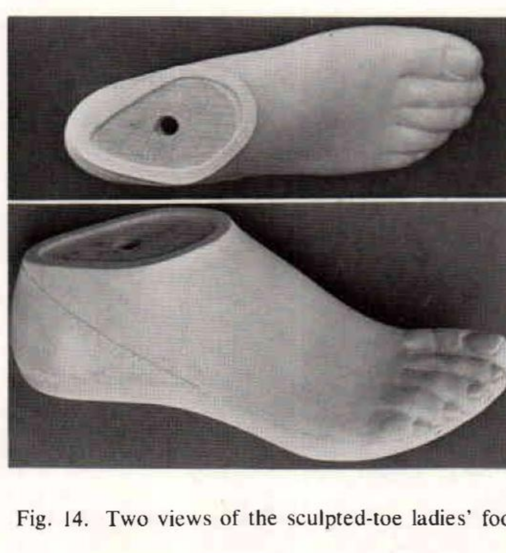

Fig. 14. Two views of the sculpted-toe ladies' foot.

Fig. 15. The flat foot.

with an immediate-postoperative prosthesis at the instigation of Dr. Vert Mooney and Roy Snelson at Rancho Los Amigos Hospital, its applications have since expanded into use with prostheses for swimming and water-skiing, and the wearing of flat-heeled shoes. Flexible leather applied to the sole enhances the foot's wearing qualities. If sufficient demand developed, this leather could be attached during production.

DISCUSSION

It was emphasized that the stump socket interface was still a matter of prime concern, particularly at the BK level since BKs constitute the majority of amputations at the present time. A concept was introduced of sockets that would grasp the stump and stumps that would grasp the socket.

The desirability of spelling out prescription criteria for the various casting, fitting, and suspension techniques was discussed. It was agreed that the delineation of prescription criteria was very difficult, and that, ultimately, the technique used for a given patient was the one that the prosthetist did best and with which he was most comfortable.

The desirability of a comparative evaluation of various casting procedures with a check of the outcome by means of transparent sockets was stressed by various speakers.

The inclusion of administrators in workshops and meetings dealing with the delivery of services was stressed. Items made available to patients are frequently determined by lists and fee schedules, and it was felt that development of administrative procedures was necessary to make possible the delivery of the best available prostheses.

ABOVE-KNEE PROSTHESES

CASTING

The BRADU Above-Knee Socket

Dr. Harris described briefly the socket which is being developed for selected AK amputations in the Biomechanical Research and Development Unit at Roehampton. Dr. Verne Inman of Berkeley had suggested that if pressures could be evenly distributed over the whole surface, the AK stump would support the body weight without producing high loads on the ischial tuberosity. This concept had greatly interested Dr. McKenzie of Roehampton who had made many attempts to cast the AK stump with weight-bearing in the stance phase. The problem was that in casting the stump with weight-bearing, the soft tissues were displaced proximally, thus shortening the soft-tissue elements of the stump and increasing its circumference. Consequently, when the stump was pulled into the socket that had been fabricated from this cast, the soft tissues elongated and patients complained that the socket was too short. In the swing phase, the weight of the prosthesis distracted the soft tissues of the stump, elongated them, and reduced the circumference of the stump. The socket could then no longer maintain its pressure differential.

Redhead and Alcock of Roehampton then postulated that if the stump could be cast in stance with the soft tissue distracted as much as possible, there could be no further distraction in the swing phase, and the pressure differential would be maintained. They developed a method of casting the stump on this principle. The stump is pulled into long-underwear-type trunks made of specially woven elastic and distracted, thus producing an evenly distributed circumferential pressure over the surface of the stump. A cast is then made with the patient supine. Pressure applied evenly and circumferentially over soft tissue must result in a round cross section; hence, BRADU-type sockets are round, rather than quadrilateral, and are not ischial-bearing. Sockets made by their method on selected patients who were previously suction-socket wearers have proved successful in approximately 70 percent of the cases. Difficulties had arisen because of inability to cast the end of the stump under pressure, and there had been other problems. Dr. Redhead had made a number of modifications to the technique and was still revising it. Dr. Harris said that those who had a satisfactory fit were very satisfied, but the whole method of weight transference was totally different from that of other prostheses. If the procedure were abandoned at any time, not only the suspension but also the whole method of loading would be changed. He suggested that the concept showed promise, but was still under development and, pending further development, it should not as yet be considered for U.S. evaluation.

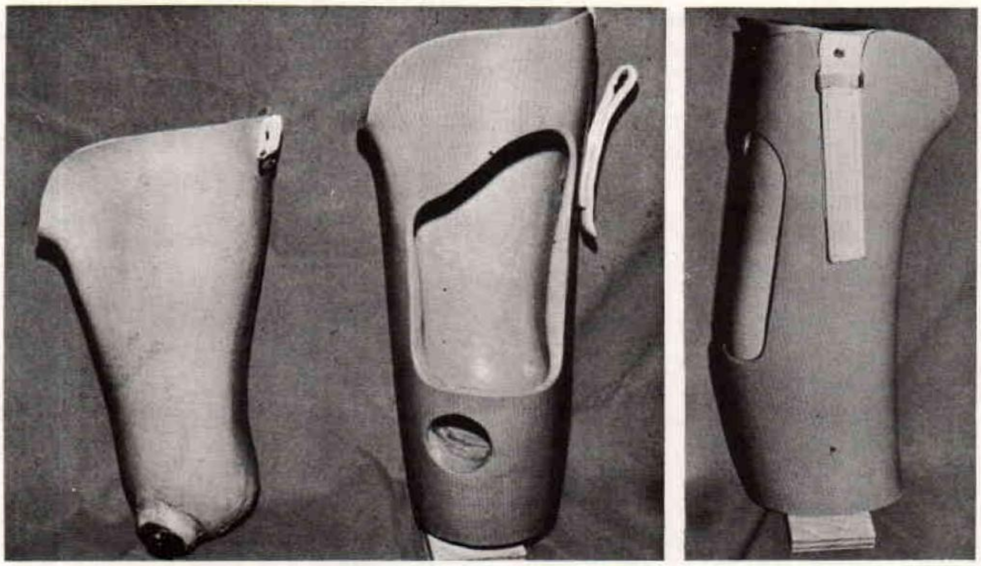

Fig. 16. Two-component type of total-contact AK suction socket designed for geriatric AK amputees. *Left*, flexible inner socket; *center*, rigid outer shell with anterior window; *right*, complete assembly of socket and shell held together by Velcro strap on lateral side.

NEW TECHNIQUES

Suction Socket for the Geriatric AK Amputee

Mr. Sinclair described the above-knee socket which had been developed at the University of Miami for aged patients. This socket incorporates an RTV silicone liner made with three layers of stockinette and a suction valve. The outer laminated shell of the socket had been fabricated with variously located cutouts in efforts to determine the configuration which provided adequate strength and retention with minimum weight (Fig. 16). The amputee dons the liner, inserts the stump with liner into the socket, and connects the two with Velcro.

Unfortunately, Mr. Sinclair reported, this system did not work as well as had been hoped. Patients still found it difficult to don their prostheses in the sitting position. Development is continuing.

This suction socket for geriatric amputees is described in the Spring 1969 issue of *Artificial Limbs* (13).

Cordo Insert Sockets

Mr. Nitschke stated that, in the Rochester experience, Cordo inserts had proven to be very useful for many above- as well as below-knee amputees. Flexible liners had been fabricated for patients with very bony stumps, and padding had been added where very little natural padding was present, *e.g.*, in such areas as the lateral distal femur and the ischial tuberosity. The liner not only greatly increased patient comfort, but adjustment between the liner and the socket could be made very easily.

In cases where suction sockets are required, Cordo inserts can still be used. The valve is inserted into a hole ½ in. in diameter after the area around the hole has been heated. The flared portion of the insert can then be tied off in the groove in the valve with a nylon cord to make a permanent seal. The area around the valve may then be built up with Plastazote and blended into the contours of the stump. When desirable, the last layer of Cordo may be deferred until the Plastazote has been added. It can then be used to finish off the liner.

Cordo inserts are apparently working very well in suction sockets for endoskeletal prostheses. The stump is first pulled into the insert and sealed with the valve; the amputee then inserts the stump with the liner into the plastic socket. A disk about 1 in. in diameter and ¼ in. thick is incorporated onto the Cordo insert, just lateral to the Scarpa's triangle area. This disk fits into a cutout in the same area of the plastic socket. This arrangement keeps the insert in proper position and prevents it from slipping out of the plastic socket. It is not necessary to pull the cosmetic cover down or install cutouts for the valve.

A schematic view showing installation of a suction socket valve into a Cordo liner is shown in Figure 17 (9).

Air-Cushion Technique

Mr. J. E. Dillard of Nashville, Tennessee, described the fitting of air-cushion AK sockets to patients with problem stumps, particularly those with marked discoloration at the distal end. Excellent relief had been obtained (Figs. 18 and 19).

The procedures for fabricating the AK air-cushion socket were based on those developed at the University of California San Francisco Medical Center by Wilson, Lyquist, and Radcliffe for BK prostheses. Essentially, the distal two-thirds of the socket was made of three layers of stockinette impregnated with No. 384 Silastic Elastomer. A suction valve is located distally, and an air space is provided between the Silastic inner socket and the outer shell. A more complete description may be found in the article, "A.K. Air-Cushion Sockets," in the June 1970 issue of *Orthotics and Prosthetics* (2).

OTHER ITEMS

THE VERMILLION LEG MECHANISMS

Mr. Charles W. Vermillion of Roseburg, Oregon, presented a film showing above-knee and hip-disarticulation prostheses he had developed. These prostheses could be adjusted manually to control the forward movement of the hip and the backward movement of the knee, and permitted selective locking or unlocking. The mechanism of the prosthesis is described in greater detail in U.S. Patent No. 3,663,967, entitled "Joint Movement Limiting Arrangement for Prosthetic Legs" (15).

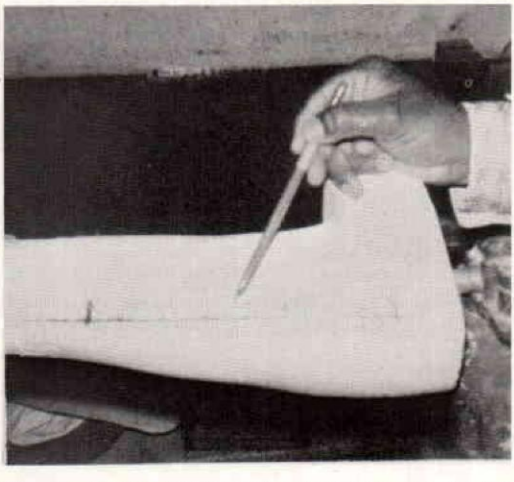

Fig. 17. Suction-socket valve installation in an AK prosthesis with a Cordo liner.

Fig. 18. Distal end of stump before fitting with air-cushion socket.

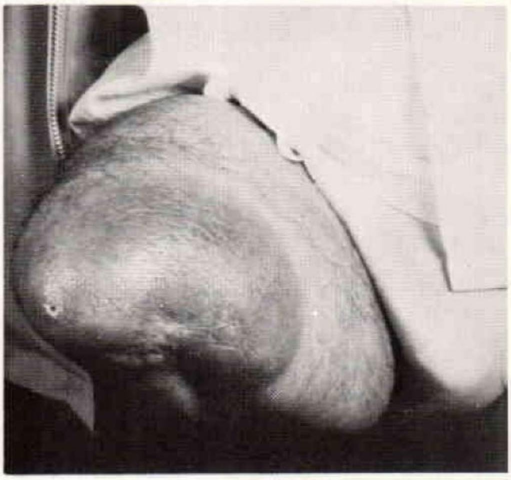

Fig. 19. Distal end of stump after fitting with air-cushion socket. Note the major change.

SEATTLE PROSTHESES FOR SPORTS AND RECREATION

Mr. Jack Graves described at some length his skiing experiences as a below-knee amputee, using prostheses that he had developed. It was recommended that Mr. Graves prepare this material for publication in *Orthotics and Prosthetics*.

RECOMMENDATIONS

In an effort to bring together the various agreements that had been reached during the workshop, Messrs. Foort and Hampton presented a list of proposed recommendations for consideration by the group. These items were:

- Carlton Fillauer's three-stage casting technique and Joe Zettl's pre-modified plaster impression technique should be evaluated as quickly as possible (within six months, including preparation of teaching material). All necessary information needed for the evaluations should be supplied by the developers. Transparent sockets with modular components should be used to evaluate the products of these casting techniques.
- Casting techniques which would permit the making of impressions under dynamic conditions should be investigated.
- Other institutions besides Rancho Los Amigos Hospital, and including the prosthetics schools, should investigate the values of transparent sockets as check sockets.
- A manual on the fabrication of gel-socket prostheses should be made available to the schools.
- Investigations to develop the VAPC below-knee suction socket and the NPRL method of socket fabrication should be continued.
- Efforts to develop prescription criteria for use of the numerous variants of the BK prosthesis should be intensified.
- Participants in the workshop should make available to the schools all pertinent information concerning their variations in the PTS wedge-suspension techniques. The schools should include these techniques in their teaching programs, as appropriate.
- The prosthetics schools should obtain vacuum-forming equipment so that they can keep abreast of developers in applications of the technique, and they should disseminate information on uses, as appropriate.
- Functional characteristics and design criteria for the SACH foot should be reviewed periodically in the light of field experience.
- Flexible, custom-made, cosmetic-cover techniques should be recorded and made available to the schools so that prosthetists may become familiar with them.
- The schools should include laboratory demonstrations of the new materials, such as those used to make custom cosmetic covers, vacuum forms, etc., and the sources of the materials should be indicated.
- With regard to modular systems, it is recommended that the schools use the systems available (1) in the investigation and evaluation of the new techniques referred to (casting techniques, transparent sockets), and (2) as alignment devices for use in teaching. This approach will allow quick assembly of trial devices and familiarize students with modular devices without necessarily recommending them for general use at this time.
- Manufacturers should supply models of their equipment to the schools so that students can become familiar with them. Manufacturers should be encouraged to contribute to the schools, and this would be a good way to do so.
- All of the new developments in AK socket design which have been shown at the workshop are of sufficient value to warrant the preparation of manuals. Evaluation should be undertaken so that indications and contraindications for use can be established.
- Various methods for sheathing the stump, including a stump-sock design, should be vigorously investigated, and manufacturers should be made aware of their importance.
- Study of the effects of shear and other forces on living tissue should be intensified.
- It is strongly recommended that a functional terminology related to prosthetics and orthotics be developed and that investigators use this terminology to identify their inventions.
- Surgeons should be encouraged to experiment with stump design in an effort to improve weight-bearing characteristics and the socket-grasping capabilities of muscle-stabilized stumps.
- A strong effort should be made to improve prosthetics for children and women. Women should be encouraged to involve themselves in the solution of this problem.
- CPRD should look into the possibility of relating to the various information retrieval systems of such professions as the various groups of engineers with a view to solving problems which relate to these specialties, *e.g.*, materials.
- A "by-mail" brainstorming operation sponsored by CPRD on the problem of cosmetic restoration of modular prostheses is recommended. Contributors would be asked to attend a workshop designed to further the brainstorming. The expectation would be that some research group would involve itself vigorously in the problem of cosmetic restoration of modular devices, on a high-priority basis.

- The ski prosthesis presented by Jack Graves should be written up and published as an article.
- Studies on James Foort's electric alignment unit should be reactivated.

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A PRELIMINARY REPORT ON THE USE OF THERMOGRAPHY AS A DIAGNOSTIC AID IN PROSTHETICS

Virgil Faulkner, C.P.O.[1], and
Charles Pritham, C.P.[2]

The need for an objective method of evaluating the stump-socket relationship has long been recognized. Traditionally, the prosthetist has had to rely on such things as the evidence of his own senses, the patient's subjective reporting, and such fitting aids as balls of clay, lipstick, and powder placed within the socket. Sometimes these practices result in the rejection of the prosthesis and the prosthetist by the patient, and, as a consequence, the rehabilitation program for the patient is delayed. To provide more objective information, the Division of Prosthetics and Orthotics at the University of Virginia, the Department of Mechanical Engineering and the Department of Orthopedic Surgery are experimenting with the use of pressure transducers, transparent sockets, and thermography. The reader is undoubtedly familiar with the potentials inherent in the use of the first two aids, but the use of thermography to measure skin temperature as a diagnostic aid in prosthetics has been limited to a very few centers (1), and therefore should be of interest.

Essentially, thermography provides us with a method for measuring differences in skin temperatures and relating them to a uniform scale. Basically the apparatus utilizes a supercooled video scanner, a cathode ray screen, and a Polaroid camera (Fig. 1) (1) (2).

The area to be studied is scanned by the camera and its image is shown on the cathode ray screen in black and white and recorded on a Polaroid film when desired. Depending upon the mode selected, warm areas register as either light or dark, and the cool areas as the opposite. Commonly, we choose to portray the warmer areas on the light end of the scale and the cooler areas on the dark end, and this is the convention followed in this article (Fig. 2). The machine is usually set for a base temperature of 90°F with a range of ±5°. Temperatures of 95°F and beyond register as absolute white, while temperatures of 85°F and below register as absolute black. Temperatures between the two extremes register as shades of gray. Thus our base temperature of 90° registers as a neutral shade of gray in the middle of the two extremes (Fig. 3).

Localized areas with increased blood supply register "warm," and therefore lighter than areas

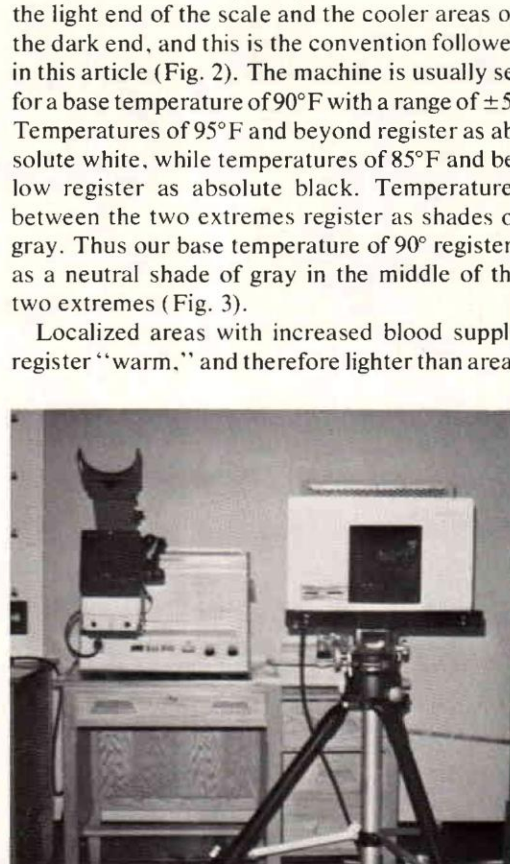

Fig. 1. Apparatus showing scanner on the right and cathode ray screen and attached Polaroid camera on the left.

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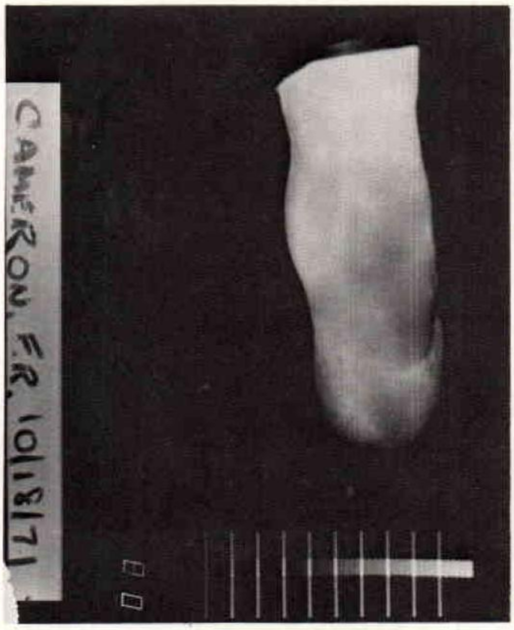

Fig. 2. Thermograph of a right BK stump, anterior-medial view, showing contrasts in gray. Scale on the bottom shows temperatures range from light to dark for comparison with the stump.

with a relatively poor blood supply which will register "dark," and therefore cooler. In the case of limb prosthetics these warmer areas can be attributed to localized pressure and irritation. (The use of thermography is also being evaluated

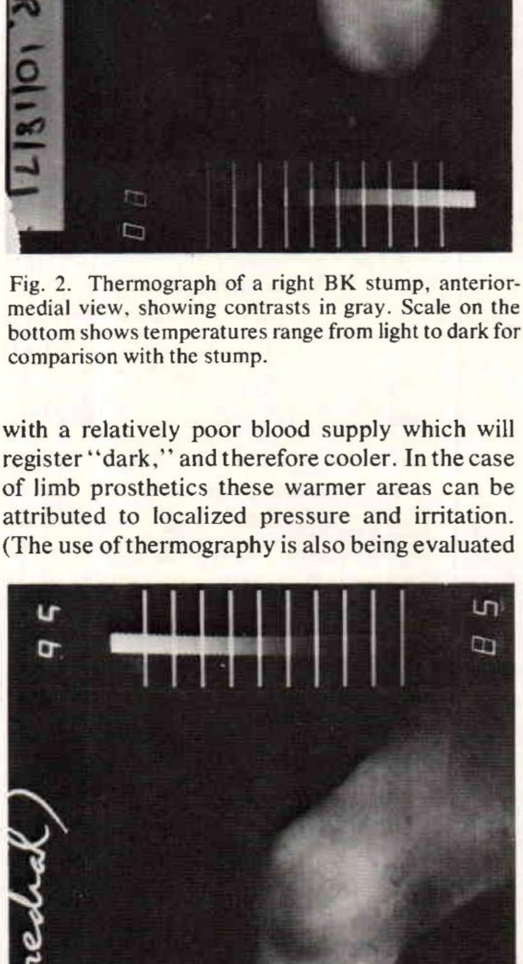

Fig. 3. This picture taken by the camera is a mirror image of the subject studied.

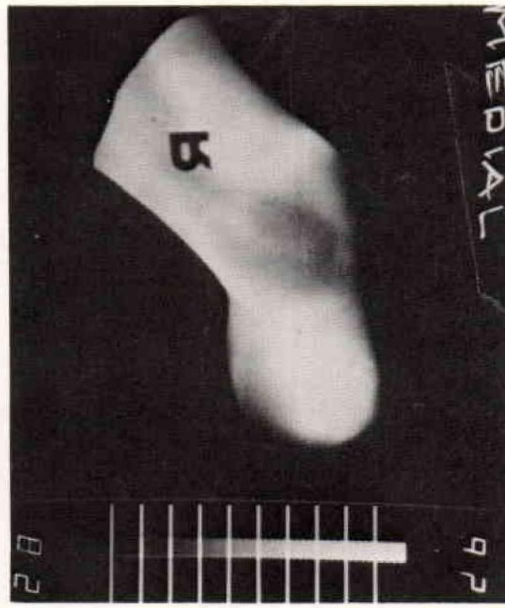

Fig. 4. BK stump showing area of concentrated pressure under the medial tibial flare. This picture is a reverse image of a right stump.

as an aid in determining levels of amputation in cases of arteriosclerosis.) Evidence of pressure over the area of the patellar tendon or the medial tibial flare is considered to be beneficial (Fig. 4). Conversely, evidence of pressure, or irritation, over the distal cut end of the tibia or some other sensitive spot, such as the head of the fibula, is considered to be a potential source of trouble (Fig. 5).

THE PILOT STUDY

In this study, we have attempted to record the surface temperature of the stump at the time of casting and immediately after delivery of the prosthesis. Thermographs of the stump are made from several angles, and serve as a reference should the patient return with complaints of irritation or pain in the stump. The pictures were also used as a basis for attempts at predicting future problem areas. By taking a thermograph later and comparing it with the reference photographs, it is possible to evaluate what effect the socket has had on the stump over a given period of time, and thus determine whether or not the patient really is experiencing trouble, and to locate the exact spot when the trouble is a mechanical one.

Our pilot study has presented us with several clear examples of the potential of thermography

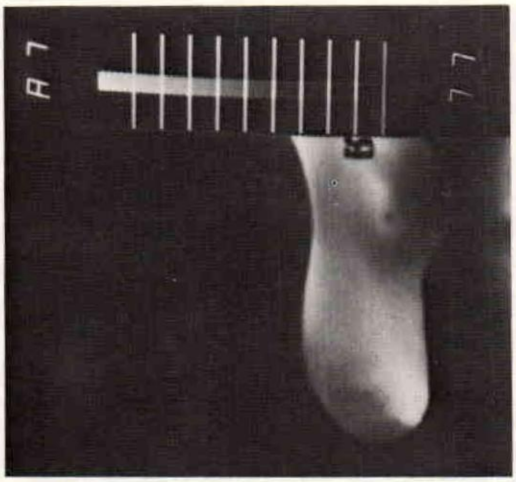

Fig. 5. BK stump showing irritation over the end of the tibia. This picture is a reverse image of a right stump.

as a fitting aid. J. D., an employee of the hospital and a bilateral below-knee amputee as well, was followed as one of the research subjects in this study. J. D. was fitted previously with PTB prostheses on both sides. His prescription was changed to PTS (supracondylar, suprapatellar prostheses) (3) (4). No reference thermographs were taken. After wearing the prostheses for several days, the subject complained of excessive pressure from the supracondylar wedge in the area of the adductor tubercle. He was sent to the prosthetist who advised him to wear the prosthesis as much as possible so he could "build-up" a tolerance to the new pressure areas. At this time a reference thermograph was taken. (It should be noted that the supracondylar wedges presented a

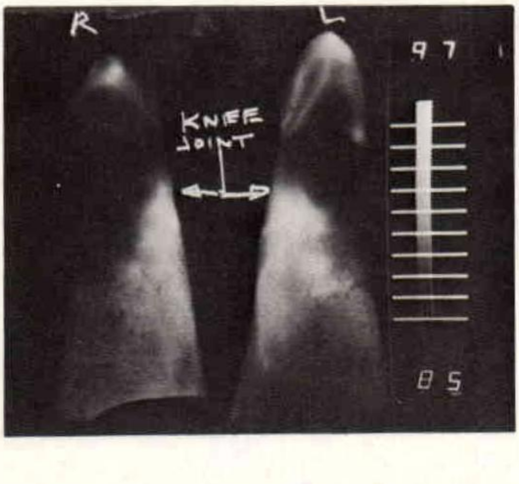

Fig. 6. Thermograph of J. D.'s stumps, showing areas of irritation above the medial epicondyles.

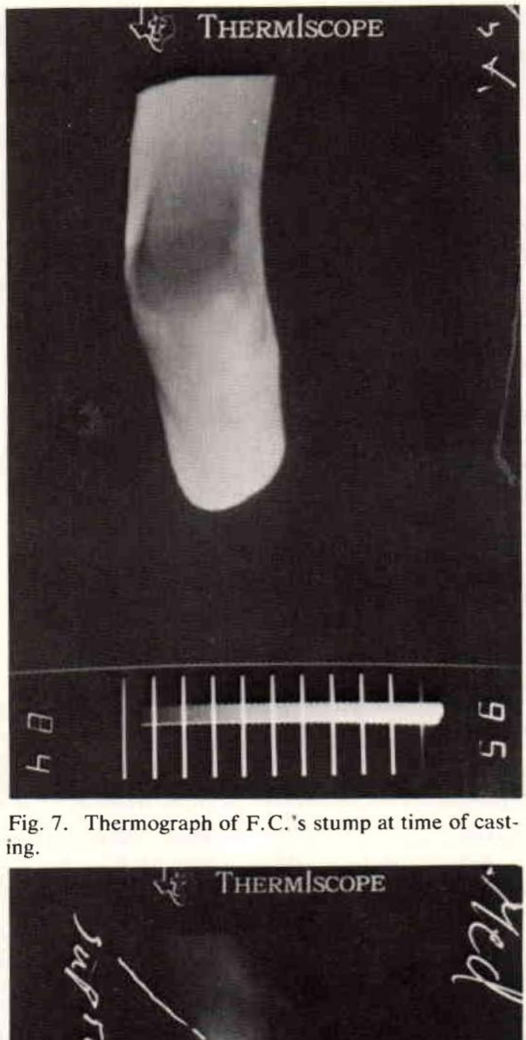

Fig. 7. Thermograph of F.C.'s stump at time of casting.

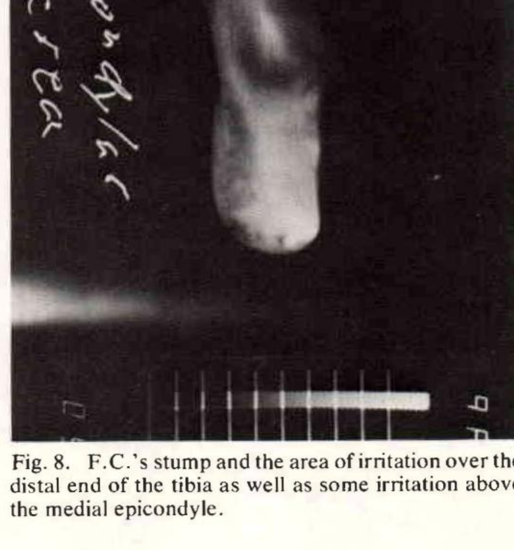

Fig. 8. F.C.'s stump and the area of irritation over the distal end of the tibia as well as some irritation above the medial epicondyle.

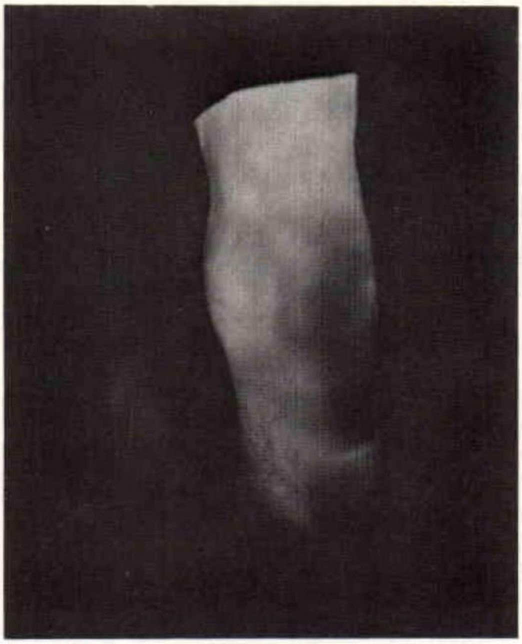

Fig. 9. F.C.'s stump after adjustments were made to the prosthesis. Note that the hot spots have disappeared.

sharp abrupt profile quite the opposite of the broad, flat profile Nitschke and Marschall (3) (4) advocate.) Two days later, the subject was seen again by the prosthetist and displayed an ulcer over the spot the thermograph showed as an area of localized pressure and irritation. A new thermograph of the affected stump confirmed that it was indeed the same area (Fig. 6). Because of these fitting problems, the patient rejected the new prostheses and went back to the use of the old PTB type even though they no longer fitted properly. Clinical use of thermography might have led the prosthetist to provide meaningful relief at the time of delivery, and not just reject the complaints of the patient on the basis that he was unaccustomed to the forces being exerted over the affected area.

F.C. was thermographed at the time of casting and again when the prosthesis was delivered (Fig. 7). After several days the patient returned with complaints of pressure over the anterior distal tibia and along the crest of the tibia. A thermograph was taken that revealed a hot spot in this area (Fig. 8). A "relief" was made by the prosthetist, and the patient was instructed to continue using the prosthesis. A thermograph taken later showed that the warmer spot had disappeared after adjustments to the socket were made (Fig. 9).

CONCLUSIONS

During this study, we had patients come to us and point to certain spots on the stump and state "it hurts here." In studying the thermograph afterwards, it was evident the pain originated in an area other than the one anticipated. It must be stated that the results of the procedure are not to be relied on absolutely, but, when related to visual evidence presented by the stump and to the subjective reporting of the patient, thermography can be a useful diagnostic aid.

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THE USE OF CHECK SOCKETS IN LOWER-LIMB PROSTHETICS

Samuel Hamontree, C.P.O.[1], and
Roy Snelson, C.P.O.[2]

Prosthetists have for years accepted and valued the use of a "check socket" in the fitting of upper-limb prostheses (4). However, prosthetists seem to be extremely reluctant to use check sockets in fitting lower-limb prostheses.

A check socket, for the purpose of this paper, is a socket in a relatively rigid material molded directly over the modified model of the amputation stump, and is used to determine the extent of additional modifications that will be required to obtain an optimum fit for the definitive prosthesis.

We began using check sockets for lower-limb fittings several years ago and have found them to be invaluable in determining the optimum fit of a socket. So useful were check sockets that they were adopted very quickly for routine use in our lower-limb prosthetics practice.

In the early days our check sockets were made by laminating three or four layers of cotton stockinette and polyester resin. Holes, ¼"-⅜" in diameter, were drilled in areas of the socket that the prosthetist felt he wanted to check. A blunt object such as a pencil eraser is used as a probe to indicate the pressure present in a given area. While these laminated check sockets were quite satisfactory and beneficial, the new *transparent* sockets (1) (2) (3) now available make the use of a check socket even more valuable.

To date the use of check sockets has provided only subjective information. We have found no way to compile quantitative, objective, or statistically useful information on the subject. Nevertheless, use of check sockets are well worth the effort.

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In our group there are eleven certified prosthetists in eight patient-care facilities (Branch Offices) who are fitting patients daily. In addition there are seven other practitioners who are at various levels of experience in a supervised training program. All but two of the eleven certified prosthetists use check sockets as a routine part of their practice, and all seven of the other practitioners use them routinely on every fitting. The two prosthetists who do not use them routinely do use them selectively, and are using them more and more as they begin to appreciate their worth.

Because the technical part of prosthetics care is of primary interest to most prosthetists, we will discuss the use of check sockets from a technical standpoint first. The discussion will be in reference to the use of transparent, rather than laminated, check sockets.

USE OF THE TRANSPARENT CHECK SOCKET

The check socket is trimmed and prepared in the same manner as the definitive socket (Fig. 1). Numerous holes of ¼" to ⅜" in diameter are then drilled in any area of the socket from which information by "feel" is desired. Most common are those areas underneath the femoral and tibial

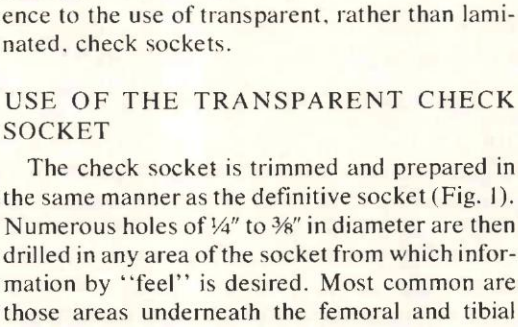

Fig. 1. Trimming the proximal border of a transparent socket for a below-knee patient.

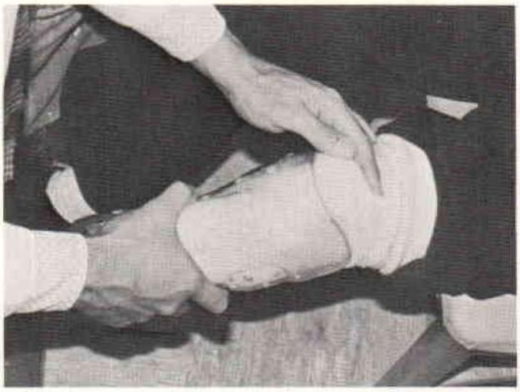

Fig. 2. Application of the transparent check socket by the prosthetist.

condyles, head of the fibula, the flare of the tibia on the medial side, but other areas may be just as critical on any given patient. A prosthetic, "stump," sock of the same type normally used by the individual prosthetist at "initial fitting" should be used in the check socket fitting.

As the amputation stump, with the sock, is introduced into the check socket (Fig. 2), the prosthetist brings his fitting experience into play and coordinates this with visual evaluation, looking for areas of restriction, tightness, or pressure in a given area prior to complete settling of the stump into the socket. We are looking for the "experience feel" in the prosthetist's hands of just how the stump is adjusting itself to the socket.

Torque, rotation, and pressure are applied through the socket by the prosthetist's hands, and, following this, the patient bears full weight on the socket as it is supported by a fitting stand (Fig. 3). After the socket is well set on the stump, further evaluation is accomplished by using a pencil eraser or other blunt object to test the pressure or lack of pressure through the holes. During all of these steps evaluations are made by correlating what is seen through the socket with what is felt by the probe on the soft tissues.

During this procedure notations and markings are made on the check socket to assist the prosthetist in making further modifications to the positive plaster model (Figs. 4 and 5). It should be emphasized that vision alone does not provide adequate evidence for the decisions that may be necessary. Only after considerable experience in relating visual information to the pressures found by palpation through holes directly to the skin surface can adequate evidence be gained for making "fitting" decisions. *In other words what you see with your eye may very well not be what is causing a problem or does not necessarily indicate that a problem does not or will not exist.* ONLY by coupling his previous experience with experience in the use of transparent check sockets will the prosthetist obtain the greatest value from transparent check sockets.

Fig. 3. Use of probe to determine degree of fit of socket during weight-bearing.

Fig. 4. Prosthetist indicates with a marking pencil areas on the cast that will require modification.

The check socket may be removed and retried numerous times; it can be ground with a "burr" on a router; it can be cut and widened or nar-

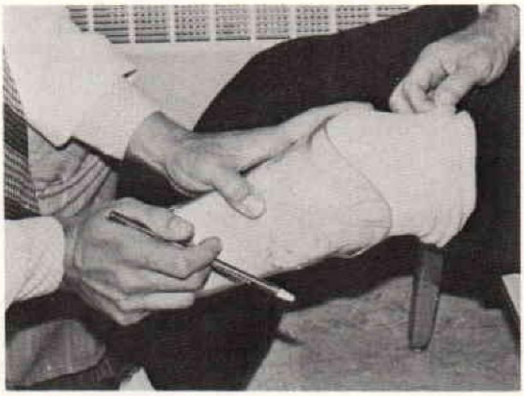

Fig. 5. View of a typical situation where a check socket is used to improve fit of the definitive socket.

rowed. There is little limit to the amount of modification that can be made to the check socket.

The check socket is then filled with plaster of Paris, and removed by splitting one side with a cast cutter after the plaster has set (Fig. 6). Appropriate modifications are then made to the new positive model in accordance with needs determined during the check socket fitting (Fig. 7). A second check socket is occasionally indicated.

We enforce one basic rule in the check socket procedure: "THE CHECK SOCKET CAN NEVER BE ISSUED AS THE DEFINITIVE SOCKET." The reason for this is that a check socket may be considered to be "good enough" and the true purpose of a check socket thus would be defeated, in that needed modifications, though small, will not be made with the idea that time is being saved.

Another major benefit accrued by use of the check socket is in psychological management of the patient. We have noted time and again a better attitude or feeling on the part of the patient when the check socket is used. This intermediate step between the patient's visit for casting and his experience with the entire apparatus set up on an adjustable alignment device seems to relieve him of the shock most patients experience at this time. By having the patient return for a check socket fitting much of the "shock" is relieved. The patient feels that the prosthetist is more interested in him as an individual and the procedure demonstrates to the patient that the best possible fit is the goal of the prosthetist. While the "shock" effect is more pronounced in new patients, it is interesting to note that the most favorable comments come from the experienced patients who are having a check socket used in their fitting procedure for the first time.

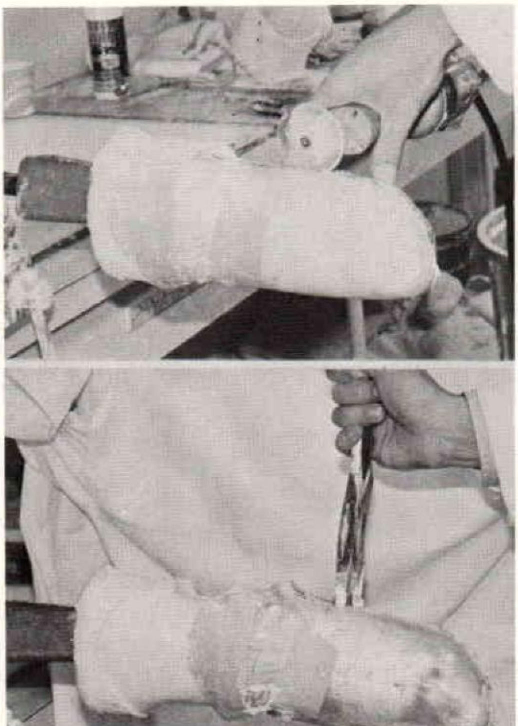

Fig. 6. Removal of check socket from newly poured model.

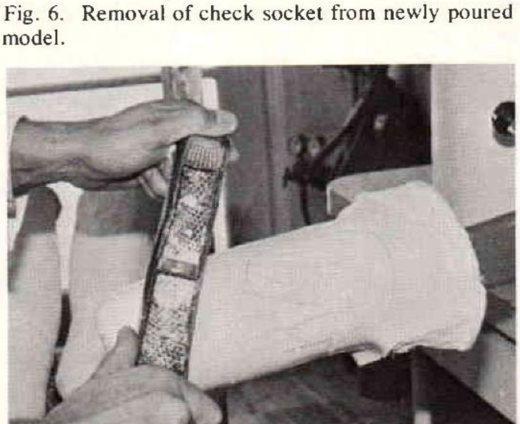

Fig. 7. Modification of second model.

CONCLUSION

In conclusion, we readily realize that our ideas on the use of a check socket in fitting lower-limb prostheses are subjective. However, we feel that the number of prosthetists who are turning to check sockets is increasing, and from the experience of all of these as well as that of the authors there is a definite feeling that the number of return visits by patients in the one-year post-fitting period is reduced drastically, and that the procedure is of tremendous psychological benefit to the patient.

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PUBLICATIONS AND ORGANIZATIONS OF INTEREST TO THE PHYSICALLY DISABLED

Cynthia Hiltz

The following lists of periodicals, other publications, and organizations of interest to the physically disabled and their families have been compiled by Cindy Hiltz, staff member of the Committee on Prosthetics Research and Development, National Research Council. The original objective was to have information readily on hand at CPRD to help in making prompt replies to the many requests received. However, it would seem that such lists might be helpful to prosthetists, orthotists, and other subscribers to Orthotics and Prosthetics *in their daily practice.*

No claim is made for completeness of the present lists, and CPRD plans to refine them continuously. The refined lists could appear in Orthotics and Prosthetics *on an annual or semiannual basis. Your comments are solicited.*

A. Bennett Wilson, Jr.
Editor

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*Dates in parentheses indicate year of publication

TECHNICAL NOTES

WEDGE ADAPTORS FOR ALIGNMENT OF LOWER-LIMB PROSTHESES

During the past three years I have used wedge adaptors in the alignment procedure of lower-limb prostheses in two ways: by themselves in determining alignment, and as a means of duplicating alignment that has been determined with the Winnipeg wedge-disc alignment unit (1, 2).

I have found that, when using the Winnipeg wedge disc units, once a satisfactory alignment has been achieved no changes are required later in the majority of cases. Therefore, I designed a series of adaptors (Fig. 1) to aid in duplication of the alignment determined with the Winnipeg wedge discs so that the unit could be used over and over, and also to lessen the problems of loosening and the consequent slippage that had been experienced with the multiple wedge discs.

The wedge adaptors have seen greatest use at the foot connection and under the socket in the below-knee (BK) prosthesis (Fig. 2). They are also used at the foot in above-knee, knee-disarticulation, and hip-disarticulation prostheses. A prefabricated rubber cosmetic cover or a custom-made plastic-laminate cover is used.

By duplicating the Winnipeg wedge discs with the wedge adaptors, the problem of disc slippage has been eliminated. When an adaptor replaces a wedge disc unit under the socket and over the foot a total weight reduction of approximately 4 ounces is realized.

WEDGE ADAPTORS

Five configurations (Fig. 3) with angulation of 0, 2, 4, 6, and 8 degrees, respectively, have proven to be adequate in meeting the alignment needs of our patients. Each adaptor is made from 2024ST4 aluminum round stock and weighs approximately 2½ ounces. (A Winnipeg wedge disc unit weighs approximately 4½ ounces.)

A moveable wedge nut (Fig. 3B) within the adaptor is used to connect the adaptor to the foot with the standard bolts, except for the 0° adaptor (Fig. 3A) which obviously does not require a wedge nut.

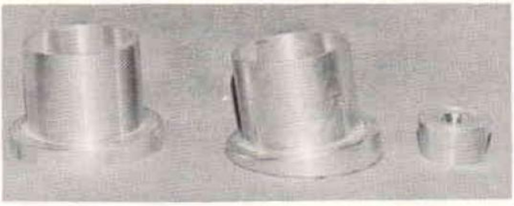


Fig. 1. A 0° adaptor and an 8° adaptor with wedge nut.

ALIGNMENT DUPLICATION BY ADAPTORS

A short review of the Winnipeg wedge disc unit is presented here for those not familiar with this alignment device. Each unit consists of two wedge discs, each having an angulation of 6° (Fig. 4), to make possible a total angulation in one plane of 12° (Fig. 5) and 6° each in two planes. When both discs are moved synchronously, angulation occurs in one plane. To provide angulation in two planes the discs are moved independently of each other.

A detailed description of the principle and use of the Winnipeg wedge disc unit is given in Figures 6 through 11.

In duplicating the alignment, the angulation produced by the wedge discs in one or both planes is determined and the required wedge adaptor is substituted, using the following rules:

1. Determine which quadrant or quadrants the thin edges of both wedge discs are acting upon (Figs. 6 and 7).
2. The maximum number of degrees a wedge

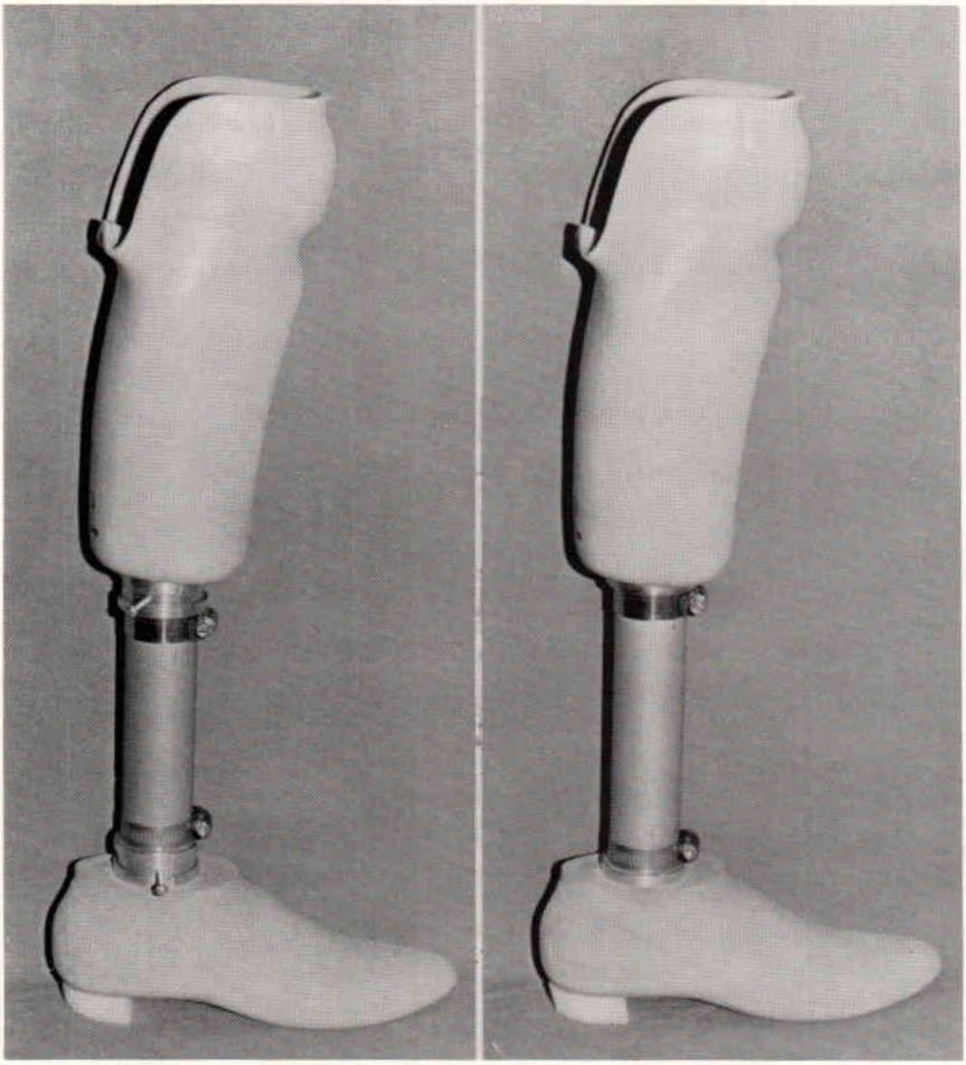


Fig. 2. *Left*, a wedge disc unit that is producing 4° flexion at socket and 0° at the foot connection. *Right*, the wedge discs are replaced with a 4° wedge adaptor under the socket and a 0° adaptor at the foot.

disc has is 6, and this must be shared by the direction in the quadrant or quadrants it is acting upon (Figs. 8 and 9).

3. Add the effects of the wedge discs (Figs. 10 and 11).

Duplication can be performed by using the Hosmer Vertical Fabrication Jig or drawing reference lines on the prosthesis for duplication by eye.

When the wedge disc units are replaced by the wedge adaptors, the pylon tubing must be lengthened to accommodate for the shortening that occurs inherently.

ALIGNMENT PROCEDURE USING ADAPTORS

Bench alignment of the BK prosthesis is performed in the usual manner, appropriate adaptors being placed beneath the socket and over the foot. During dynamic alignment, adaptors are changed as required until the alignment is satisfactory.

Carrying out alignment changes in one or two planes is a simple matter with these adaptors. For example, an 8° adaptor can produce 6° in an interior direction and 2° in a lateral direction (Fig. 12). If a reduction from 6° to 4° is desired in the

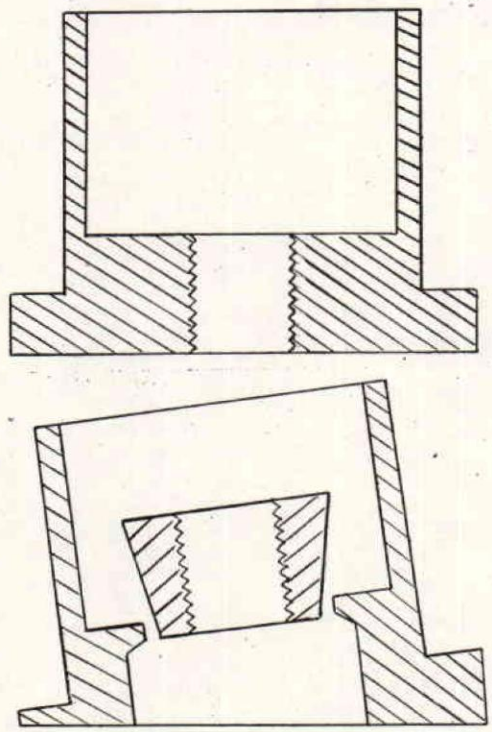


Fig. 3. Drawing of (A) a 0° and (B) an 8° wedge adaptor.

anterior direction while maintaining the 2° in the lateral direction, a 6° adaptor will perform the adjustment (Fig. 13).

DISCUSSION

In using wedge adaptors for determining alignment the prosthetist is concerned only with one quadrant of angulation and two directions (Figs. 7, 12, and 13). When using the Winnipeg wedge discs he often is concerned with two quadrants and three or four directions (Figs. 10 and 11). I have found the wedge adaptors easier to use than the Winnipeg wedges in determining alignment.

CONCLUSION

Wedge adaptors have been found useful as an alignment tool and as a duplication method in a modular type of prosthesis. Ease of adjustment has made changing alignment a simple matter.

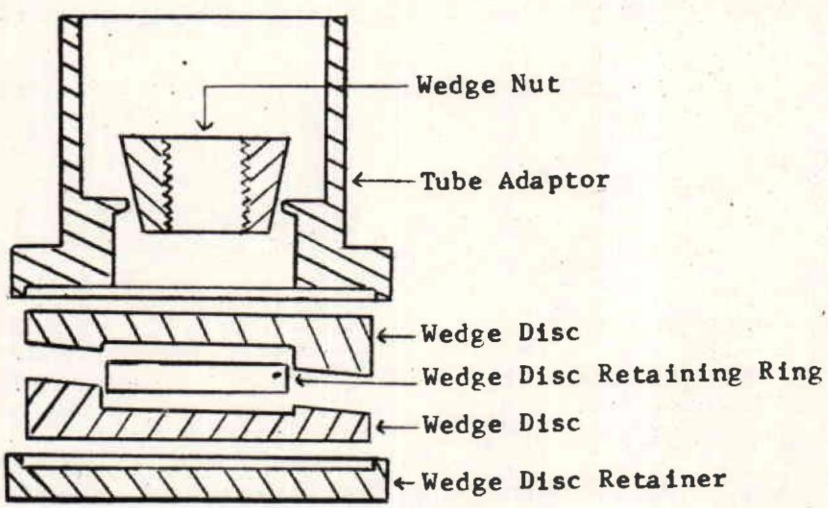


Fig. 4. Sketch of a Winnipeg wedge disc unit.

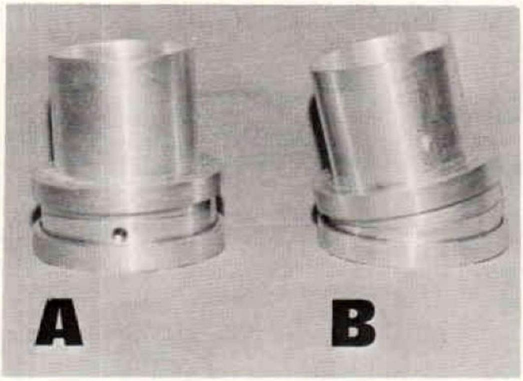


Fig. 5. Winnipeg wedge disc unit in (A) neutral (0°) and (B) 12° of angulation.

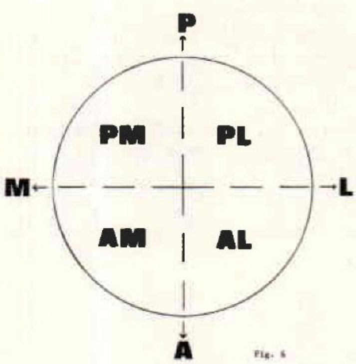


Fig. 6. Alignment adjustments occur in one or two planes. AP: anteroposterior plane, and ML: mediolateral plane. The two planes produce four quadrants: AM, AL, PM, and PL.

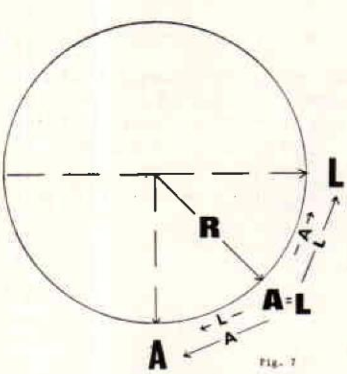


Fig. 7. When quadrant AL is bisected by a wedge, the angulation produced in direction A and direction L is equal. When the thin edge of the wedge is moved towards A, the angulation in A direction increases while L decreases. The converse is true when the thin edge of the wedge is moved towards L.

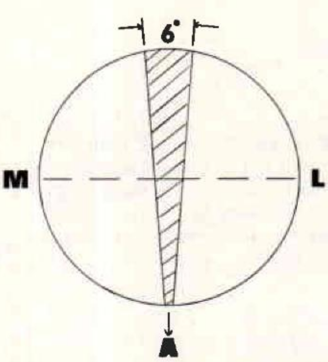


Fig. 8. One of the two 6° Winnipeg wedges produces 6° of angulation in direction A when the thin edge of wedge is centered exactly at A.

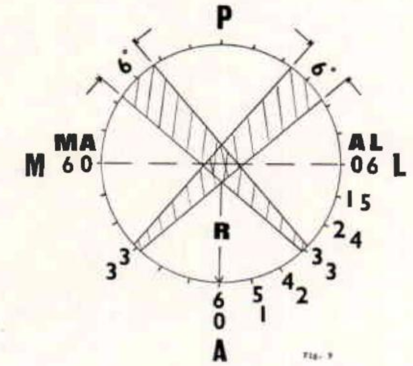


Fig. 9. Two Winnipeg wedges moving synchronously produce 3° each of angulation with a resultant of 6° in direction A. In quadrant AL the wedge disc produces 3° in both A and L directions. In quadrant AM the wedge disc produces 3° in both A and M directions. Because M and L directions are opposite, they cancel each other, leaving 6° in direction A.

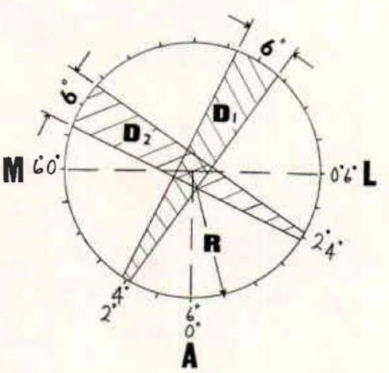


Fig. 10. Two Winnipeg wedges producing 6° in direction A and 2° in direction L. D_1 disc in quadrant AL produces 2° in direction A and 4° in direction L. Therefore, in direction A $D_1(4°) + D_2(2°) = 6°$. As M direction and L direction are opposite directions, M (2°) is offset by L (4°) resulting in 2° in direction L.

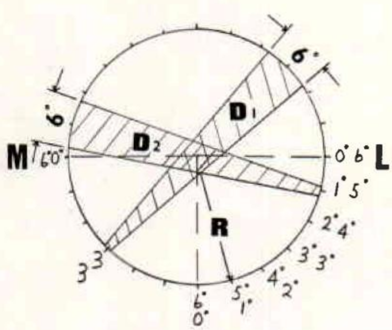


Fig. 11 Two Winnipeg wedges producing 4° in direction A and 2° in direction L. In quadrant AM, Disc D_1 produces 3° in direction A and 3° in direction M. In quadrant AL, disc D_2 produces 1° in direction A and 5° in direction L. Therefore, in direction A: D_1 (3°) + D_2(1°) = 4°. Direction M (3°) is offset by L (5°) resulting in 2° in direction L.

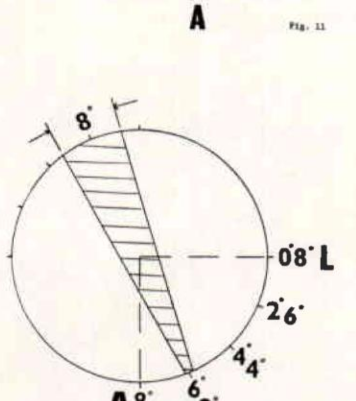


Fig. 12. To produce 6° in direction A and 2° in direction L with a wedge adaptor, an 8° adaptor is used. AL quadrant is divided into quarters with each quarter producing 2° change in angulation. Thin edge of wedge positioned at lower quarter produces desired angulation.

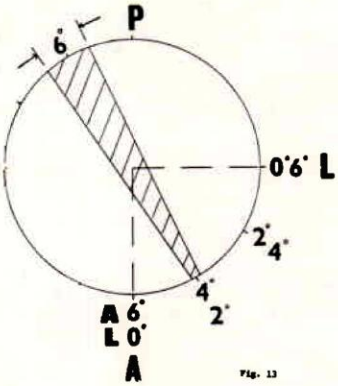


Fig. 13. To produce 4° in direction A and 2° in direction L, a 6° adaptor is chosen, and quadrant AL is divided into thirds so that each third produces a 2° change in angulation. The thin edge of the wedge positioned at the lower third of the quadrant produces the desired angulation.

REFERENCES

1. Foort, J., and D.A. Hobson, *A pylon prosthesis system for shank (B/K) amputees*, Report No. 6, Prosthetics and Orthotics Research and Development Unit, Manitoba Rehabilitation Hospital, Winnipeg, Canada, November 1965

2. Prosthetics and Orthotics Research and Development Unit, *The wedge disc alignment unit*, Report No. 3, Manitoba Rehabilitation Hospital, Winnipeg, Canada, December 1964

James W. Breakey, B.Sc.

ORTHOTICS DISPLAY PANELS USED AS TEACHING AND COMMUNICATION AIDS

The orthotist who practices in a teaching hospital or in an institutional setting is required to spend much time in communication with his associates from other disciplines. Much written and oral interchange often takes place concerning the prescription, purposes, and fitting of orthoses. Often physicians and therapists have problems in visualizing certain elements and devices even

It is unfortunate that Dr. Bunnell's name was mispelled on the illustration above. *Ed.*

Fig. 1.

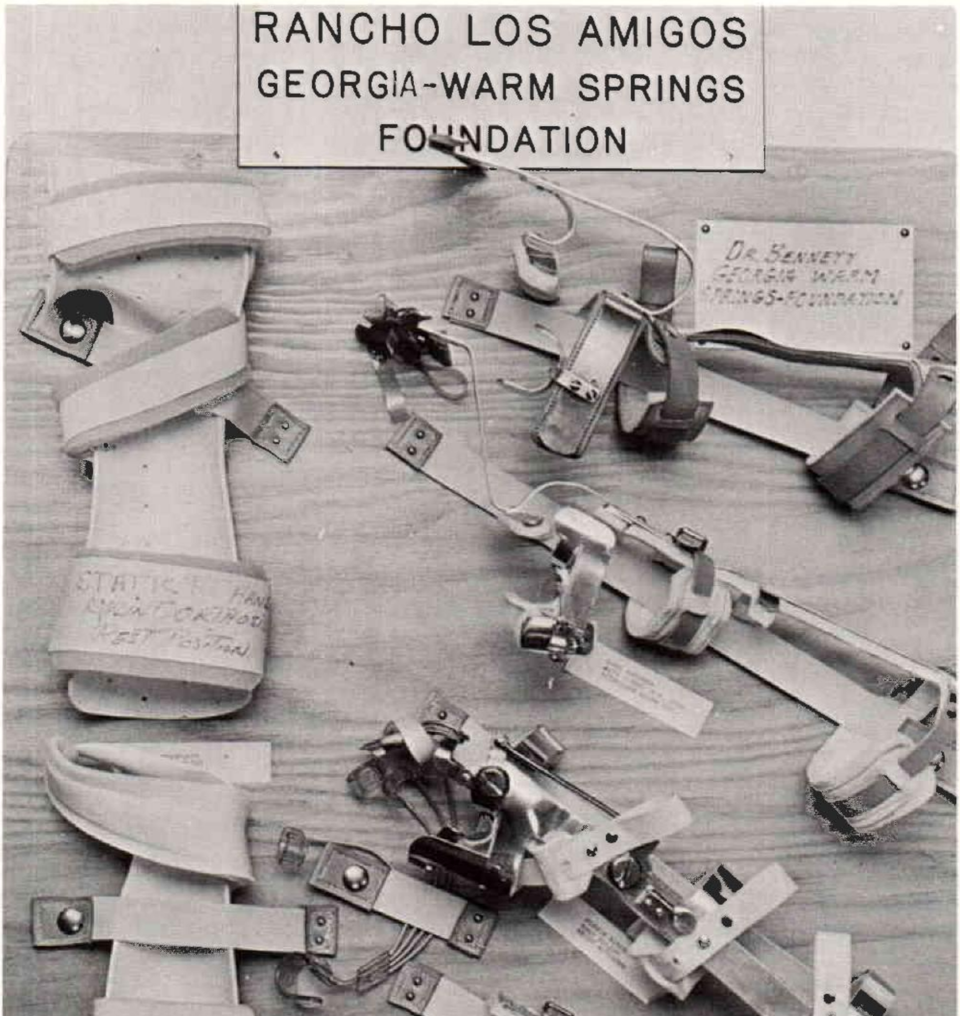


Fig. 2.

though they may have an excellent concept of the effect which is to be achieved. Alternative solutions to a given problem may be overlooked with the result that modifications and more costly corrections occur later. It is also a common occurrence for an orthotist to be required to translate a rather general prescription into an appropriate device by means of a series of meetings involving the patient and the physicians. Therapists and nurses need advice in how to make routine inspections of a device in order to ascertain whether or not it is properly fitted and functioning as designed.

It is self-evident that demonstration of an actual orthotic unit is the best way to illustrate its application. To do this economically, it is helpful to have models available to demonstrate actual fittings and to expose the contraindications as well. Pressure point dangers can also be more readily explained to primary care personnel.

Orthotic displays to meet the needs in upper-limb orthotics (Figs. 1, 2, and 3) have been prepared here at the Sacramento Medical Center. Each element is attached to the panel by snap fasteners to permit easy removal for demonstration and inspection.

Although several systems of arrangement and selection of items can be made, it is generally most helpful to assemble them according to recognized designers or by the research centers which have developed them. This enables more convenient reference to the literature on each system and its application.

The first panel (Fig. 1) displays various static and active hand and finger splints which have been named after Dr. Sterling Bunnell (2) because he was instrumental in developing the original models. These are excellent orthoses when adjusted and fitted properly.

On the second panel, (Fig. 2), a number of components which have been developed at Rancho Los Amigos Hospital and the Georgia Warm Springs Foundation are shown (1).

The third display, (Fig. 3), is labeled the Modular System and carries more sophisticated pieces which are assembled from prefabricated parts. These have been developed by Thorkild J. Engen and his staff at the Texas Institute for Rehabilitation and Research at Houston, Texas (3).

This model and display system can be extended to lower-limb and spinal orthoses.

It is felt that this concept can help physicians

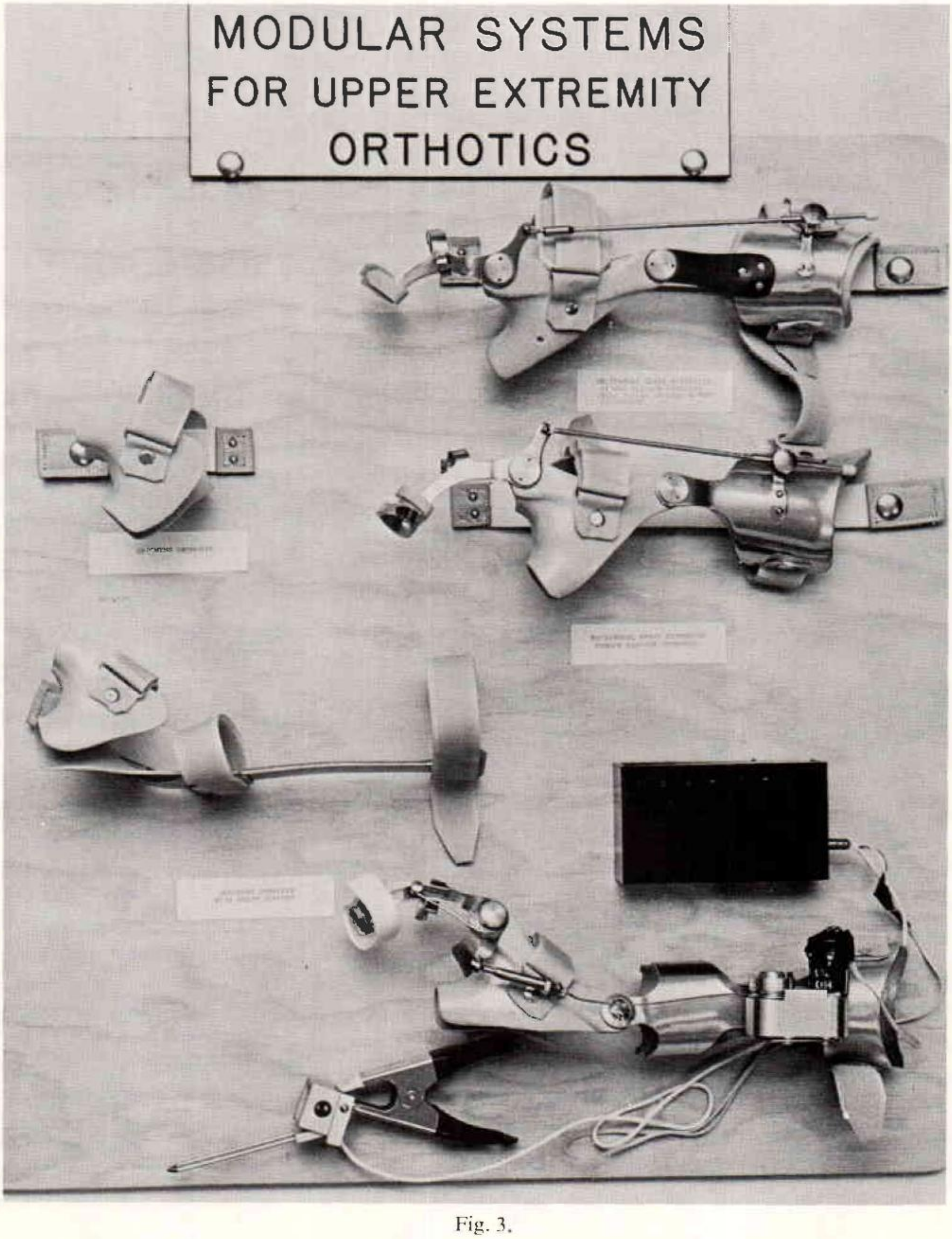


Fig. 3.

and others to better visualize orthotic concepts, produce better prescriptions, detect fitting problems, and inform patients, and can save a good deal of the orthotist's time.

REFERENCES

1. Anderson, Miles, R.E. Sollars, R. Snelson, J. Bray, and L. Marmor, *Upper Extremities Orthotics,* Charles C Thomas, Publishers, Springfield, Ill., 1965.

2. Bunnell, Sterling, *Surgery of the Hand,* J.B. Lippincott Co., Philadelphia, Pa., 1956.

3. Engen, Thorkild J., Upper-extremity orthotics at the Texas Institute for Rehabilitation and Research in *First Workshop Panel on Upper-Extremity Orthotics,* July 8-10, 1970, p. 35.

Robert Buchanan, C.O.,
and J.A. Zelle

LETTERS TO THE EDITOR

Gentlemen:

I would like to say that we received the new March Journal, and it is beautiful. The size is much better and lends to better advertising. It is a great improvement over the old style.

Very truly yours,
Montez Harp
Southern Prosthetics Supply Co.
Atlanta, Georgia

Dear Sir:

The following is a personal opinion relating to prosthetic practice which we would like to submit for your consideration for possible inclusion in a future issue of *Orthotics and Prosthetics*. A. Bennett Wilson, Jr., suggested in his editorial in the March 1973 issue that readers submit letters to the Editor which raise appropriate controversy or register concrete criticism. We feel this falls within that area.

Sincerely,
Dudley S. Childress, Ph.D., Director
John N. Billock, C.P.O.
Chief Research Prosthetist
Prosthetics-Orthotics Research Center
Northwestern University
Chicago, Illinois

STUMP: AS IN TREE

"Stump" is a perfectly good English word and its meaning is clear. Nevertheless, it is our personal opinion that this word should be used mainly as in "tree stump" when speaking to a person with an amputation and not in reference to the person's residual lumb. Our primary reason for this view is that the word seems, in our experience, to be harsh and without grace when used in conversation with an amputee. It also does not seem to be necessary to use it in this context. After all, the person with an amputation still usually regards the remaining portion as a limb. Why should we christen it "stump"? There should be no confusion if the individual examining the person refers simply to the person's limb by its name (e.g., right leg, left arm, etc.). The fact that a part of the limb is missing doesn't seem to change the situation very much. Consequently, an examination of an amputee's residual limb or a personal discussion about the amputation may take place with the same terminology as with unamputated individuals. There seems to be no need to involve the word "stump," not even as a ritual to confirm the amputation.

It does seem convenient to use a word like "stump" in conversation and writing which does *not* involve the amputee directly. "Stump" seems adequate for this purpose except that this usage may frequently carry over into the direct discussion with the amputee. We've tried several replacement terms which have not been completely satisfactory. However, Mr. Maurice LeBlanc of the Committee on Prosthetics Research and Development has recently suggested "residual limb" in lieu of stump. This seems clear and has worked well for us. We are generally opposed to euphemisms, but in this case the use seems warranted.

Terminology in Prosthetics and Orthotics recently has been widely considered with respect to the technical aspects. It seems well for practitioners in these fields also to consider from time to time the words which are used with the people being served and to examine the impressions which these words may convey. "Stump" is an example of an often-used word in prosthetics which we think should be reconsidered.

Gentlemen:

Ninety percent of your articles are devoted to orthotics, lately. Doesn't anything ever happen in prosthetics anymore?

R. E. Collons
West Sacramento, California

A recapitulation of the four issues beginning with the December 1972 publication shows that there were 11 articles devoted exclusively to orthotics, eight exclusively to prosthetics, and four that were concerned with both closely related fields. Most of the contributions to Orthotics and Prosthetics *are contributed voluntarily, and therefore tend to reflect the activity taking place throughout the country. At the present time the application of plastics to lower-limb orthotics seems to be progressing rapidly and therefore could account for slightly more emphasis on orthotics. In any event an overall balance between prosthetics and orthotics will be the goal of* Orthotics and Prosthetics.

The Editor

Dear Sir:

The June 1973 issue of *Orthotics and Prosthetics* came to my desk August 21, 1973. I was interested in the material on metrication, and glancing at the Conversion Factors on page 42 I got the feeling something was awry.

I checked only the length conversions and found two errors out of four entries. Perhaps these are the only errors, but the whole set probably could stand checking.

To convert from inches to meters one should multiply by 0.0254 vice 0.254 as shown. For miles to kilometers the factor is 1.6093 vice the 0.6093 shown.

Additionally I am not sure the dagger note, "Exact conversion, all subsequent digits are zeros," is quite correct. For all practical purposes one probably could assume zeros, but residual digits will be found in these constants if one consults a table of higher precision.

I hope I am correct in all this and not misunderstanding something in your tables.

Sincerely yours,
Howard Freiberger, Electronics Engineer
Research and Development Division
Prosthetic and Sensory Aids Service
Veterans Administration
252 Seventh Avenue
New York, New York 10001

We are grateful to Mr. Freiberger for calling the errors to our attention. As a result we have checked the other entries.

The Editor

Dear Ben:

I thought you might be interested in the enclosed[1] which relates the history of the development of the PTB orthosis.

The article by Faulkner and Gwathney in the September 1973 issue of *Orthotics and Prosthetics* suggests that the functional PTB orthosis was developed as a result of Sarmiento's work with tibial fracture cast bracing (p. 32, para. 2, line 7 *et seq.),* instead of vice-versa. The first PTB orthosis was reported in 1958. Sarmiento first became interested in fracture bracing in 1963, and his original paper was published in 1967.

I believe that the fact that I originated the basic concept—and referred the original patient —is little known, but the accompanying article clarifies this.

Sincerely,
Gustav Rubin, M.D.
Veterans Administration
252 Seventh Avenue
New York, N.Y. 10001

[1]Rubin, Gustav, The patellar-tendon-bearing orthosis. Bull. Hosp. Joint Dis., 33:2, October 1972.

Dr. Rubin is quite correct. The error, however, is an editorial one because both the editor and authors know better. For some reason the text read "Sarmiento's work with the functional below-knee cast for tibial fractures that resulted in *the development of the functional below-knee brace. . ." should have read "that resulted* from *the development of the functional below-knee brace. . ." We apologize.*

The Editor

NEW PUBLICATIONS

MODERN MANAGEMENT OF MYELOMENINGOCELE, by Wilton H. Bunch, M. D., Ph. D., Alexander S. Cass, M.B., B.S., F.R.C.S., Alan S. Mensman, M. D., and Donlin M. Long, M. D., Ph. D. Warren H. Green, Inc., St. Louis, Mo.: 1972; 251 pp.; $16.50.

In the preface, the authors of *Modern Management of Myelomeningocele* state "This book is written for all who see and treat the myelomeningocele child—professional and paramedical personnel alike. It is designed to provide information on two levels—an overview and details of specific therapy." The authors deserve our vote of thanks for a fine achievement. The book is a nicely balanced presentation of "the most complex, treatable congenital anomaly consistent with life." This is only one of many examples throughout the volume that could be cited to show clarity of expression.

A major thrust of the book is directed to the team approach in the management of myelomeningocele, and the last chapter deals with the concept of "The Comprehensive Care Clinic." This reader was particularly drawn to the following lines: "The real key to having a successful clinic is finding the personnel who can function well together. There is no room for the prima donna or the tyrant. On the other hand, the clinic cannot have a laissez-faire attitude with each person doing just what he wants. Nor can medical care be provided by having the team members vote on each decision with the nonexperienced given the same voice as the expert. The key is having competent people, each of whom is comfortable enough with his position so as not to feel threatened when others discuss his area of expertise."

This book contains much pertinent information on myelomeningocele for the orthotist. Discussions of the disease include neurosurgical procedures, urological management, habilitation, intellectual and emotional development, and orthopaedic approaches, each delivered with economy and clarity.

Chapter 5, "Orthopaedic Approaches"—the longest chapter in the book—will be of special interest to orthotists. This reader found it challenging from an orthotic point of view. It would have been helpful if the authors had included a discussion of optimal placement of a stoma when spinal bracing is likely to be necessary. Also, there is but one reference to a need for improvement of present orthotic devices: ". . . new types of bracing for the child who has weakness of the quadriceps." This was disappointing, because plastic materials, such as polypropylene and Plastazote, have given the orthotist much greater freedom in design than was possible just a few years ago. Work now in progress indicates that orthotic developments may soon provide more options to the physician for the treatment of myelomeningocele through better orthoses for prevention of deformity and for more efficient ambulation.

Chapter 5, and indeed the whole book, is an educational challenge to the orthotist. A clearer understanding of the problems of treating myelomeningocele with orthoses is the reward to be gained through a better understanding of the problems of treating this complex disease in its totality. I strongly recommend *Modern Management of Myelomeningocele* to my fellow orthotists.

John Glancy, C.O.

HELP FOR THE HANDICAPPED CHILD, by Florence Weiner, McGraw-Hill Book Co., New York, N.Y.; 1973; 221 pages; $7.95.

This book might be better titled "Where to Find Help for the Handicapped Child" since the main emphasis seems to be in telling people where they can go to get help rather than providing it directly.

This volume is said to be intended primarily for parents of children with physical, emotional, or mental handicaps, and for physicians, teachers, social workers, nurses, and others who are called upon to advise such parents.

This is the type of book that makes a reviewer more than slightly unhappy because the quality of the information presented is so spotty and uneven. Some few sections, for example the one on hemophilia, are reasonably authoritative and useful. However, the treatment of the bulk of the material presented is essentially superficial. An outstanding example of this superficiality is the chapter on "Recreation for the Handicapped" which covers an entire one and one-half pages and makes no mention of the extensive programs available in skiing, horseback riding, wheelchair bowling, basketball, and other sports for handicapped children and adults.

Discussion of orthotic and prosthetic devices for orthopedically handicapped people is essentially nonexistent. Hence this work must be considered basically as an introduction to the subject area rather than one which provides comprehensive coverage.

A wide variety of handicaps is discussed and each is considered under a number of subheadings, viz., description of condition, treatment, prognosis, medical progress, future goals, services, and vocabulary. This last item—vocabulary—is perhaps particularly irritating in its brevity. For example, seven terms are defined under cerebral palsy, six under hemophilia, and five each under diabetes and Cooley's anemia, including in the last a lengthy description of the liver. One wonders as to the value of such information to parents and whether they would not do better to consult a medical dictionary at the library.

In summary, if parents are willing to pay to read a few pages of limited information about their child's particular disability this book should sell well—but we doubt it.

Hector W. Kay

THE MILWAUKEE BRACE, by Walter P. Blount and John H. Moe. Williams & Wilkins, Baltimore, Md.; 1973; 198 pp.; $9.75.

Drs. Blount and Moe have combined their efforts to document the past history of the development of the treatment for scoliosis and how surgical methods requiring a more efficient postoperative external system led to the concept and development of the Milwaukee Brace. Dr. Jacquelin Perry has contributed a concise description of the anatomical basis of the support system that explains the principles to the medical doctor, the orthotist, the patient, and the parents.

The guidelines laid down for the use of roentgenology assure adequate studies without danger of overexposure. The pressure-force system and the time required for results, related to the infantile, juvenile, adolescent, round-back, and congenital scoliotic or back conditions are clearly documented.

Conditions under which this system must operate to achieve results are defined by the team concept of the orthopaedic surgeon, orthotist, and therapist, along with concerned parents and child. The components of the system, their use, problems and the method of wearing the orthosis are well correlated. Included is an excellent step-by-step description in pictures and words of the exercise program required.

A well-documented evaluation of 169 cases offers an excellent target to compare results for those contemplating this procedure, or for those already involved.

A complete description of measuring, casting, and fabrication of the components, along with their assembly and applications to the patient, are covered in complete detail.

Postoperative use of the system is documented for modifications and additions, such as the skull halo and lower-limb distraction, as well as time required to achieve stabilized correction.

This book may require some revisions as future knowledge is gained in this most difficult area, but the ground rules are well established in this historical and practical document based on the sincere, dedicated efforts of the authors and those who have been part of their team these past twenty-five or more years.

Charles W. Rosenquist, C.O.

THE CHILD WITH AN ORTHOPAEDIC DISABILITY: HIS ORTHOTIC NEEDS AND HOW TO MEET THEM, Committee on Prosthetics Research and Development, National Academy of Sciences, Washington, D.C.; 1973; 71 pp.; free.

This publication is a report of a conference organized by the Subcommittee on Child Prosthetics Problems of CPRD in collaboration with Howard University for the purpose of developing recommendations for future activities of the Maternal and Child Health Service (Public Health Service) and others with respect to children's orthotic problems. The major fiscal support was provided by the Maternal and Child Health Service. The meeting held in Annapolis, Md., Nov. 19-21, 1972, was attended by 55 orthotists, therapists, engineers, surgeons, and physicians. The chairman was Charles H. Epps, Jr., M.D., Chief of the Division of Orthopaedic Surgery, Howard University.

This report reflects that the participants were divided into four groups to consider separately the following problems:

Group I
Myelomeningocele
Paraplegia
Quadriplegia
Other Spinal-Cord Injuries

Group II
Cerebral Palsy
Hemiplegia of Other Etiologies
Arthrogryposis
Birth Palsy

GROUP III
Scoliosis
Scheuermann's Disease and Round-Back Problems
Muscular Dystrophy
Nonspastic Neuropathies and Myopathies
Osteogenesis Imperfecta

GROUP IV
Legg-Perthes Disease
Arthritis
Trauma
Congenital Deformation of the Hip
Torsional Alignment and Static Problems

Although not a detailed technical report that is of much value to the practitioner, many readers of *Orthotics and Prosthetics* will find the report interesting since, in addition to recommendations for future work, it does give a perspective of present management procedures for orthopaedically disabled children.

A. Bennett Wilson, Jr.

PLEASE NOTE

Mr. Byers has written to say that an error has been made in the article "A Porous, Flexible Insert for the Below-Knee Prosthesis" which appeared in the September 1973 issue of *Orthotics and Prosthetics*. On page 24, second column, the second paragraph should have read:

> Because the relationship of stump to socket is crucial, the ½" to ¾" differential built into the distal end of the liner must be protected against any slight downward displacement of the entire insert within the socket.

AVAILABILITY OF BACK ISSUES OF *ARTIFICIAL LIMBS*

The Committee on Prosthetics Research and Development advises that copies of the following issues of *Artificial Limbs* are available upon request until the small supply is exhausted:

Vol. 8, No. 2	Autumn 1964
Vol. 11, No. 2	Autumn 1967
Vol. 12, No. 1	Spring 1968
Vol. 12, No. 2	Autumn 1968
Vol. 13, No. 1	Spring 1969
Vol. 13, No. 2	Autumn 1969
Vol. 15, No. 2	Autumn 1971
Vol. 16, No. 1	Spring 1972

Address all requests to Committee on Prosthetics Research and Development, National Research Council, 2101 Constitution Ave., N.W., Washington, D.C. 20418.

METRIC SYSTEM

Conversion Factors

LENGTH

Equivalencies

angstrom	= 1 x 10^{-10} meter (0.0 000 000 001 m)
millimicron*	= 1 x 10^{-9} meter (0.000 000 001 m)
micron (micrometer)	= 1 x 10^{-6} meter (0.000 001 m)

To Convert from	To	Multiply by
inches	meters	0.0254†
feet	meters	0.30480†
yards	meters	0.91440†
miles	kilometers	1.6093

AREA

To convert from		
square inches	square meters	0.00063616†
square feet	square meters	.092903

VOLUME

Definition

1 liter = 0.001† cubic meter or one cubic decimeter (dm^3)
(1 milliliter = 1† cubic centimeter)

To convert from	To	Multiply by
cubic inches	cubic centimeters	16.387
ounces (U.S. fluid)	cubic centimeters	29.574
ounces (Brit. fluid)	cubic centimeters	28.413
pints (U.S. fluid)	cubic centimeters	473.18
pints (Brit. fluid)	cubic centimeters	568.26
cubic feet	cubic meters	0.028317

MASS

To convert from	To	Multiply by
pounds (avdp.)	**kilograms**	**0.45359**
slugs‡	kilograms	14.594

FORCE

To convert from	To	Multiply by
ounces-force (ozf)	newtons	0.27802
ounces-force (ozf)	kilogram-force	0.028350
pounds-force (lbf)	newtons	4.4732
pounds-force (lbf)	kilogram-force	0.45359

***This double-prefix usage is not desirable. This unit is actually a nanometer (10^{-9} meter = 10^{-7} centimeter).**
† For practical purposes all subsequent digits are zeros.

STRESS (OR PRESSURE)

To convert from	To	Multiply by
pounds-force/square inch (psi)	newton/square meter	6894.8
pounds-force/square inch (psi)	newton/square centimeter	0.68948
pounds-force/square inch (psi)	kilogram-force/square centimeter	0.070307

TORQUE (OR MOMENT)

To convert from	To	Multiply by
pound-force-feet	newton meter	1.3559
pound-force-feet	kilogram-force meters	0.13826

ENERGY (OR WORK)

Definition

One joule (J) is the work done by a one-newton force moving through a displacement of one meter in the direction of the force.

1 cal (gm) = 4.1840 joules

To convert from	To	Multiply by
foot-pounds-force	joules	1.3559
foot-pounds-force	meter-kilogram-force	0.13826
ergs	joules	1×10^{-7}†
b.t.u.	cal (gm)	252.00
foot-pounds-force	cal (gm)	0.32405

TEMPERATURE CONVERSION TABLE

To convert °F to °C $\quad °C = \frac{°F - 32}{1.8}$

°F	°C
98.6	37
99	37.2
99.5	37.5
100	37.8
100.5	38.1
101	38.3
101.5	38.6
102	38.9
102.5	39.2
103	39.4
103.5	39.7
104	40.0

***A slug is a unit of mass which if acted on by a force of one pound will have an acceleration of one foot per second per second.**

The following candidates successfully completed the 1973 American Board for certification examination held at Northwestern University in August and have been awarded certification status in the disciplines indicated.

NEW CERTIFEES

CERTIFIED ORTHOTISTS

Anderson, William E., C.O.
Beard, Malcus T., C.O.
Brekke, Dale O., C.O.
Christenson, Donald M., C.O.
Clayton, Kermit G., C.O.
Claxton, Hollis Lee, C.O.
Cooney, Eugene J., C.O.
Day, Ronald, C.O.
Deaton, Ronald E., C.O.
Deckert, Frank L., C.O.
Detoro, William W., C.O.
Dos Remedios, Titus R., C.O.
Frank, Walter, C.O.
Guth, Joseph T., C.O.
Hammer, Terry K., C.O.
Harrell, Needham E., C.O.
Hartwig, Eugene C., C.O.
Hodgins, John C., C.O.
Mason, James C., C.O.
Parker, Ivy, C.O.
Pecorella, Michael N., C.O.
Quintana, Alfred M., C.O.
Rilling, Thomas R., C.O.
Schaeffer, William C., C.O.
Schnell, Richard L., C.O.
Shalant, Herbert N., C.O.
Shallow, Steven C., C.O.
Sherer, Paul D., C.O.
Shields, Bart A., C.O.
Stenzel, Harry C., C.O.
Strebe, Ronald J., C.O.
Thullen, David M., C.O.
Tyo, James H., C.O.
Wahlen, Robert, C.O.
Wunder, Kenneth E., C.O.

CERTIFIED PROSTHETISTS

Aubry, Daniel J., C.P.
Beaudoin, Leo E., C.P.
Brace, David, C.P.
Byzewski, Larry J., C.P.
Carey, Richard, C.P.
Collings, Robert E., C.P.
Colwell, Donald F., Jr., C.P.
Daniel, Gerald W., C.P.
Digby, Ronald, C.P.
Flores, Hermino, C.P.
Forlenza, Patricia, C.P.
Goller, Herbert, C.P.
Graves, Jack M., C.P.
Green, Kenneth, C.P.
Griffin, Myron P., C.P.
Heide, Marvin, C.P.
Hendrickson, John R., C.P.
Huestis, Danny E., C.P.
Kabat, Richard W., C.P.
McClanahan, James E., C.P.
Manners, David, C.P.
Martin, Tony E., C.P.
Martinez, Joseph D., C.P.
Meyers, Dennis L., C.P.
Morgan, Dan, C.P.
Mullenix, Henry R., C.P.
Nelson, Bruce, C.P.
Nicely, Sidney Mc., C.P.
Noss, David N., C.P.
Paruszkiewicz, Janice S., C.P.
Polega, Thomas, C.P.
Roberts, William M., C.P.
Sayler, James L., C.P.
Shamp, Daniel L., C.P.
Shelly, Daniel A., Jr., C.P.
Soisson, Paul R., C.P.
Teoli, Albert P., Jr., C.P.
Teoli, William R., C.P.
Verhoff, Conrad, C.P.
Watson, Thomas J., C.P.

CERTIFIED PROSTHETISTS/ ORTHOTISTS

Anderson, Daniel E., C.P.O.
Brenner, Carl D., C.P.O.
Fillauer, Karl D., C.P.O.
Hartson, Robert C., C.P.O.
Kramer, Stephen, C.P.O.
Layton, Anthony, C.P.O.
McGrew, Daniel, Jr., C.P.O.
Mahon, Clifton R., C.P.O.
Meltzer, Lewis N., C.P.O.
Murphy, Michael P., C.P.O.
Pawlowski, Ronald W., C.P.O.
Rosenquist, Bradd, C.P.O.
Sabolich, John, C.P.O.
Sarles, Peter G., C.P.O.
Saxton, Loren, C.P.O.
Schultz, David C., C.P.O.
Scott, Alton, C.P.O.
Snell, Frank E., C.P.O.
Stewart, Lloyd A., C.P.O.
Tindall, Gerald A., C.P.O.
Wilson, Michael T., C.P.O.
Young, Edward R., C.P.O.

INTERNATIONAL SOCIETY FOR PROSTHETICS AND ORTHOTICS
1974 WORLD CONGRESS
MONTREUX, SWITZERLAND, OCTOBER 8th-12th

INTERBOR
INTERNATIONAL ASSOCIATION ORTHOTISTS AND PROSTHETISTS 6TH INTERNATIONAL MEETING

The scientific Congress will be held in conjunction with the triennial assembly meeting of the I.S.P.O. which will incorporate the 6th annual international meeting of INTERBOR and the 8th international course of APO. It will review progress, identify patient needs and offer guidelines for future developments in the field of prosthetics and orthotics.

Opportunities for discussion through the medium of workshops, round table seminars and private sessions will be provided. Film showings will also be included.

An extensive scientific and commercial exhibit is planned.

During the plenary sessions facilities for interpretation into English, French and German will be available as well as for additional languages should the registration warrant it.

In order to permit proper planning of the Congress please complete the attached non-commital postcard. In return more detailed information will be sent to you as it is developed.

APO
SWISS ASSOCIATION FOR PROSTHETICS AND ORTHOTICS 8TH INTERNATIONAL COURSE

The proceedings will include review papers by leading authorities, symposia, and free papers from all professions involved in management of patients requiring prosthetic and orthotic devices.

The subject areas will include:
Amputation and related surgery
Congenital deficiencies
Prosthetic and orthotic devices
Flaccid paralysis
Cerebral palsy
Stroke and spinal cord lesions
Lesions of the spinal column
Feet and Footwear
Education
Rehabilitation engineering
Patient training and acceptance
Technology, administration and management.

REGISTRATION INFORMATION

The Conference is interdisciplinary in nature, and is open to all professionals concerned with prosthetic-orthotic restoration— Doctors, Surgeons, Prosthetists, Orthotists, Technicians, Physical and Occupational Therapists, Engineers, Educators, etc.

Programs will be arranged to meet the specific needs of interested professional groups

Registration Fees (including Social Event)	**Until June 30, 1974**	**After June 30, 1974**
Full Members of ISPO, INTERBOR or APO	sFr. 225.00	sFr. 275.00
Non Members	sFr. 300.00	sFr. 350.00
Accompanying Registrations (wives, families, etc.) Available only in conjunction with full registration	sFr. 75.00	sFr. 75.00
SINGLE DAY REGISTRATION		
Full Members	sFr. 45.00	sFr. 55.00
Non Members	sFr. 60.00	sFr. 70.00

(Rate of exchange per July 2nd, 1973: sFr. 1.00 = US $0.34

PRELIMINARY INDICATION

(Detach and mail to R.F. Baumgartner, M.D., Secretary General, 1974 I.S.P.O. World Congress, P.O. Box, CH-8126 Zumikon/ Zurich, Switzerland)

ISPO WORLD CONGRESS 8th-12th October, 1974 MONTREUX, SWITZERLAND

I hope to attend the Conference yes ☐ no ☐

I would be accompanied by no one ☐ 1 person ☐ 2 persons ☐ more than 2 ☐

I would like to offer a paper on*: ☐ minutes

I would be interested in participating in a workshop or seminar on*:

I would like to show a film on*:

☐ minutes

My field of professional specialization is:

Language preferences: 1. 2.

Please send me further information yes ☐ no ☐

I am member of ISPO ☐ INTERBOR ☐ APO ☐

Name: Address:

Position:

*Deadline: December 31, 1973

INTERNATIONAL SOCIETY FOR PROSTHETICS AND ORTHOTICS

AN INVITATION TO SUBMIT PAPERS
INTERNATIONAL SOCIETY FOR PROSTHETICS AND ORTHOTICS
FIRST WORLD ASSEMBLY, MONTREUX, SWITZERLAND
October 8-12, 1974

Interested individuals are invited to submit free papers for inclusion in the program of the First World Assembly, International Society for Prosthetics and Orthotics, which will be held in conjunction with the 8th International Course of APO, and the 6th International Meeting of INTERBOR. Notification of intent to submit a free paper should be mailed to Mr. George Murdoch, 133 Queen Street, Broughty Ferry, Dundee, Scotland, by *December 1, 1973,* and the manuscripts of these papers are to be submitted, also to Mr. Murdoch not later than *March 1, 1974.*

As the program is presently conceived, the interests of the conference will be covered under some 18 subject headings which are listed and described briefly overleaf. Writers of free papers are urged to focus their attention under one of these subject headings, unless some unusual circumstance indicates the desirability of a paper outside this range. Papers should be in English, French or German and be presented in 10-12 minutes, unless again some unusual circumstance dictates the need for greater length.

Papers submitted for consideration may be accepted in various categories:

- as free papers in the program
- as standby papers to replace those of invited lead speakers who may have to cancel
- as presentations in a major subject symposium
- as papers to be read by title and to appear in the record of the proceedings with the name of the author(s) and the title of the paper, but without an abstract.

I.S.P.O.
FIRST WORLD ASSEMBLY, MONTREUX, SWITZERLAND
October 8-12, 1974

Detach and mail to: George Murdoch, 133 Queen St., Broughty Ferry, Dundee, Scotland

- I plan to submit a free paper for inclusion in the Montreux program ☐
- The title of this paper will be: ______________________________
- I understand that the paper is to be submitted by March 1, 1974 ☐
- It will be prepared for presentation in (circle one) English, French, German

NAME AND ADDRESS (Please Print) ______________________________

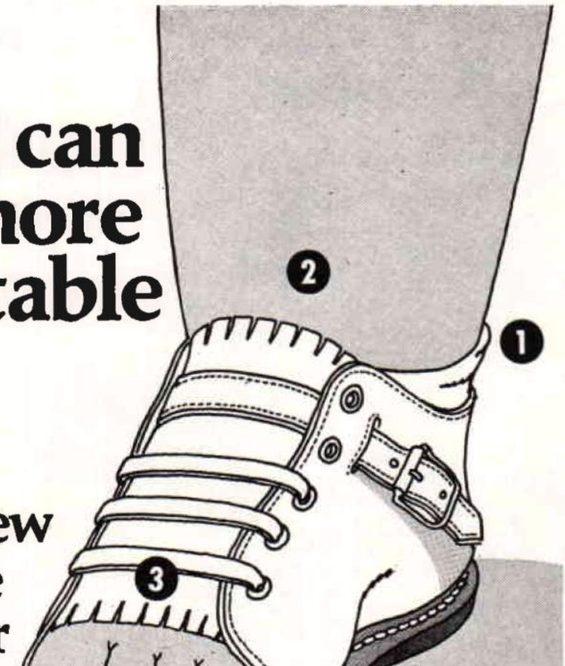
____

PROPOSED SUBJECT AREAS	EXPLANATORY REMARKS
Central Nervous System Lesions including Spinal Cord	Includes both congenital and acquired conditions: e.g., spina bifidia, cerebral palsy, traumatic paraplegia.
Spinal Column Lesions	Includes surgical and orthotic aspects of traction techniques, the design of apparatus, etc., for scoliosis, kyphosis, and other spinal problems.
Biomechanics, Research & Development	Excluding locomotor research (vide infra).
Education, Training and Practical Instruction	Critical reviews of existing and proposed programs including not only curricular subjects but also techniques such as audiovisual aids and the like.
Technology in Prosthetics/Orthotics	To include matters such as materials and design; and aspects of shaping, handling and finishing in relation to the underlying physics or chemistry.
Congenital Deficiency and Malformation	Medical, psychological and technical aspects including surgery, classification and nomenclature.
Ankle/Foot and Footwear	Medical, biomechanical and surgical considerations plus technical and orthotic aspects.
Locomotor Research	Includes gait deviations, analysis, measurement, and biomechanics in relation to implants.
Amputation	To include epidemiology, critical reviews of surgery, and particularly reports on any long-term follow-up of procedures.
Hand Function	Includes pathology pertinent to hand mechanics, bracing and prosthetics.
Fracture Bracing	Reports of work done, technical and service aspects.
External Power	Including power sources, control mechanisms, etc., plus devices and systems for the severely handicapped.
Properties of Tissue	In particular skin, muscle and bone, effects of pressure, tissue mechanics, etc.
Delivery of Service	To include management, supply and production in relation to clinical need, with special reference to geriatric patients and children.
Psycho-Social Aspects	Consideration of the patient's self-concept, and his interactions with others.
Evaluation in Prosthetics/Orthotics	Assessment of the efficacy of treatment devices, techniques and procedures.
Prosthetics/Orthotics	To include individual training, design and devices.
Problems of the Technologically Developing Countries	Statements of the medical needs, existing arrangements for education and training, proposals for the future; existing treatment centers; production capacity.

ORTHOTICS AND PROSTHETICS 1973 AUTHOR INDEX (Volume 27; Numbers 1, 2, 3, 4)

Control can be more comfortable

with the new Child Life pre-walker abduction boot



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Advanced Straight Last Boots
Basic Straight Last Boots

1. **Sof-Top Seamless Back**... prevents chafing and blistering while retaining the high back necessary to hold the heel securely in the shoe
2. **Serrated Tongue**... prevents irritation to the instep area
3. **Wider Toe Opening**... gives you a better view of foot position within the shoe

Child Life SHOES

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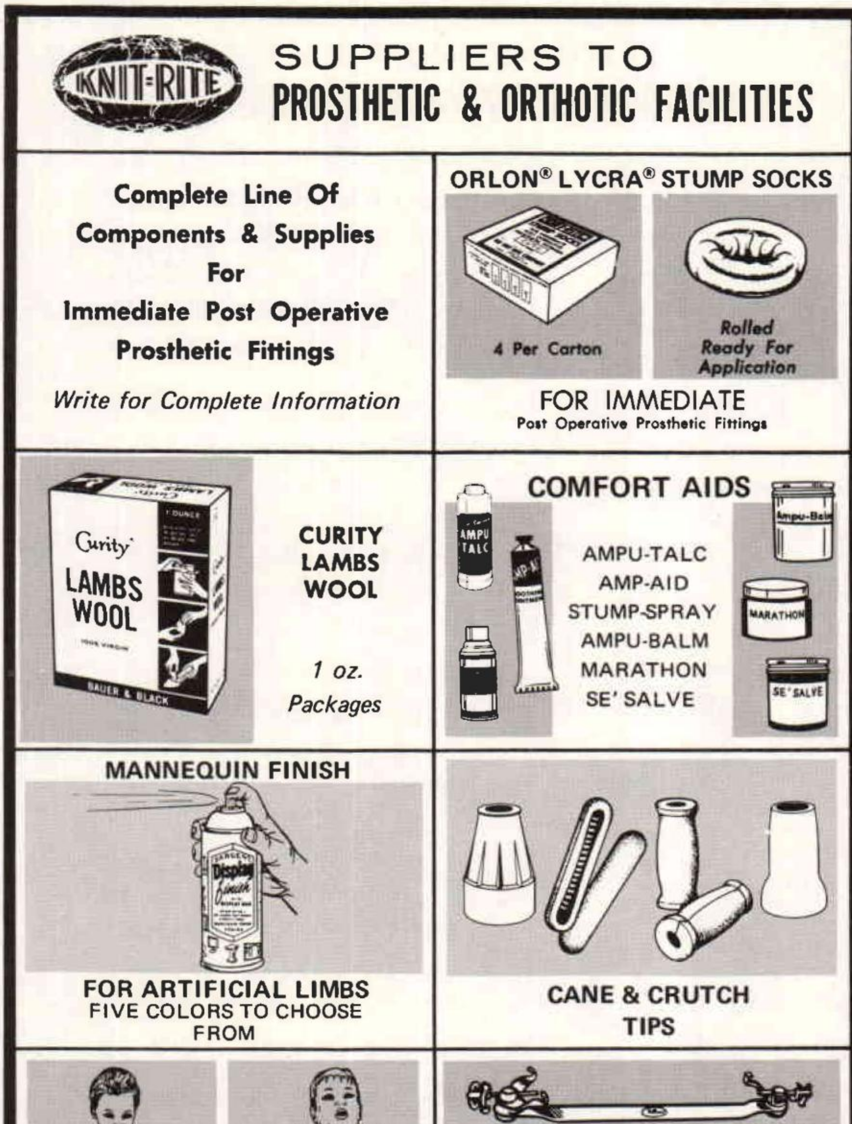
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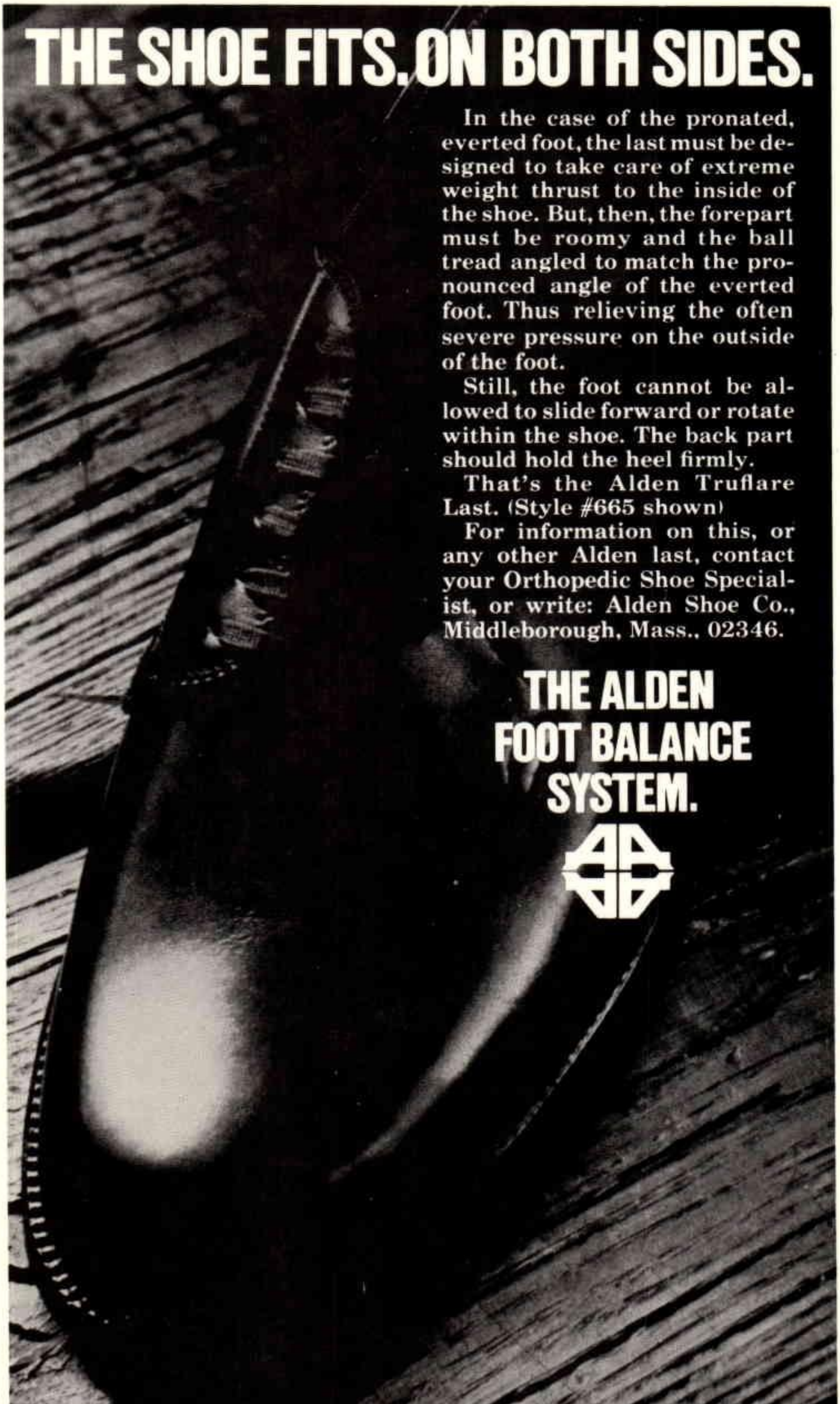
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