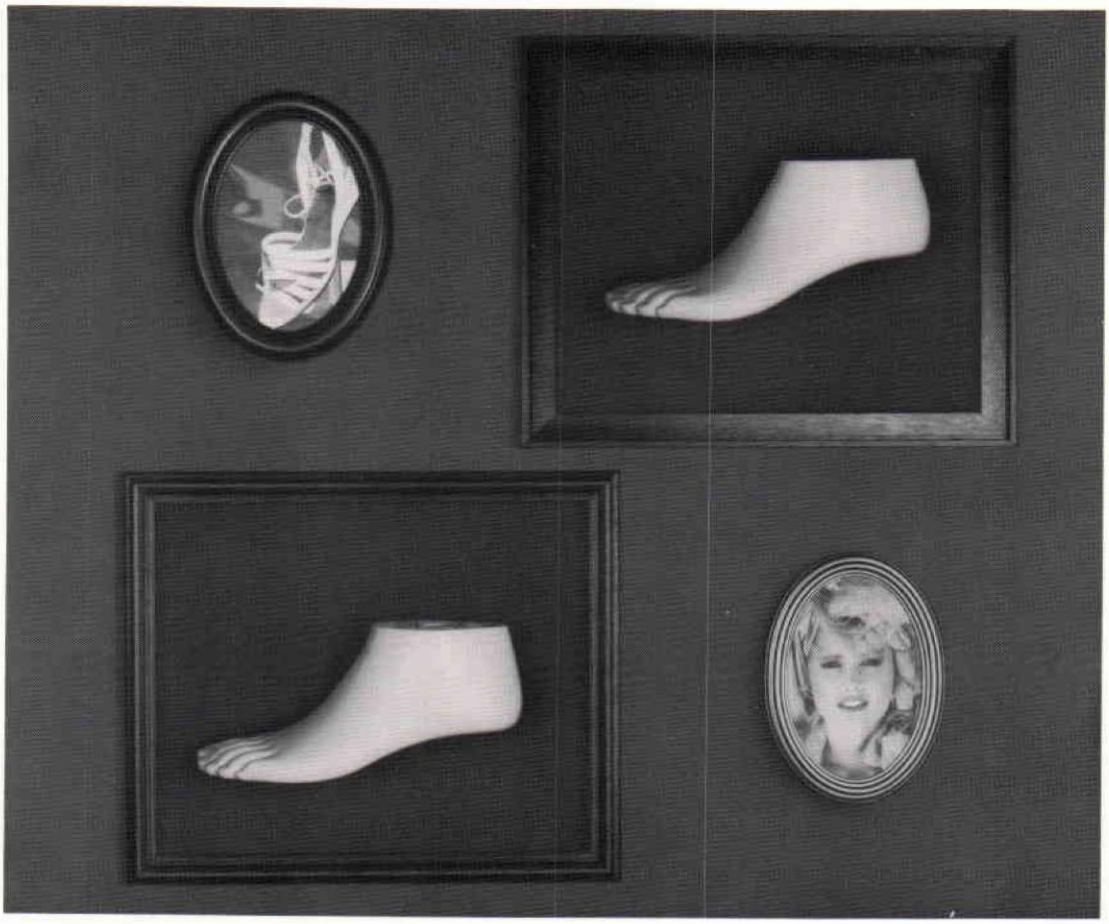
Winter 1985–86
Volume 39
Number 4

Orthotics and Prosthetics

Journal of the American Orthotic and Prosthetic Association



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Winter 1985–86 **Volume 39, Number 4**

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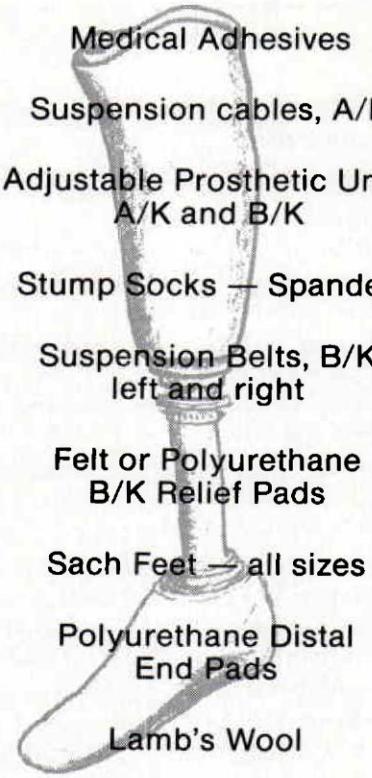

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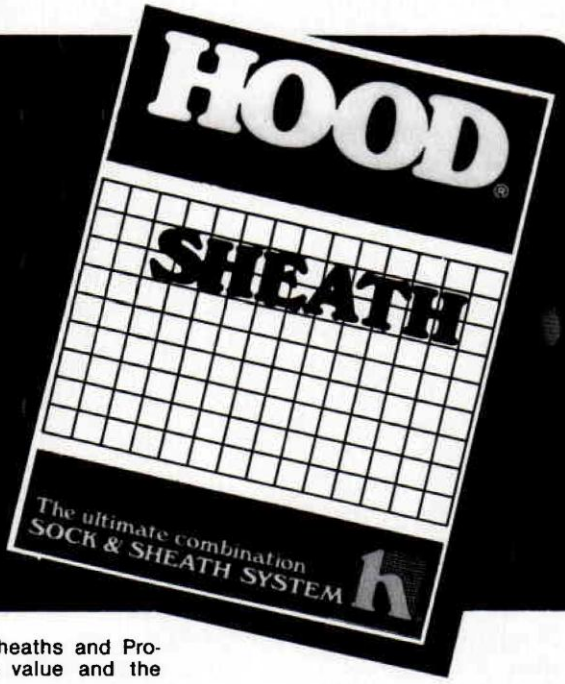

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January 20–26, HANDEX '86, China's First National Care for the Handicapped Exhibition, Military Museum, Beijing, People's Republic of China. Contact: Harry Lepinske, International Marketing Services Ltd., China International Trade Centre, 1719 S. Clinton Street, Chicago, Illinois 60616; tel. 312-593-2462.

January 27–February 2, Academy Annual Meeting and Scientific Symposium, MGM Grand, Las Vegas, Nevada. Contact: Academy National Headquarters: 703-836-7118.

January 30–February 1, 13th Annual Sports Medicine Symposium, The University of Texas Health Science Center at San Antonio, San Antonio, Texas. Contact: Jesse C. DeLee, M.D., UTHSCSA, 7703 Floyd Curl Drive, San Antonio, Texas 78284-7980; tel. 512-691-6295.

February 16–20, ARAB HEALTH '86, the International Hospital, Medical Equipment, and Services Exposition for the Middle East, Jeddah, Saudi Arabia. Contact: George B. Keen, U.S. Dept. of Commerce, Room H1104, Washington, D.C. 20230; tel. 202-377-2010.

February 20–25, American Academy of Orthopedic Surgeons Annual Meeting, New Orleans, Louisiana.

March 2–5, 3rd Israel-Scandinavian Rehabilitation Seminar, "ISRASCAN: Work for Disabled Adults," Eilat, Israel. Contact: Israel Rehabilitation Society, 18 David Elazar Street, Tel Aviv 61901, Israel.

March 14–15, American Academy of Orthotists and Prosthetists Continuing Education Conference 1-86, "Spinal and Seating Orthotics," Birmingham, Alabama.

March 17–21, Fitting Procedures for the Utah Artificial Arm, UCLA Post-Graduate Medical School, Department of Prosthetics and Orthotics, Los Angeles, California. Contact: Harold Sears, Ph.D., Motion Control, Inc., 95 S. Elliott Road, #105, Chapel Hill, North Carolina 27514; tel. 919-968-8492.

April 8–11, Pacific Rim Conference, Intercontinental Hotel, Maui, Hawaii.

April 9–12, Ambulatory Surgery in 1986—What's Happening Now. Freestanding Ambulatory Surgery Association, Boston Marriott Copley Place, Boston, Massachusetts. Contact: 703-836-8808.

April 10–12, New England Chapter of the Academy Spring Seminar, Dunfey Hotel, Hyannis, Massachusetts. Contact: E. Janulaitis, CPO, tel. 617-586-7700.

April 12, Midwest Chapter of the Academy Spring Continuing Education Seminar/Social Event.

April 17–20, AOPA Region IV Annual Meeting, Orlando, Florida.

April 18–19, New York State Chapter of the Academy Meeting, Rochester, New York.

April 24–26, International Conference on the Menisci of the Knee, Hotel Libertas, Dubrovnik, Yugoslavia. Contact: Marko Pecina, President of the Organizing Committee, International Conference on the Menisci of the Knee, Zagreb, Yugoslavia.

April 26–29, AOPA Regions II and III Combined Annual Meeting, Resorts International Casino, Atlantic City, New Jersey. Contact: Mort Levy, CP, 201-222-0366.

May 7–10, Annual Meeting of the Association of Children's Prosthetic-Orthotic Clinics, Milwaukee, Wisconsin. Con-

tact: Francis J. Trost, M.D., Program Chairman, 2545 Chicago Avenue S., Minneapolis, Minnesota 55404.

May 16–17, American Academy of Orthotists and Prosthetists Continuing Education Conference 2-86, "Lower Limb Prosthetics," Kansas City, Kansas. Contact: Academy National Headquarters, 703-836-7118.

May 28–30, S.M. Dinsdale International Conference on Rehabilitation, "Towards the 21st Century," hosted by the Royal Ottawa Regional Rehabilitation Centre, 505 Smyth Road, Ottawa, Ontario K1H 8M2. Contact: Education Dept. tel. 613-737-7350, ext. 602.

May 28–31, AOPA Region V Annual Meeting, Hyatt Regency, Cincinnati, Ohio.

June 2–6, Fitting Procedures for the Utah Artificial Arm, Northwestern University Post-Graduate Medical School, Department of Prosthetics and Orthotics, Chicago, Illinois. Contact: Harold Sears, Ph.D., Motion Contol, Inc., 95 S. Elliott Road, #105, Chapel Hill, North Carolina 27514; tel. 919-968-8492.

June 6–8, AOPA Region IX, COPA, and the California Chapters of the Aacdemy Combined Annual Meeting, Newport Beach Marriott, Newport Beach, California.

June 11–14, AOPA Regions VII, VIII, X, and XI Combined Annual Meeting, Alameda Plaza, Kansas City, Missouri.

June 19–22, AOPA Region VI and Academy Midwest Chapter Combined Annual Meeting, Lakelawn Lodge, Delavan, Wisconsin.

June 23–27, RESNA 9th Annual Conference on Rehabilitation Technology, "Employing Technology," Radisson South Hotel, Minneapolis, Minnesota. Contact: RESNA, Suite 700, 1101 Connecticut Avenue, NW, Washington, D.C. 20036; tel. 202-857-1199.

July 18–19, American Academy of Orthotists and Prosthetists Continuing Education Conference 3-86, "Disarticulation Prosthetics," Milwaukee, Wisconsin. Contact: Academy National Headquarters, 703-836-7118.

August 5–7, Canadian Association of Prosthetists and Orthotists bi-annual national convention, World Trade Centre, Halifax, Nova Scotia, Canada. Contact: Nova Scotia Rehabilitation Centre, Orthotics/Prosthetics Unit, 1341 Summer Street, Halifax, Nova Scotia B3H 4H4, Canada.

September 19–20, American Academy of Orthotists and Prosthetists Continuing Education Conference 4-86, "Powered Limb Prosthetics," Albany, New York. Contact: Academy National Headquarters, 703-836-7118.

October 24–25, American Academy of Orthotists and Prosthetists Continuing Education Conference 5-86, "Spina Bifida," Cincinnati, Ohio. Contact: Academy National Headquarters, 703-836-7118.

November 4–9, AOPA Annual National Assembly, Marriott's Orlando World Center, Orlando, Florida. Contact: AOPA National Headquarters, 703-836-7116.

1987

January 22–27, American Academy of Orthopaedic Surgeons, Annual Meeting, San Francisco, California.

February 15–22, Academy Annual Meeting and Scientific Symposium, Hyatt Regency Tampa, Tampa, Florida. Contact: Academy National Headquarters, 703-836-7118.

May 28–31, AOPA Region V Annual Meeting, Grand Traverse Hotel, Traverse City, Michigan

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July 5–10, International Conference on Disability Education, Jerusalem, Israel. Contact: Israel Rehabilitation Society, 18 David Elazar Street, Tel Aviv 61901, Israel.

July 12–16, International Conference of Rehabilitation Journalists, Jerusalem, Israel. Contact: Israel Rehabilitation Society, 18 David Elazar Street, Tel Aviv 61901, Israel.

September 21–27, AOPA Annual National Assembly, Hyatt Regency Hotel, San Francisco, California. Contact: AOPA National Headquarters, 703-836-7116.

1988

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

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

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

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October 2–8, AOPA Annual National Assembly, MGM Grand Hotel, Reno, Nevada. Contact: AOPA National Headquarters, 703-836-7116.

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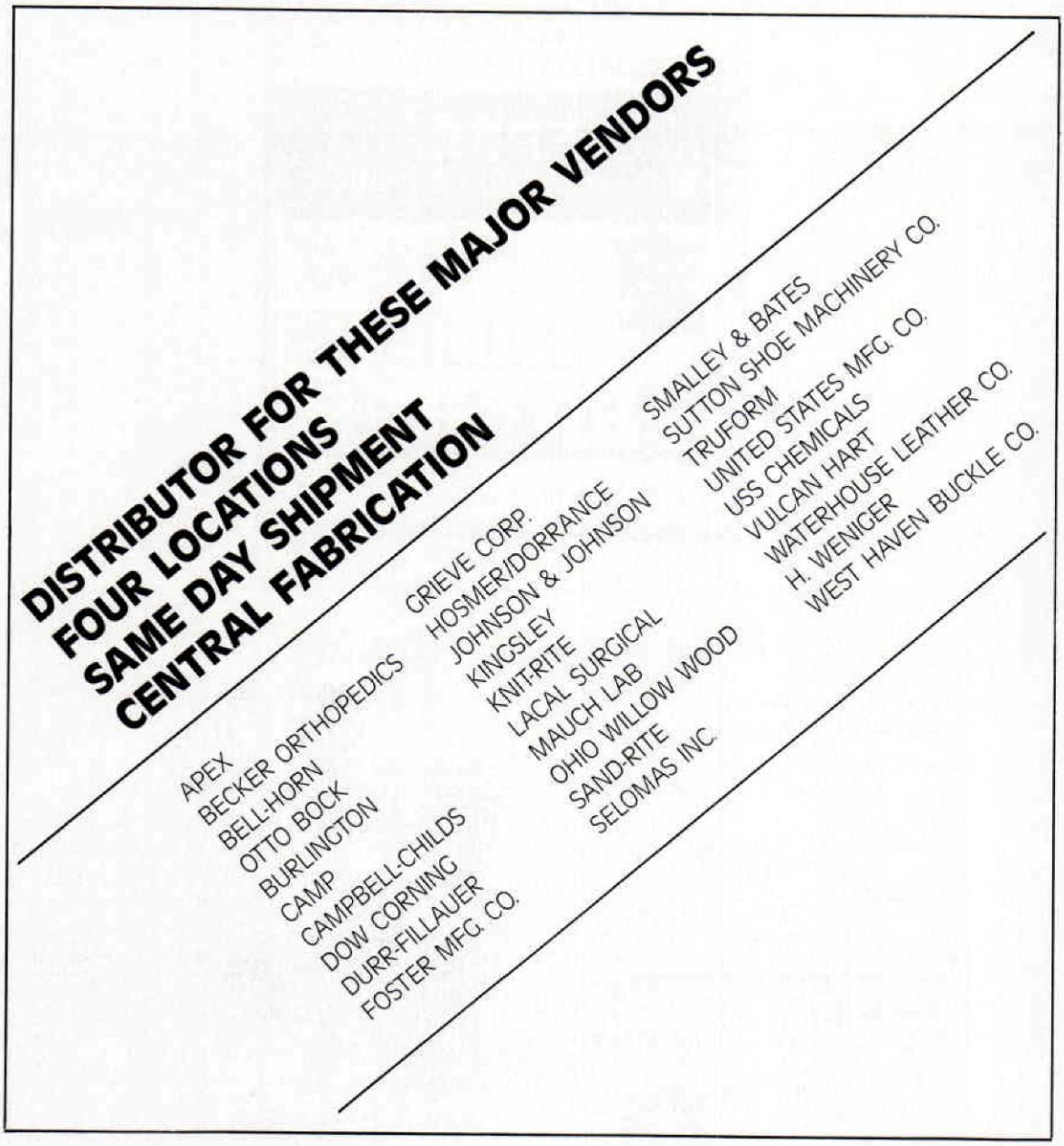

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Orthotics and Prosthetics, Vol. 39, No. 4, pp. 13–15.

Low Profile Contoured Ring

Sidney Wallace, M.D.
Robert Madigan, M.D.
Jack Wasserman, Ph.D.
Carlton Fillauer, C.P.O.
Karl Fillauer, C.P.O.

The design of the Milwaukee Orthosis has changed considerably since its introduction in 1945.[1] Continued development has led to decreased use of the traditional Milwaukee Orthosis in the treatment of idiopathic scoliosis. In many locales, the low profile T.L.S.O. (thoracic lumbar sacral orthosis) dominates the non-operative treatment of scoliosis because of better patient acceptance and its effectiveness in managing mid-thoracic and lumbar curves. We utilize a T.L.S.O. module on a routine basis when the apical vertebra is at the ninth thoracic vertebra or below. We have also used a T.L.S.O. on borderline mid-thoracic curves with the understanding that the orthosis may need to be modified to the C.T.L.S.O. (cervical thoracic lumbar sacral orthosis) design if we fail to control the curve. Recently we have modified the neck ring of our C.T.L.S.O. to make it less conspicuous and, therefore, gain better patient acceptance without sacrificing effectiveness. (Figure 1).

The development of this new neck ring resulted from an outgrowth of work conducted at The Children's Hospital at Stanford University.[2] The Hospital staff had modified the Fillauer throat frame for use in a biofeedback program for the treatment of scoliosis. This stimulated our interest in

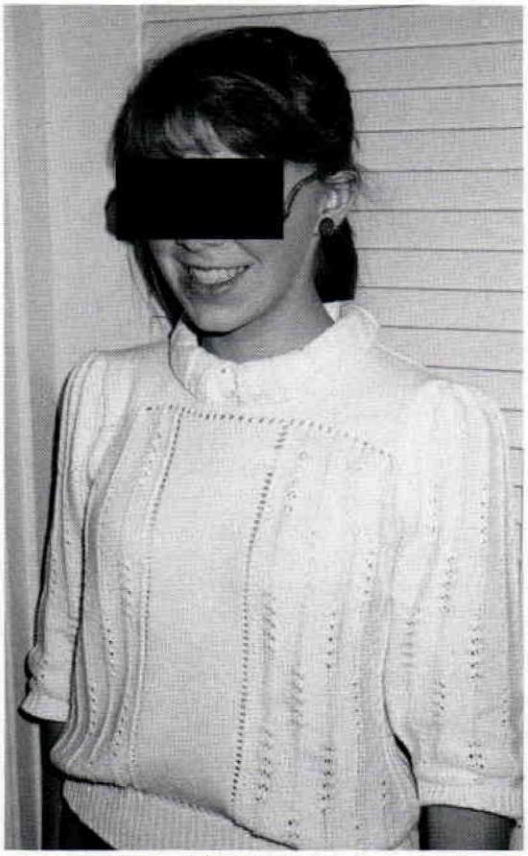

Figure 1. The modified C.T.L.S.O. is more effective and less conspicuous.

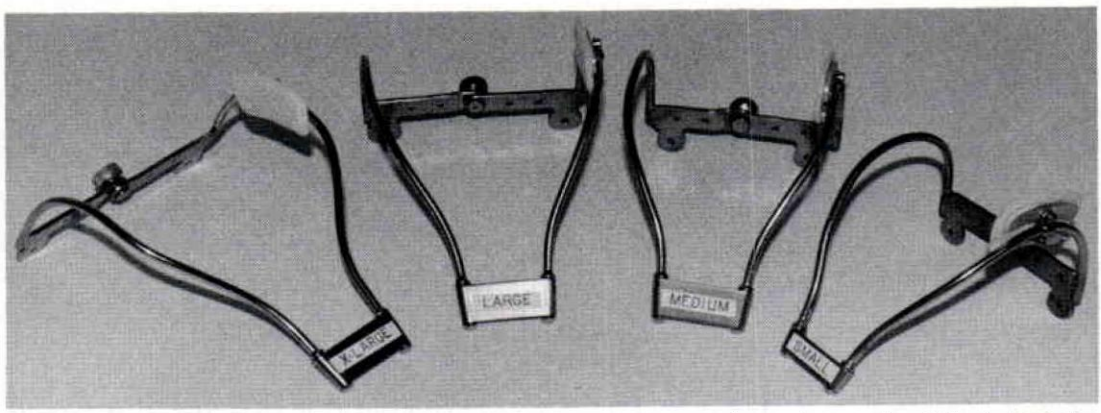

Figure 2. There are four standard ring sizes—small, medium, large, and extra large—that differ in both the antero-posterior and medio-lateral dimension.

modification of the neck ring to effect a more cosmetically acceptable device. In 1981 we began fitting patients with this type of neck ring, and soon realized that our patients accepted this design more than the conventional neck ring. This was most apparent in the children who had initially used the conventional neck ring. Eliminating the mandibular and occipital sections also improved comfort.

Traditionally, the neck ring provided three functions. A distraction force was applied to the spine as a result of the occipital and mandibular pads. It provided a lateral counter pressure, and it functioned to center the head and neck over the trunk. It is our impression that the latter two functions are the most important and are maintained in the new design.

Distraction played a prominent role in the early Milwaukee orthoses. Such extreme measures were shown to have a deleterious effect on the jaw and teeth, and the use of the mandibular pad was eliminated in the 1960's. It has been stated that the occipital pads in the absence of a high mandibular pad serve as a fulcrum about which the patient can obtain distraction by hyperextending the cervical spine. We are now reevaluating this accepted theory in

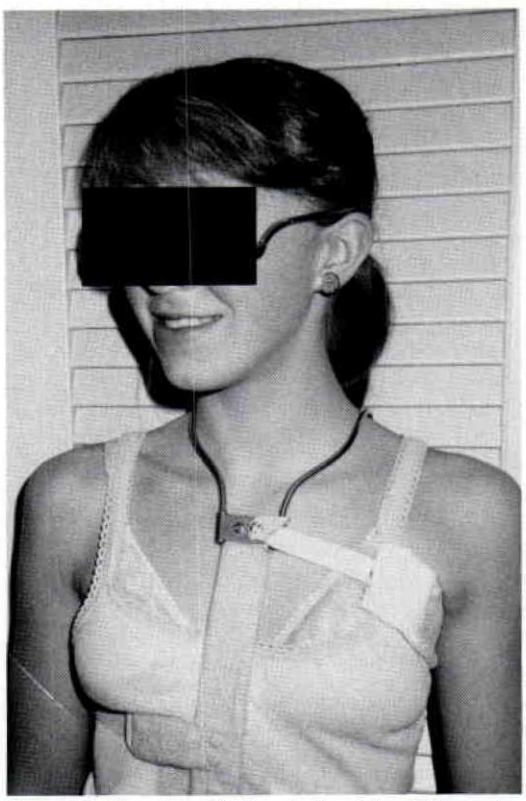

Figure 3. The ring will touch the side of the neck, but it is possible to reduce excessive pressure on the neck by adding a three-quarter ring.

light of the success the low profile ring is achieving. In practice, it seems that the patient does not utilize this function of the ring, and our feeling is that it is of little benefit to provide provisions in a ring to achieve this function.

Paramount in this new concept is the realization that with the cosmetically acceptable low profile neck ring, the problems associated with compliance are removed, while desirable effects from using a neck ring are preserved. The Low Profile Neck Ring provides a lateral control force to act in concert with an axillary sling to oppose the thoracic pad. The ring also positions the head over the pelvis to result in a compensated spine.

RING SELECTION AND FITTING

There are four standard ring sizes—small, medium, large, and extra large—that differ both in the antero-posterior and medio-lateral dimension (Figure 2). It is very important to carefully select the proper size in order to achieve maximum cosmesis. The ring should fit around the base of the neck without impinging on the clavicle. As in the other designs, the ring will touch on one side of the neck. It is possible to reduce excessive pressure on the neck by adding a three quarter axillary ring (Figure 3). The axillary ring will often make orthosis use more comfortable.

A disadvantage to the use of the Low Profile Contoured Ring is the added time required in fitting as compared to the more traditional designs, because of the emphasis placed on achieving maximum cosmesis. What used to be acceptable parameters for a properly fitted ring have now changed, and close attention must be paid to determine the proper height of the ring. Observing the patient both in the standing and the sitting position is mandatory, since there may be a considerable difference in height measurement. Adjusting the various pads frequently lessens this difference. The ideal situation is achieved when the algebraic sum of the pressure of the right and left pressure pads is equal. This is obviously a subjective judgment, for there are no means of accurately measuring the pressure on each pad. However, keeping this concept in mind will aid in achieving optimum orthotic function.

SUMMARY

The authors have fit 50 patients with orthoses incorporating the Low Profile Contoured Ring. The overall results appear to be excellent, and the ring is continuing to be used in place of previously used designs. The authors have further modified the concept by lowering the lateral placement of the ring from mid-neck to the base of the neck, which does not compromise the effectiveness of the orthosis. The inch lost in length is functionally insignificant, but is cosmetically important. With the placement of the ring at the base of the neck, it is unobtrusive when wearing clothes. At present, orthopedic surgeons, orthotists, and especially patients are very optimistic about this new design. A protocol for its usage and fitting requirements is being written.

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REFERENCES

[1]Blount, Walter P., Moe, John H., *The Milwaukee Brace, Sec. Edition*, Williams & Wilkins, Baltimore/London, 1980.

[2]Moore, Greg, "A New Cervical Ring for the Idiopathic Scoliosis C.T.L.S.O," *Orthotics and Prosthetics*, Vol. 38, No. 1, Spring 1984, pp. 50–54.

Orthotics and Prosthetics, Vol. 39, No. 4, pp. 16–20.

The Application of ISNY Principles to the Below-Elbow Prosthesis*

Norman Berger, M.S.
Sidney Fishman, Ph.D.
David Krebs, M.A.
William Webb, B.S.

Since January, 1984, when New York University Post-Graduate Medical School introduced the ISNY (Icelandic-Swedish-New York) Above-Knee Socket System to the prosthetic profession by offering the first instructional course on this subject, this revolutionary technique has spread with surprising speed all over the United States and, indeed, through many of the industrialized nations of the world.[1,2] In view of the overwhelmingly favorable response to the comfort provided by the thinner, lighter, cooler, flexible ISNY socket and its weight-transmitting frame, it is obvious that consideration would soon be given to the application of these design principles to other amputation levels. The purpose of this paper is to report on the ISNY Flexible-Hinge Prosthesis, for the medium and long below-elbow amputee.

For this level of below-elbow amputee, the conventional prosthesis is fabricated of rigid plastic laminate, with a double wall construction. The inner wall forms the socket and the outer wall provides for attachment of the wrist unit and flexible hinges, as well as for appropriate length and shape. As illustrated in Figure 1, the ISNY below-elbow prosthesis consists of a thin, thermoplastic socket connected via volar and dorsal struts to the laminated distal portion. As in the above-knee ISNY design, the socket is soft and flexible rather than hard and rigid. The frame, while allowing for length, shape, and component attachment, is minimal in size and extent.

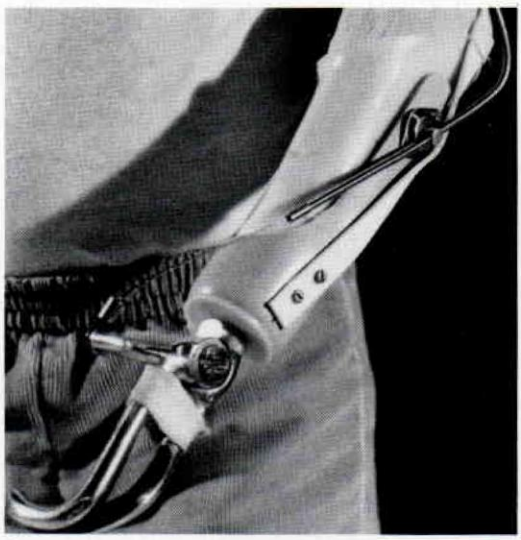

Figure 1. I.S.N.Y. Flexible Hinge Below-Elbow Prosthesis.

*Funded by Special Project MCJ-363082—Bureau of Health Care Delivery & Assistance Division of Maternal & Child Health, U.S. Public Health Service, Rockville, MD 20857.

Characteristics of Sample

Subject	Age at Fitting (yr.)	Sex	Length as Compared to Sound Side (%)	Duration of ISNY Experience (mo.)	Weight Difference (Conventional-ISNY Forearm) (oz.)
1	11	M	62	2	6.25
2	18	F	69	7	4.0
3	13	F	38	7	4.0
4	13.5	F	69	7	5.5
5	14	F	75	11	4.75
6	7.5	M	68	2	4.0
x	12.8	4-F, 2-M	63.5	5.8	4.75

Table 1.

CLINICAL EXPERIENCE

Following several laboratory fittings for developmental purposes, the first ISNY below-elbow prosthesis was delivered in February, 1984 to a 73 year old male, semi-retired plumber who had been a part-time user of his conventional prosthesis. With the ISNY prosthesis, however, he became a full-time wearer, and was able to perform his activities of daily living and vocational activities more comfortably. The subject has worn the ISNY prosthesis successfully for more than one year without need for repair. Due to these encouraging reactions, NYU began a series of ISNY flexible-hinge below-elbow prosthesis fittings to a group of young amputees, this being the specific population that we were funded to serve.

In our initial series, six unilateral, congenital, below-elbow amputees were fitted. The four girls and two boys range in age from 7½ to 18 years (X = 12.8 yrs.), with an average residual limb measuring 63 percent of sound forearm length. All were full-time wearers of conventional prostheses. ISNY sockets were fabricated for each subject utilizing a new plaster negative impression, plaster positive model, and wrist unit, but the terminal device and harness type were unchanged. These six individuals have worn the new sockets for an average of 5.8 months (range: 2-11 mo.). The forearms containing the ISNY sockets have averaged 4.8 oz. lighter than their conventional counterparts (Table 1).

Structured interviews were conducted with each wearer at the time of delivery of the new prosthesis and at two, four, and six week intervals post-delivery to elicit comparative opinions concerning the conventional and ISNY prosthesis. As detailed in Table 2, all subjects indicated that the ISNY was more comfortable than the conventional socket, being lighter, cooler and permitting the input of sensory stimuli, particularly when writing or leaning on the prosthesis. They also reported that wear times increased with the ISNY system, especially during the summer months, and that the device "felt more like my real arm," probably due to the greater intimacy of fit made possible by the soft, flexible thermoplastic. Three individuals objected to the appearance of the prosthesis, indicating that the two dissimilarly colored parts

Comments Regarding the ISNY Below-Elbow Socket

Comment	Number of Children
Comfort	
Lighter	6
Adheres to limb better	5
Able to wear most of time	5
Cooler	5
Softer	2
Better flexibility	2
Feels more like part of my arm	2
Thinness is good	2
Heat: same	1
Good pressure distribution	1
Sensation	
Better feedback from environment	5
Better sensation	4
Quieter when ISNY strikes something	3
Likes to touch ISNY	2
Friends like to touch ISNY	1
Hurts others less when they are struck	1
Function	
Better pro/supination	3
Better flexion ROM	2
Hook opens more easily	1
Doesn't slip off table	1
Appearance	
Appearance better	3
Appearance worse	3

Table 2.

(socket and frame) "looked different than a real arm." Nonetheless, they persisted in wearing the device due to the overriding comfort and other advantages in comparison with the conventional system. The other three individuals considered the cosmesis to be better than the conventional.

In summary, all subjects reacted enthusiastically to the new sockets and emphatically rejected any suggestion to return to their conventional sockets.

FABRICATION METHODS

Vacuum-forming the Socket

Using round frames (inside diameter 9") and a round platen (diameter 8"), the socket is vacuum formed from either polyethylene or Surlyn.® For longer and broader residual limbs, the thermoplastic should be 3/16" thick, while for shorter and thinner residual limbs, 1/8" thickness may be used. In most cases, drawing the socket over the plaster model is a simple and straight-forward procedure.

Problems may be encountered, however, if the residual limb presents an unusual non-conical shape, as for example a wrist disarticulation with undercuts just above the styloid processes, or a limb with a distinct curve at its end. It is difficult to prevent wrinkling and excessive thinning of the socket wall in these undercut areas. To solve such problems, we have either used 1/8" Surlyn,® which tends to mold more easily than polypropylene; or 1/4" polyethylene, in which case the portions of the socket that are too thick are ground down and buffed to appropriate thinness and flexibility. This latter solution does not work with Surlyn® because it does not readily accept grinding.

Frame Lay-Up

With the socket, the wax extension, and the wrist unit in place on the plaster positive model, lay-up materials are applied as follows:

- a sleeve of light dacron felt
- two layers of nylon stockinette
- two layers of carbon fiber tape(1/2" width) placed along with volar and dorsal midlines of the socket and extension
- two layers of nylon stockinette

With the exception of the carbon fiber, all materials are pulled over the model and tied off at the wrist unit in the usual manner. The layers of carbon fiber tape are formed by folding a one inch width lengthwise, thus creating two layers of 1/2" width, and sewing to maintain the fold. These sewn lengths are then placed along the volar and dorsal midlines beginning approximately one inch proximal to the

wrist unit and extending to approximately one inch distal to the anticipated socket trimline.

Frame Trim

After lamination, the frame is trimmed so that the volar and dorsal struts are approximately ¾" in width, which means that about ⅛" of resin-impregnated nylon and dacron felt remain on each side of the ½" wide carbon-fiber tape. Proximally, these struts terminate anywhere between ⅛" and ¾" distal to the socket trimline. The shorter the residual limb, the closer the proximal termination will be to the socket trimline.

Posteriorly, the curve which connects the struts is at a level just distal to the distal end of the residual limb. Anteriorly, however, this curve is just proximal to the distal end of the residual limb (Figure 2). The purpose of the more proximal location of the anterior curve is to improve cosmesis by hiding the site of amputation, without contacting the socket. It is essential to keep this in mind when preparing the wax forearm extension, which must be shaped so as to provide approximately ⅛" clearance between socket and frame in this area.

Attachment of Socket to Frame

Several methods of attaching the socket to the struts have been explored. Our initial approach of simply riveting the thermoplastic socket to the frame resulted in bearing failure due to the inadequate area available to resist stress. As a second approach, the socket was formed over Nyloplex strips placed on the volar and dorsal sides of the positive model with Nyloplex rivets put through the socket, frame, and strips. This greatly increased bearing surface solved the bearing failure problem, however, fabrication proved to be a somewhat cumbersome and time-consuming process.

The preferred procedure utilizes an adhesive-backed, Velcro type** pile secured to the thermoplastic socket, with the hook

Figure 2. I.S.N.Y. flexible socket displaying anterior distal trimline.

portion either adhesive backed, or glued to both struts with Devcon 5-Minute Epoxy® or 3M#4693.® The parts are then simply pressed together. Although this technique provides a very satisfactory attachment, the mediolateral dimension of the prosthesis is increased by the thickness of the pile and hook. It is possible, if desired, to reduce this dimension by utilizing only the pile. As before, the adhesive backing of the pile is applied to the thermoplastic socket; however, the other surface is glued directly onto the laminated struts.

Harness Attachment

The flexible hinges are attached to the ISNY forearm at the conventional sites. However, it is important to recall that the cross-hanger strap that connects the two hinges should be positioned precisely at the joint centers (i.e., directly over the humeral condyles).

Though we are unable, as yet, to report long-term results on a large number of patients, we are confident on the basis of the evidence presented that the ISNY Flexible Hinge Prosthesis, as described, represents a significant advance in prosthetic comfort and function for medium and long below-elbow amputees. We are also confident that the same approach will be applicable to

**Scotchmate Hook and Loop, 3M Manufacturing Co., Minneapolis, Minnesota.

other types of lower and upper-limb prostheses and we are currently directing research efforts along these lines.

REFERENCES

[1]Kristinsson, O., "Flexible Above Knee Socket Made From Low Density Polyethylene, Suspended By a Weight Transmitting Frame," *Orthotics and Prosthetics*, Vol. 37, No. 2, pp. 25–27, 1983.

[2]Faculty, Prosthetics and Orthotics, New York University Post-Graduate Medical School, New York, New York, Fabrication Procedures for the ISNY Above Knee Flexible Socket, April 1984.

[3]Faculty, Prosthetics and Orthotics, New York University Post-Graduate Medical School, New York, New York, Upper-Limb Prosthetics-Prosthetists Supplement, 1982 Revision.

Orthotics and Prosthetics, Vol. 39, No. 4, pp. 21–28.

Comparison of Three Prefabricated Cervical Collars

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INTRODUCTION

The functional objective of any cervical orthosis is to limit unwanted cervical spine motion.[1] Motion control at the cervical spine is sought to ameliorate an array of problems which vary in etiology and severity.[6] Special cervical orthotic requirements may include one or more of the following: realignment of the cervical spine,[1] motion control in flexion, extension, anterior or posterior displacement, lateral flexion, axial rotation, and modest unweighting of the vertebrae.[1,7] Some common prescription criteria for use of a cervical orthosis are: post surgical management, immediate post-traumatic management, subluxations, degenerative diseases, and management of pain secondary to a multitude of disorders.[1,2,6,8] Each disorder may require one or more specific functions from a cervical orthosis.

In response to the different etiological factors and various manifestations of problems, many categories and types of cervical orthoses have become available to the orthotist.[1,3,4,5,6] The trends indicate a preference toward using prefabricated designs whenever possible,[9] and this has motivated manufacturers to design and market many prefabricated cervical orthoses. Most prefabricated cervical orthoses allow for minor adjustments only, with each having its own inherent advantages and disadvantages.

According to Johnson,[6] there are four categories of cervical orthoses. These are (in order from least to most restrictive) the cervical collars, poster cervical orthoses, cervicothoracic orthoses, and the halo skeletal fixation orthosis. Given the variety of orthoses available, prescription rationale includes consideration of function, comfort, and cost of the orthosis.

Effective stabilization is paramount. However, when a cervical orthosis needs to be worn for an extended period of time, comfort becomes an issue. Often, some restrictive efficacy is sacrificed for this purpose. When cervical spine instability is not apparent, the collar types are most frequently the first choice for use. The collar's kinesthetic reminder property plays an important role in limiting motion about the cervical spine.[1]

In emergency situations when supplies must be maintained, ease of application and cost are important. In view of this, the collar types have been widely used by paramedics for immediate post-traumatic cervical spine management.[10] However, it is known that collars are inadequate for controlling cervical spine instability. Paramedics will utilize sand bags about the injured body, particularly the head and neck, and tape the head to an underlying

Figure 1. (From left to right) The Philadelphia Collar, Nec-Lok®, and Soft Foam Collar.

board. These actions supplement the inadequacies of the various collars.

Many studies have been conducted on the popular cervical orthoses.[2,4,5,6] These studies have explored the relative motion control in the three anatomical planes. Documentation of motion in the sagittal, coronal, and transverse planes have been photographed and roentgenographed. The results are presented as percentages of motion restricted when compared to the normal range exhibited by the cervical spine.[4,5,6] In addition, the mechanics of motion at each individual vertebral level from the occiput through T-1 have been explored.[5,11] In all, documentation of motion in the three anatomical planes has provided sufficient information in determining the orthoses overall effectiveness for controlling motion of the cervical spine.[5,11] A secondary consideration is patient tolerance, which remains somewhat subjective and difficult to quantify. The orthotist obtains this information from patient feedback, appearance of the orthosis, and through trial fitting the orthosis, when possible.[7,10]

These studies are an excellent compilation of information for comparisons of cervical orthoses. However, there exists a need to document the new orthoses within each category, since many new cervical orthoses have been developed and marketed since the previous studies. It is the specific objective of this report to evaluate one of these new devices, the NecLok® cervical collar. The soft foam collar and the Philadelphia collar were used to establish internal criteria for comparison.

To date, no quantitative study has been conducted on the NecLok® cervical orthosis. A subjective analysis by the State of Indiana Emergency Medical Service Commission has rated this cervical collar superior over other cervical collars. Results were obtained by evaluating the orthoses according to the following criteria: simplicity, ease of cleaning, immobilization quality, ease of application, construction material, space needed for storage, sizes available, and manufacturer's wholesale price.[10]

MATERIALS AND METHODS

Ten subjects were selected, three female and seven male, with ages varying from 24 to 45 years. All subjects had normal cervical spines with no history of injury or disease. Each subject was tested for cervical range of motion in four treatment modes: wearing no orthosis and wearing each of the three test orthoses (Figure 1). All the orthoses were fit according to the manufacturer's recommendations.

Because of the accuracy of goniometry compared to roentgenography has been substantiated by others,[12,13,14,15] goniometry was used only to measure gross cervical motion in this study. By doing this, the

high radiation exposures associated with roentgenography were avoided. Also, the angular errors associated with locating both gross anatomical landmarks and then convergent projections were avoided.

Each of the 10 subjects was seated in a standard, straight back chair and had their thoracic spine held against the chair back with the aid of a custom fabricated chest apron. In addition, each subject was instructed to exert a conscious effort to eliminate unnecessary motion, thus reducing unwanted thoracic and lumbar spine motion minimizing the introduction of errors into the cervical motion measurements.

For the purpose of this paper, motion in the sagittal plane is described as anterior/posterior motion. Previous studies have indicated that during an attempt to flex the cervical spine against mandibular restriction, some of the lower cervical vertebrae actually extend. In addition, gliding motion among the facets also contributes to motion in this plane.[5,6] Lastly, flexion and extension occurs about many axes and thereby contributes to anterior or posterior displacement of the structures proximal to those axes.

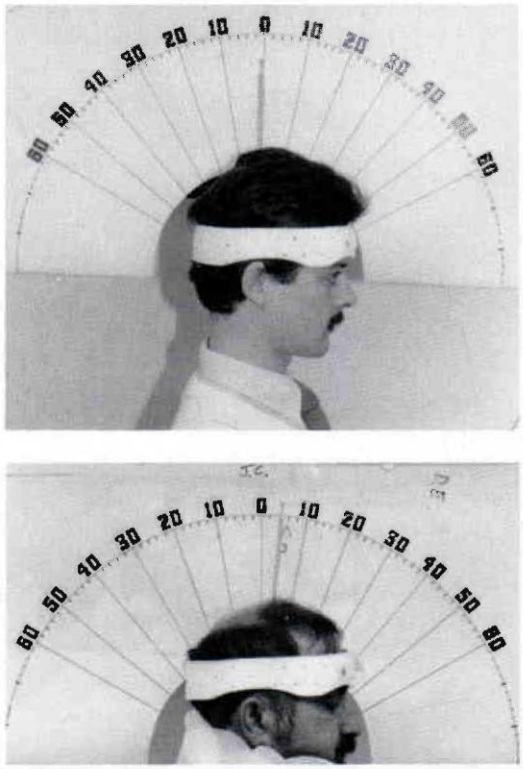


Figure 2. Anterior/posterior motion measurement.

Anterior/Posterior Motion

Anterior/posterior motion was measured as shown (Figure 2). An angular scale was positioned in the sagittal plane closely along the side of each subject. Each subject wore a custom fabricated head halter with an indicator needle attached (Figure 3). The indicator needle could be attached to various sites on the halter to accommodate the other measurements. The indicator needle traversed the scale during the ranging of the cervical spine and pinpointed the magnitude of angular motion. This allowed for a visual observation of an arc, depicting two end points of the full range of motion for that subject. The study goal was to obtain the subject's full arc measured in degrees (Figure 4).

Each of the 10 subjects were instructed on a procedure for allowing their neck to flex forward to the end of their range and then backward to the end of the extension range. The angular scale was marked at each end point of cervical spine motion. This procedure was repeated three times in each direction.

The platen with scale was calibrated in two degree increments. A camera was diametrically positioned from the scale to document the findings on film. A telephoto lens was utilized in an attempt to minimize errors created by parallax between the indicator needle and angular scale. Each photograph recorded three data end points, two of which were indicated on the angular scale with an ink marker (triangle and square), and the third was indicated with the needle protruding from the head halter. After it was determined that the difference of the three data points were not statistically significantly different, they were averaged into a single value representing one extreme range of motion. This procedure was repeated for each of the cervical collars used in this study.

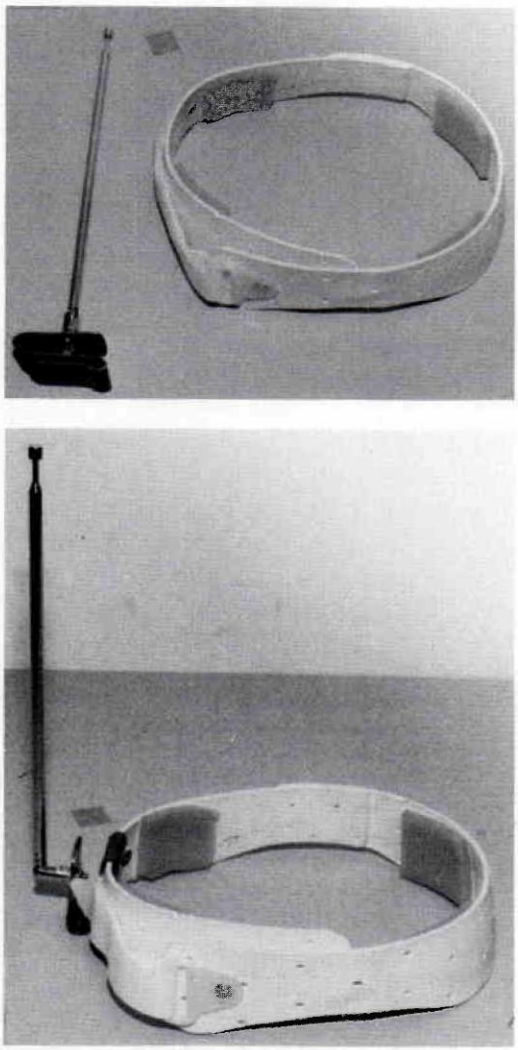


Figure 3. Head halter and indicator needle.

Lateral Flexion Motion

This testing procedure was repeated for lateral flexion. The angular scale was repositioned behind the subject's head in the coronal plane as shown (Figure 4). The indicator needle was also repositioned at the posterior aspect of the head halter. The subjects were instructed to flex their necks laterally to the left, and then to the right. This procedure was repeated for each of the various cervical orthoses tested. Photographs were taken in the same manner as described above.

Axial Rotation Motion

Axial rotation was measured with the platen and scale repositioned in the transverse plane (Figure 5). The subject's indicator needle was also repositioned, which allowed the needle to extend horizontally from the anterior aspect of the head halter and over the angular scale. The subjects were instructed to rotate their necks clockwise and then counterclockwise. This procedure was repeated for all the cervical orthoses tested. A mirror was positioned at a 45 degree angle over the subject's head to facilitate photographing the angular scale. Range of motion data were recorded in the same fashion as with anterior/posterior and lateral motion.

RESULTS

As indicated, all the observations were recorded in a continuum of degrees. These measurements described an arc which represented a total range of motion for that subject, for each observed anatomical plane. The cervical spine was measured as a whole unit without consideration to the angulations at each vertebral level. The

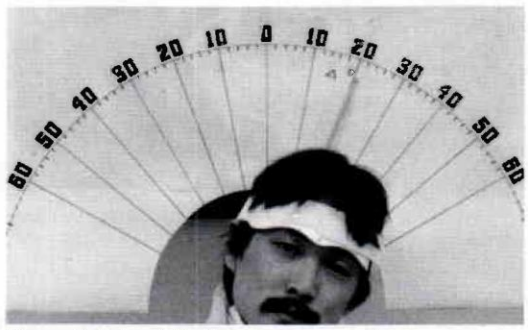


Figure 4. Lateral flexion measurement.

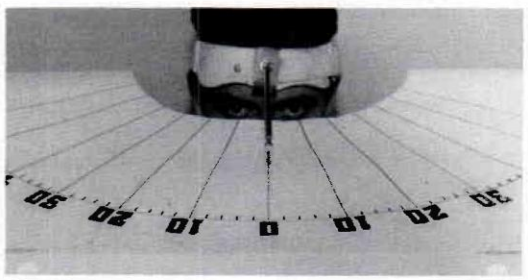
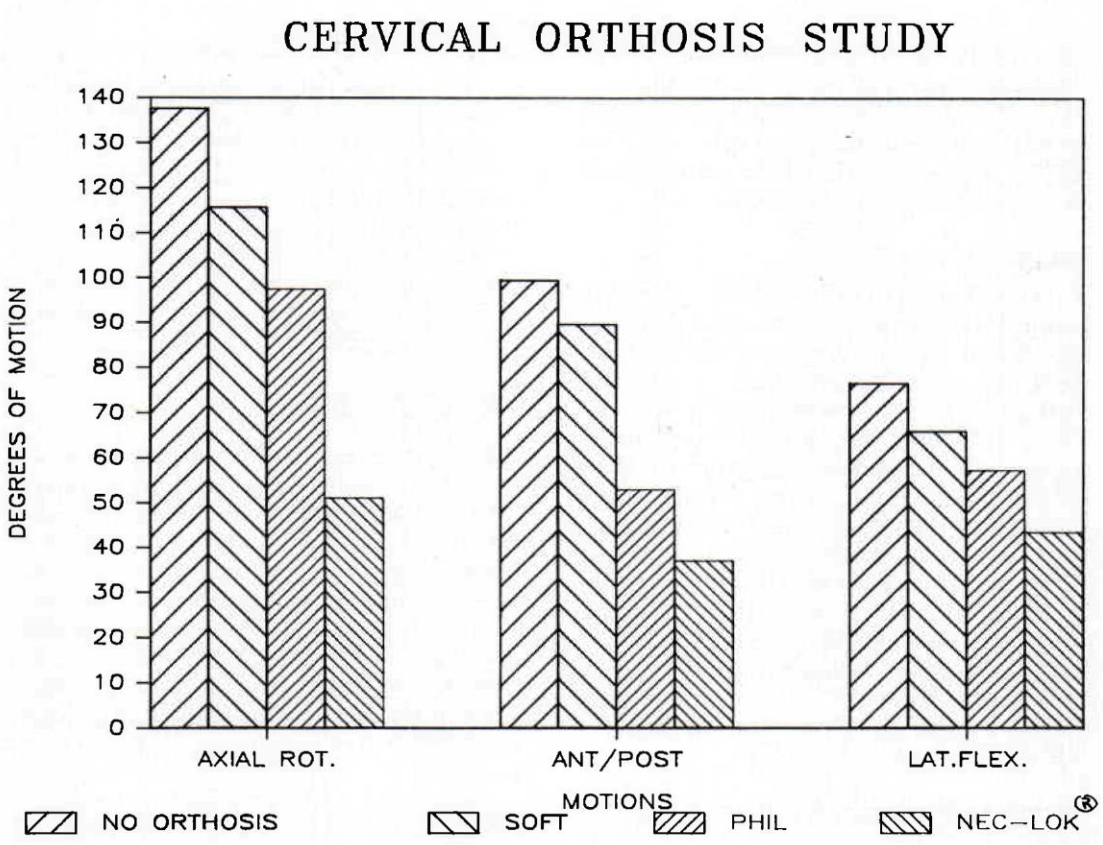


Figure 5. Axial rotation measurement.



Average Angular Arc in Degrees and Percent Restriction of Motion from Unrestrained Normal (N = 10)

	Axial Rot.	%R	Ant./Post.	%R	Lat. Flex.	%R
No Orthosis	137.60 (±10.8)	0.0%	99.53 (±15.7)	0.0%	76.83 (±12.8)	0.0%
Soft Foam Collar	115.70 (±13.9)	15.9%	89.70 (±15.6)	9.9%	66.00 (±11.7)	14.1%
Phil. Collar	97.57 (±20.3)	29.1%	52.97 (±08.3)	46.8%	57.27 (±14.6)	25.5%
NecLok® Collar	51.30 (±17.7)	62.7%	37.07 (±07.0)	62.8%	43.57 (± 9.1)	43.3%

MEAN (±1 sd)
%R + % Restrained Motion

p = Values Sheffe

Orthoses	1-2	1-3	1-4	2-3	2-4	3-4
Axial Rot.	0.0020	0.5000	0.0000	0.0119	0.0000	0.0000
Ant./Post.	N.S.	0.0000	0.0000	0.0000	0.0106	
Lat. Flexion	N.S.	0.0008	0.0000	N.S.	0.0001	0.0239

CODES: 1 = No Orthosis
2 = Soft Collar
3 = Philadelphia Collar
4 = Neclok® Collar

Table 1.

data were summarized by means and standard deviations and compared using Analysis of Variance. The Scheffe' test was used to do the multiple paired comparison. The CRISP Interactive Statistical Package was used for the statistical procedures.[16]

Axial Rotation

Axial rotation in the transverse plane exhibited the greatest difference among the individual treatment modes. The normal axial rotation measurement was 137.6 (±10.8) degrees, unrestrained (Table 1). The Soft Foam collar restricted rotation to 115.7 (±13.9) degrees, resulting in a 15.92 percent restriction from normal. The Philadelphia collar allowed 97.57 (±20.2) degrees of axial rotation, which resulted in a 29.9 percent restriction. The NecLok® collar allowed 51.3 (±17.6) degrees, which resulted in a 62.7 percent restriction. This is twice that of the Philadelphia collar. These initial three measurements indicate a significant difference from one another at $p < .05$ (Table 1).

Anterior/Posterior Motion

The average unrestrained anterior/posterior cervical spine motion computed to 99.53 (±15.7) degrees (Table 1). The Soft Foam collar's restrictive capability measured slightly less than normal with 89.70 (±15.6) degrees of total motion, a 9.88 percent restriction. A sharp drop with the Philadelphia collar was observed with 52.97 (±8.7) degrees, 46.78 percent of normal motion. The NecLock® had the greatest ability to control allowing 37.07 (±7.0) degrees of motion, 62.76 percent of normal motion. All three collars were statistically and significantly different from one another with $p < .05$ (Table 1). The Soft Foam collar did not display a significant difference from the "no treatment" mode.

Lateral Flexion

Lateral flexion measurements revealed the least amount of difference among the four modes of treatment (Table 1). The unrestricted measurements had a mean arc of 76.83 (±12.8) degrees of motion. The Soft Foam collar allowed 66 (±11.7) degrees, or 14.10 percent effective restriction from the normal range. The Philadelphia collar allowed slightly less at 57.27 (±14.6) degrees of motion, a 25.50 percent restriction. The NecLok® averaged 43.57 (±9.1) degrees of total motion, a 43.30 percent restriction. In this plane the Philadelphia and NecLok® collars were significantly different from no orthosis ($p < .01$) while the NecLok® was significantly different from both the Soft Foam and Philadelphia collar ($p < .01$).

DISCUSSION

The orthoses selected for this study are three commonly used cervical orthoses. This study verified other studies that have found cervical collars are less effective in controlling cervical spine motion than the more sophisticated category of cervical orthosis (e.g., SOMI,® Guilford two poster, and halo vest apparatus). However the prevalent application of cervical collars does indicate their importance in treating cases other than severe cervical spine instability.

The Soft Foam collar demonstrated a significant difference over no treatment at all (Figure 6). However, it offered very little immobilization of motion in the three planes which were studied. This collar's major effectiveness is derived through its kinesthetic reminder capabilities to withdraw which are inherently present with wear.

The Philadelphia collar offered substantially better immobilization than did the Soft Foam collar (Figure 6). However, its role in cervical spine immobilization is still considered ineffective. Previous studies have suggested its well accepted tolerance levels rather than its efficacy have gained this collar much popularity. In this particular study, it became apparent that good matching of proper collar size with patient, and proper application during donning, plays an important role in motion restriction effectiveness. Axial rotation immobilization was the most difficult motion to control. This was due to the collar's soft mandibular support, which the subjects of this study could overpower and occasionally extend and

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The NecLok® collar immobilized the cervical spine substantially more than the other two collars (Table 1). It proved to be the superior collar for immobilization in all three planes which were studied (Figure 6). All the subjects perceived the NecLock® to "feel more restrictive" than that of the other two collars. They claimed that it was less comfortable than the Philadelphia collar, yet it was not uncomfortable to wear.

The NecLok® collar has become popular among paramedics because of its advantages over the other cervical collars in its category. The NecLok's® attributes include the following: immobilization characteristics, superior ease of donning (may be applied with patient in any position, without log rolling), simple design, a cut-out for tracheotomy, and it stores flat and compact, minimizing storage problems. In addition it is easy to clean, comes in three prefabricated sizes, and the price is less than that of the Philadelphia collar.[10]

This study demonstrates the value of objectively evaluating new collars (cervical restraints) as they are made available to the consumer to aid in the selection process.

AUTHORS

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REFERENCES

[1]Berger N., Lusskin R., "Prescription Principles," *Atlas of Orthotics*, St. Louis, Mosby Co., 1975, pp. 370–372.

[2]Rubin, G. et. al., "Emergency Cervical Orthosis," *Bulletin of Prosthetics Research*, Spring, 1978, pp. 51–64.

[3]N.Y.U. Staff, *Cervical Orthoses, Teaching Manual*, Prosthetics and Orthotics, New York University Post Graduate Medical School, pp. 413-A, B, C, 204-G.

[4]Hartman, J.T. et. al.: "Cineradiography of the Braced Normal Spine, a Comparative Study of Five Commonly Used Cervical Orthoses," *Clinical Orthopedics*, October, 1975, pp. 97–102.

[5]Fisher, S. et. al., "Cervical Orthoses Effect on Cervical Spine Motion: Roentgenographic and Goniometric Method of Study," *Archives of Physical Medicine and Rehabilitation*, 58/7 March, 1977, pp. 109–115.

[6]Johnson, R.M., et. al., *Cervical Orthoses, a Study Comparing Their Effectiveness in Restricting Cervical Motion in Normal Subjects*, 59-A, 3, April, 1977, pp. 332–339.

[7]Fisher, S., "Proper Fitting of Cervical Orthosis," *Archives of Physical Medicine and Rehabilitation*, 59, November, 1978, pp. 505–507.

[8]Edmonson, A., "Spinal Orthotics," *Orthotics and Prosthetics*, Vol. 31, No. 4, December, 1977, pp. 31–42.

[9]Schoenwald, I., Scott, R., and Lance, L., "Orthotists and Prosthetists: Issues in a Developing Profession," *Orthotics and Prosthetics*, Vol. 37, No. 3, Fall, 1983, pp. 74–77.

[10]Garman, D.; Broughton, R., *Extrication Collar Study Lab Report*, State of Indiana Emergency Medical Services Commission, July 6, 1984.

[11]Kottke, F.; Mundale, M., "Range of Mobility of the Cervical Spine," *Archives of Physical Medicine and Rehabilitation*, September, 1959, pp. 379–382.

Appendix A
Motion Restriction
No Orthosis Measured in Degrees Representing 100%
Cervical Collars in Percentage (%) From No Orthosis

Axial Rotation

Subject #	1	2	3	4	5	6	7	8	9	10
No Orth.	142.3	131.7	126.7	125.3	154.0	133.3	129*	156.7	135.7	140.7
Soft	18.0%	23.0%	23.4%	5.2%	18.4%	9.2%	19.6%	9.4%	22.6%	10.4%
Phil.	21.0%	30.0%	63.7%	16.0%	31.6%	29.5%	27.5%	38.0%	19.0%	15.2%
NecLok®	60.0%	77.4%	83.2%	48.4%	64.3%	70.7%	64.5%	66.4%	43.5%	49.5

Anterior/Posterior

Subject #	1	2	3	4	5	6	7	8	9	10
No Orth.	119.3	78.0	110.7	81.0	121.7	97.0	98.0	82.7	110.0	97.0
Soft	32.7%	0	17.2%	30.5%	15.4%	0	0.3%	1.7%	5.7%	0
Phil.	56.2%	54.2%	61.8%	34.2%	50.5%	38.5%	48.3%	27.0%	48.8%	39.5%
NecLok®	68.4%	67.9%	73.5%	65.1%	68.0%	53.9%	55.4%	49.6%	61.2%	60.1%

Lateral Flexion

Subject #	1	2	3	4	5	6	7	8	9	10
No Orth.	87.7	74.7	90.3	55.7	87.7	56.7	69.0	87.7	76.7	82.3
Soft	25.5%	0.5%	34.3%	10.2%	0	13.0%	7.2%	21.3%	12.2%	10.9%
Phil.	30.1%	2.3%	74.5%	19.2%	24.4%	6.5%	8.7%	23.3%	29.2%	19.4%
NecLok®	48.3%	29.5%	72.3%	26.4%	45.6%	65.8%	45.4%	51.8%	34.8%	31.1%

Figure 6.

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A Breath Activated Switching Mechanism for the Electric Powered Prehension Orthosis: Design and Fabrication

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INTRODUCTION

A person with quadriplegia, paralysis of all four limbs caused by lesions at high levels of the spinal cord, has extremely complex needs for rehabilitation care. Quadriplegia has a devastating effect on a person's entire life. Even after successful rehabilitation, the formerly independent person intermittently requires the help of an attendant for many activities of daily living and activities required for gainful employment or for attending school.

Because attendant care is the single greatest cost of living, exceeding even medical cost, for a person with quadriplegia,[9] any intervention that improves independent function of a person with quadriplegia enough to reduce this need for attendant care should be investigated.[2,3,5] Furthermore, if a device can allow a quadriplegic person to be gainfully employed, the cost to the individual and to society would be further reduced and the person with quadriplegia could be much more self-reliant.

Our early experience indicates that the use of a Breath Activated Switching Mechanism (B.A.S.M.), rather than the switching mechanisms that are now available, may improve the ability of quadriplegic persons to use the electric powered prehension orthoses that are already available. Furthermore, the extent of this improvement may be significant enough to reduce the need for attendant care and to improve the outlook for gainful employment.

Certain types of adaptive aides have been used to substitute for hand function. Some quadriplegic persons have received automated devices, such as environmental control units[8] (ECU) that provide some measure of independence in such activities as the turning on and off of lights and appliances and answering the telephone (Figure 1). While E.C.U.s provide much assistance to the home bound quadriplegic person, they cannot be moved from place to place. The user requires attendant care for most activities outside the home. Furthermore, automated devices do not give the user the personal satisfaction of using the hand in a "normal way."

Mouthsticks have been used to extend the functional independence of those with

Figure 1. Environmental control units (ECU) provide some measurement of independence, such as the turning on and off of lights and appliances and answering the telephone.

the most severe paralysis of the upper extremities.[4] However, they do not permit independence from an attendant and are often poorly accepted by patients who have enough upper extremity strength to move their hands about.

Most people with quadriplegia retain some use of the upper extremities. The person with C-5 level quadriplegia (in this paper, the level of lesion is named by the lowest normally functioning spinal segmental level), the most common level of traumatic quadriplegia, is left with no function in the wrist and hand complex, but has preservation of flexion at the elbow and some ability to elevate and move the shoulder joint. This person can move the hand to different positions in space; but has no grasp-release function of the hand. Some C-4 level quadriplegic persons have enough strength of the shoulder girdle and elbow to move the hand about; but, like the C-5 quadriplegic person, they also have no grasp-release function of the wrist or hand. Many persons with C-6 level quadriplegia, the next most common level, have insufficient wrist extension power to be able to use a wrist driven finger prehension orthosis[6] (Figure 2).

Most of the people will be fitted with a static orthosis (Figure 3). A static orthosis, when properly designed and fitted, will

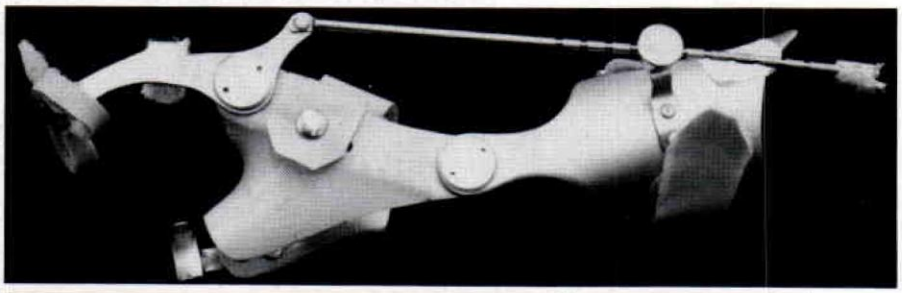


Figure 2. The wrist-driven finger prehension orthosis.

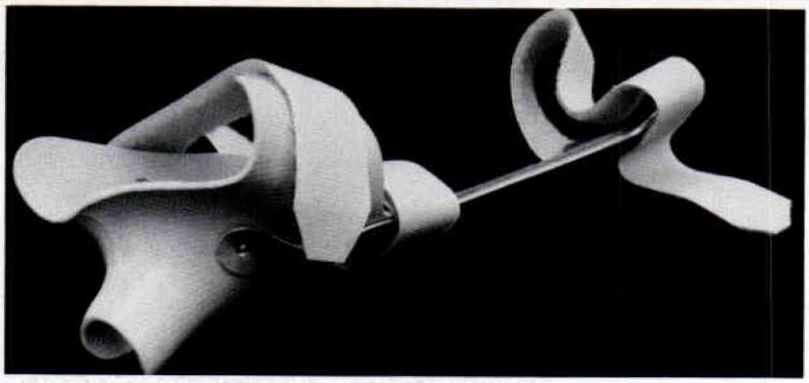


Figure 3. A static orthosis.

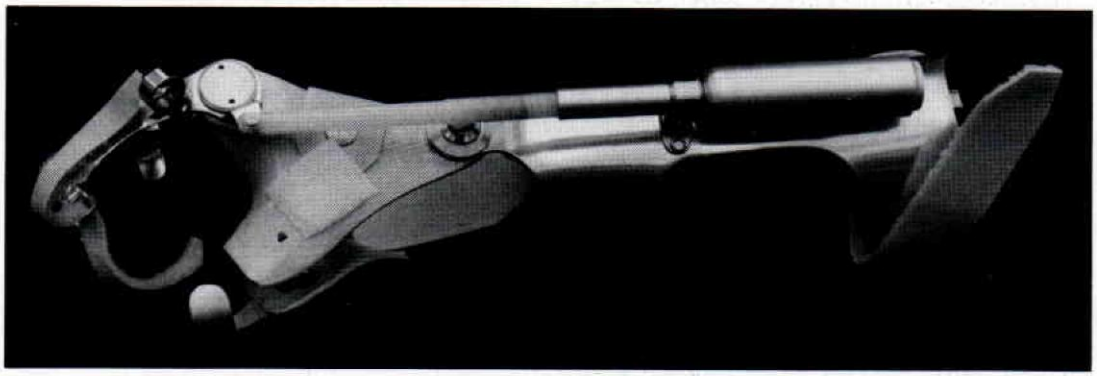


Figure 4. An electric powered prehension orthosis (EPPO) that provides a three-jaw type finger prehension.

allow the user to do some activities of daily living (ADL).

However, it is impossible for the user to accomplish many of these tasks, or to switch from one activity to another, without the assistance of another person.

If prehension and release could be provided to a quadriplegic person who is able to move his or her hand to different positions in space, most of the functional tasks needed for employment at a desk job, performing school work, activities of daily living, and participating in social activities could be accomplished without any need for an attendant. A few people have been fitted with an electric powered prehension orthosis (E.P.P.O.)[7] that provides a "three-jaw-chuck" type finger prehension (Figure 4). The E.P.P.O. has been perhaps the most promising development to improve function for quadriplegic persons who are appropriate candidates. However, the usefulness of the E.P.P.O.has been limited by the awkwardness of the switching mechanisms normally supplied with these orthoses. These mechanisms are normally pull or butterfly-type switches that are operated by movements of the shoulders or the contralateral limb, respectively (Figure 5).

Many users cannot achieve a good functional result with an E.P.P.O. because these switches do not allow them to fully concentrate on the task at hand. The major problems associated with these switching mechanisms are due to the users' impaired sensation, as well as their limited and

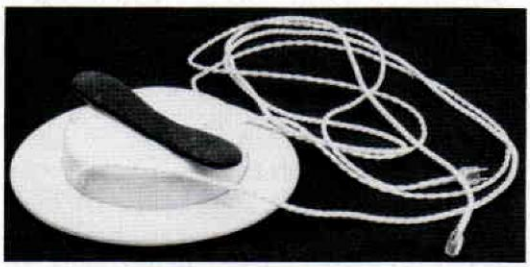


Figure 5. A butterfly switch operated by movements of the shoulders or the contralateral limb, respectively.

poorly controlled movements. The butterfly switch can be especially difficult to use when visual input is the only available position sense. The user must constantly shift his/her attention from the task at hand to the operation of the switch by the other arm (assuming a functional contralateral limb).[6] The pull-type switch requires the user to have very finely coordinated movement because the three modes—open, close, and off—are in close sequence. Lack of fine control or maladjustment may cause the orthosis to react improperly.

Many attempts have been made to solve such switching problems, because these problems can make the simplest task frustrating, unnecessarily fatiguing, or impossible. A switching problem can make the difference between acceptance and rejection of an otherwise functional orthosis. For example, as far back as the early 1950's, surface E.M.G. electrodes have been used to operate switches on orthoses and pros-

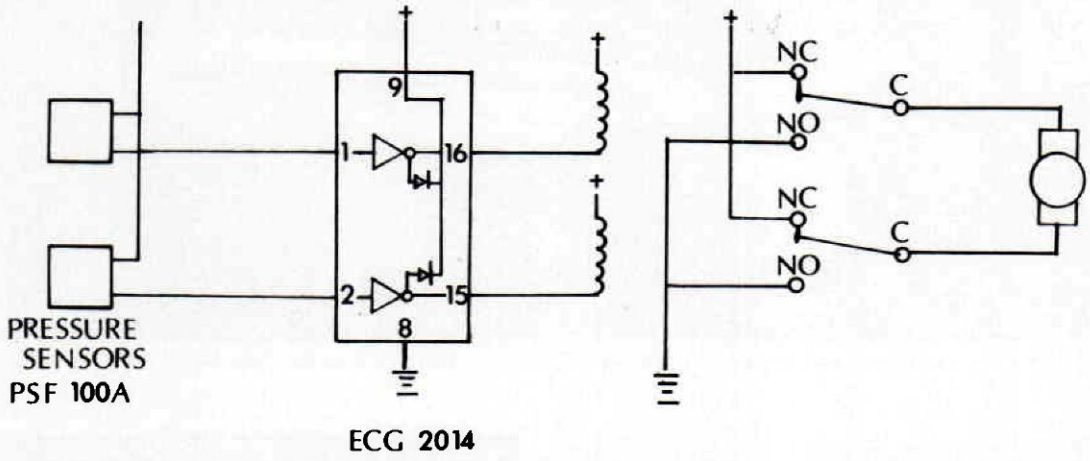


Figure 6. A schematic diagram for an interface control for a "breath activated switching mechanism" using two Fairchild Ultralow differential pressure sensors, Basic Model PSF 100 A, manufactured by Dumont.

theses.[1] However, because of problems in locating appropriate placement sites and problems with attaching the electrodes, this means of operation has achieved only limited success in practical clinical settings.

The Rehab Engineering Institute (R.E.I.) at The University of Texas Health Science Center at San Antonio (U.T.H. S.C.S.A.) became interested in another approach to the switching problem for externally powered upper extremity prostheses while conducting an evaluation procedure for a male quadriplegic patient. His neurologic level for motor and sensory function was C-5 spared on the right and C-4 on the left. The person had been fitted previously with an E.P.P.O. However, he was not able to operate the butterfly switch and consequently was not using his orthosis. One of the team members suggested that a "sip and puff" switching mechanism might be a way for this person to effectively use his orthosis. This system proved to be so clearly superior to other switching mechanisms that it has now become a standard part of all E.P.P.O.s fabricated in our center.

DESIGN AND DEVELOPMENT OF THE BREATH ACTIVATED SWITCHING MECHANISM (B.A.S.M.)

After consulting rehabilitation engineers and trying out several designs, a schematic diagram for an interface control was drawn up for a "breath activated switching mechanism" using two Fairchild Ultralow differential pressure sensors, Basic Model PSF 100A, manufactured by Dumont (Figure 7). This switch senses as little as .002 PSI of air pressure (Figure 8).

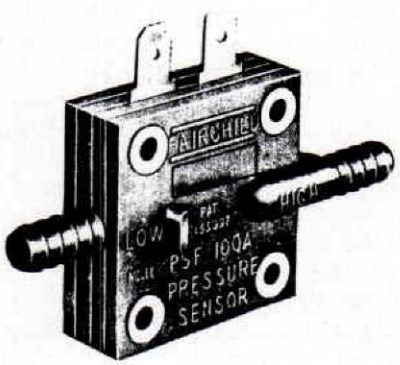
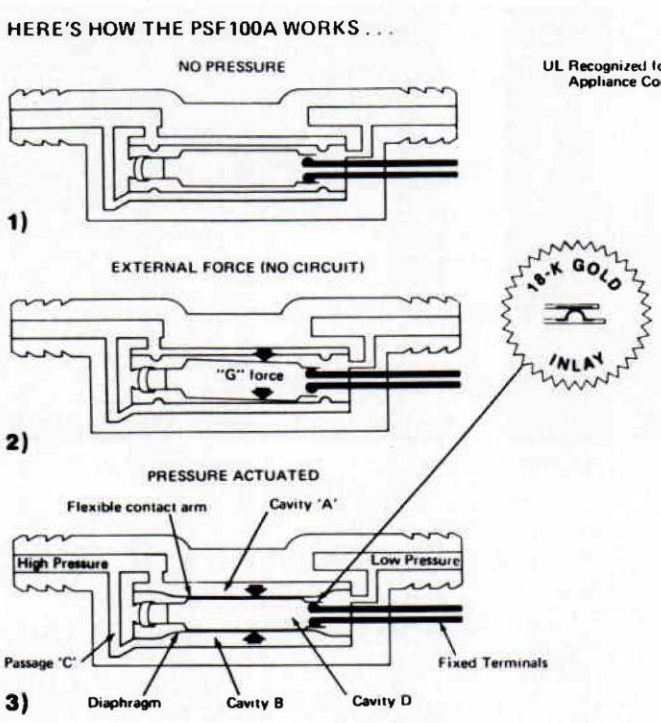


Figure 8. (right) The switch senses as little as .002 PSI of air pressure.



With no differential pressure applied, the diaphragms do not exert a force on the moveable contacts (see Diagram 1). An external force may cause one contact to close, however, the other contact moves in parallel and remains open (see Diagram 2). There is still no circuit closure. With pressure applied (see Diagram 3), air enters at the high pressure inlet port and is routed directly to Cavity A and through the manifold (C) to Cavity B. The applied pressure actuates the diaphragms inward, deflects the flexible contacts, and completes the circuit.

The following information is taken by permission from Dumont's printed form #PSF 782/37371PO.

SPECIFICATION:

Mechanical

Switch Type—SPST, Normally Open, Double Break
Switching Medium—Air
Actuation Pressure—Refer to table of standard actuation ranges for PSF 100A models
Proof Pressure—PSF 100A 100A-1.5, PSF 100A-3 8 PSIG, "C" Series 15 PSIG
Mechanical Life—More than 10 million cycles
Weight—Less than 10 grams
Shock and Vibration—At zero or above actuation pressure, will not make or break at 50G's shock. Will not make or break at 10G's shock, 50 to 2000 Hz vibration.

Physical

Mounting—Eyeletted for No. 2 screws
Case Material—Polycarbonate
Contact Materials—Gold inlay on phospher bronze
Electrical Connections—Terminals—$^{3}/_{16}$" male tab-type, for use with $^{3}/_{16}$" female quick disconnects (ref. AMP 60972 2LP or equivalent)
Pressure Ports—Two $^{3}/_{16}$" diameter barbed ports for use with $^{5}/_{32}$" ID tubing. Suggested materials: Silicone, Neoprene, Polyurethane

Electrical

Current Rating—10 MA, resistive, DC norminal
Operating Voltage—AC/DC 30V or less with resistive load, 120 VAC neon lamp load (Use with SRF 100B Solid State Relay for higher loads).

A prototype B.A.S.M. was fabricated using two (2) PSF 100A sensors, one (1) RCA integrated circuit #SK-9094-2014 Darlington Array, CMOS/POMS interface, and two (2) Archer's subminiature PC relays #275-243. These were attached to a basic integrated circuit board (Figure 10).

*Schematic by Calvin P. Franke, Engineering Technician III, Department of Physiology, The University of Texas Health Science Center at San Antonio.

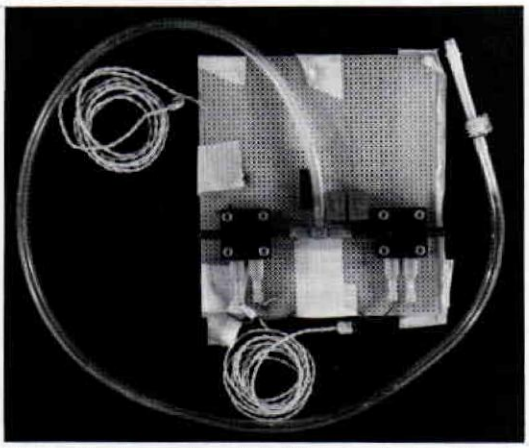


Figure 10. A prototype B.A.S.M. attached to a basic integrated circuit board.

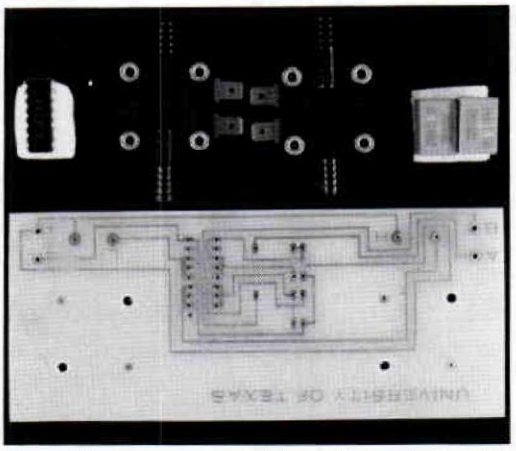


Figure 11. A custom printed board is now in use. No failures have occurred.

The B.A.S.M. was connected to the E.P.P.O. and fitted for use. The only problem with this B.A.S.M. was occasional failure of the hand wired integrated circuit boards due to faulty soldering techniques. The wired circuit board has been replaced with a custom printed board, which is now in use in nine E.P.P.O.s. No failures have occurred since the printed circuit boards were introduced (Figure 11).

FABRICATION OF THE BREATH ACTIVATED SWITCHING MECHANISM

This section consists of detailed instructions for fabrication of a breath activated switching mechanism.

A) Attach the two (2) PSF 100A sensors, one (1) RCA integrated circuit #SK-9094-2014, and two (2) Archer subminiature relays #275-243 to the printed circuit board** as shown in Figure 12.

B) After the components are attached to the circuit board, the following parts are

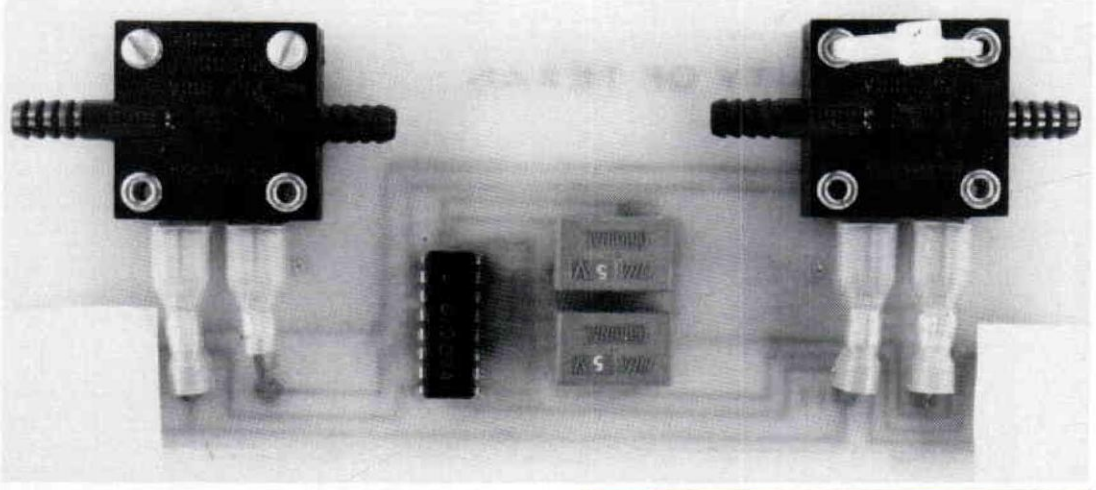


Figure 12.

**Available on request from UTHSCSA for $50.

used to adapt the B.A.S.M. to the E.P.P.O.:

1. Two pieces 5/32" transparent plastic tubing 5cm. long.
2. One piece 5/32" transparent plastic tubing 90cm. long.
3. One piece "T" connector 5/32".

(Note: The above items are available at many pet stores.)

4. One piece 5cm. wide cotton webbing about 30cm. long.
5. One piece 5cm. wide hook and adhesive-backed loop Velcro® about 5cm. long.
6. One piece 1/2" adhesive-backed loop Velcro® 5cm. long.
7. One piece 1/2" adhesive-backed hook Velcro® 5cm. long.

(Note: The above items are available at PEL Supply Company, 4666 Manufacturing Road, Cleveland, Ohio 44135.)

8. One set E.P.P.O. connector wires.
9. Battery pack for E.P.P.O.

(Note: The above items are available from Orthotic Systems, Inc., P.O. Box 20262, Houston, Texas 77025.)

10. One plastic pipette tip (available through many surgical supply houses).
11. Experimenter Box, CAT #270-232 (available at many Radio Shack stores).
12. Two 4/40 machine screws 1" long with nuts attached.

The assembly of the B.A.S.M./E.P.P.O. is shown in Illustrations A-M. Item numbers in instructions refer to items in the above list.

The B.A.S.M. can easily be adapted for use with any externally powered orthosis or prosthesis that operates on a 6-volt system. It can be adapted to operate a 12-volt system by substituting 12-volt relays and integrated circuits.

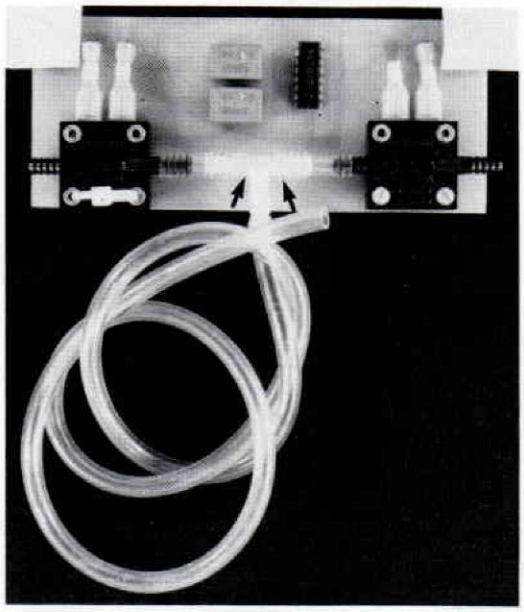
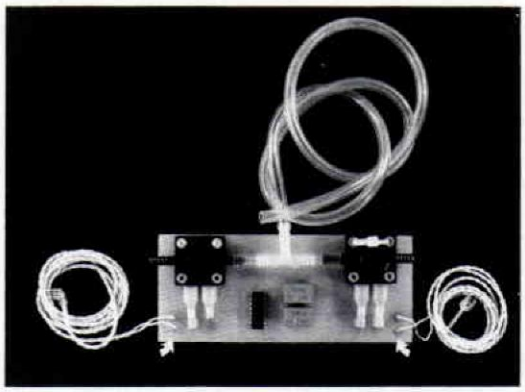


Figure 12-A. Attach Items #1, 2, 3 to pressure sensors.



Fgure 12-B. Attach Item #8 (battery and orthosis connector wires) to printed circuit board.

PRECAUTIONS

A few precautions must be taken by users of the B.A.S.M. The B.A.S.M. will not operate properly if the pressure introduced through the air hose to the sensors is not expelled. Expelling the air volume is easily accomplished by:

1. Removing the tube from the mouth; or
2. Removing the tube from the "T" connector.

Care must be taken to eliminate saliva and food particles from the tube to prevent its interferring with open parts of the sensors which must not be blocked. Special attention must be given to this precaution when the B.A.S.M./E.P.P.O. is used for eating activities. Simple, common sense

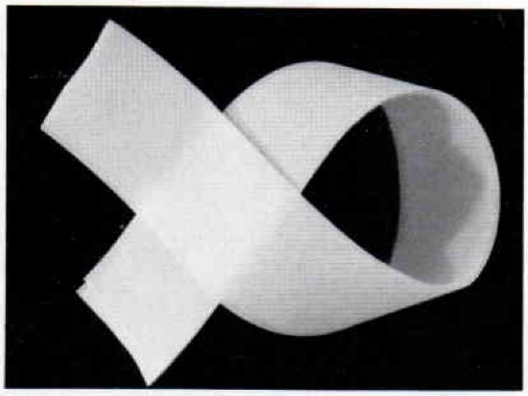


Figure 12-C. Using Items #4 and #5, make arm band.

practices such as swallowing drinks, food, or saliva prior to activation of the switch should protect the switch and should not interfere with activities.

RESULTS

Although formalized clinical evaluation using an evaluation protocol which we have developed is still underway, informal observations reveal a clear superiority of the B.A.S.M. over other switching mechanisms we have tried for the E.P.P.O. The B.A.S.M./E.P.P.O., by offering the patient some direct use of his hands,

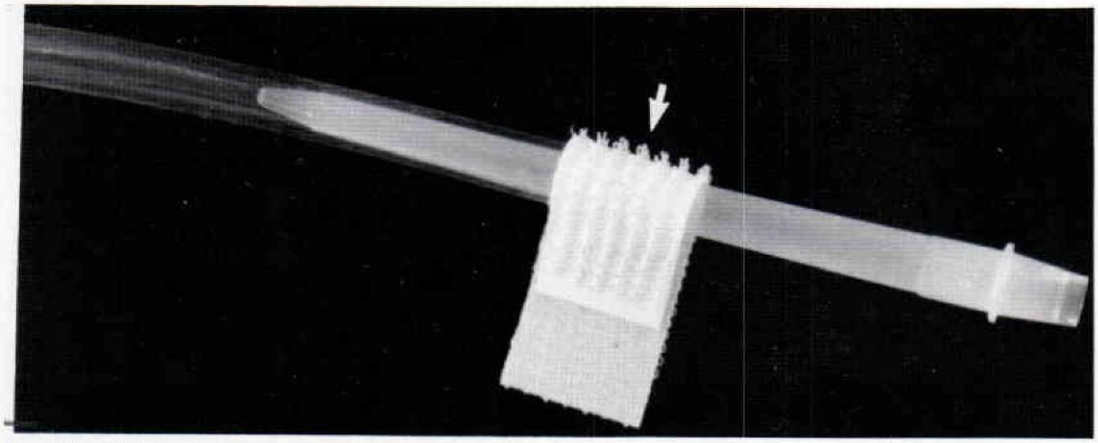


Figure 12-D. Take Item #6 and place on E.P.P.O. as shown above.

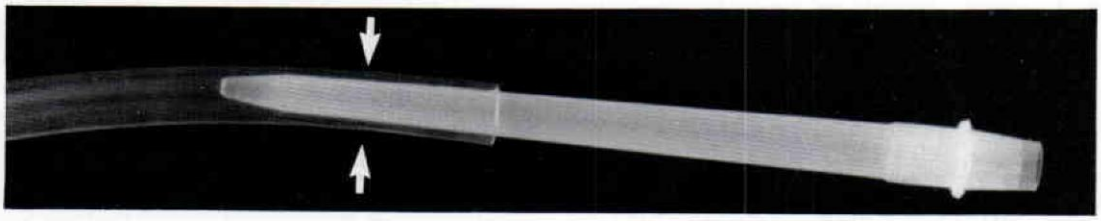


Figure 12-E. Take Item #10 and place small end of tip into the end of $^{5}/_{32}$" transparent tube (Item #2).

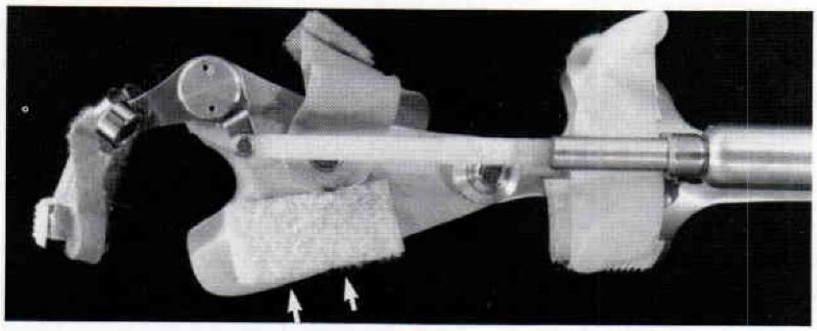


Figure 12-F. Take Item #7 and wrap around the transparent tube (Item #2) where it joins the tip.

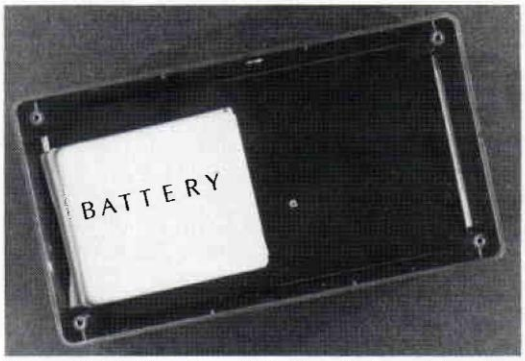


Figure 12-G. Place Item #9 in Item #11, mark location of battery charger plug and battery connector wire plug.

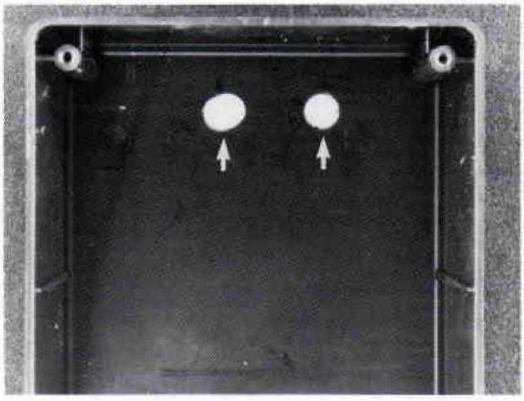


Figure 12-H. Use a 3/8" H.S. drill to drill a hole for plugs.

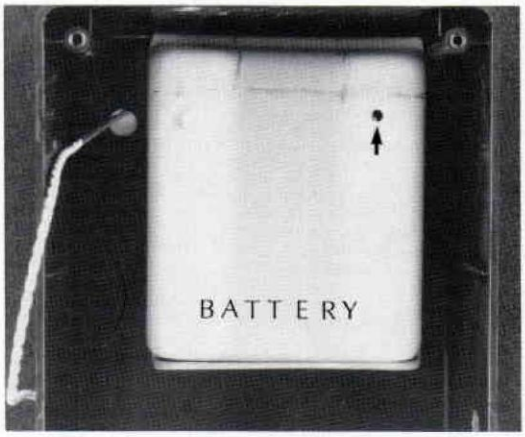


Figure 12-I. Attach Item #9 to Item #11 by drilling a 1/8" hole as shown and inserting item #12.

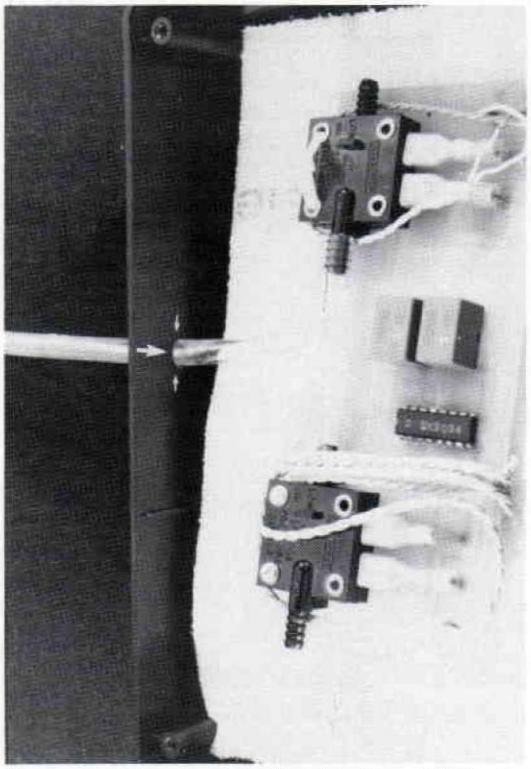


Figure 12-J. Place the B.A.S.M. into Item #11, locate the position for the 5/32" transparent tube, mark and drill with a 9/32" H.S. drill.

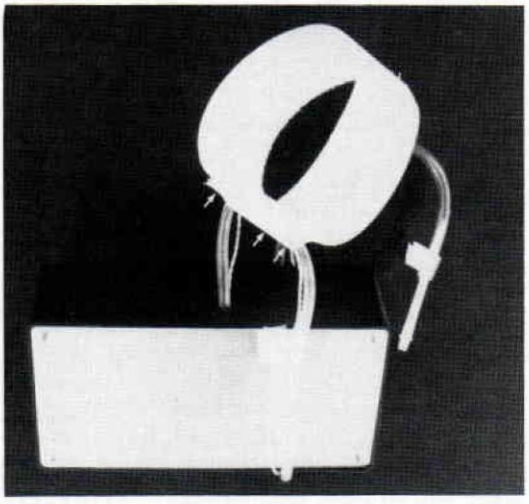


Figure 12-K. Replace the bottom to Item #11, attach the arm band to the transparent tube and orthosis wire connector as shown.

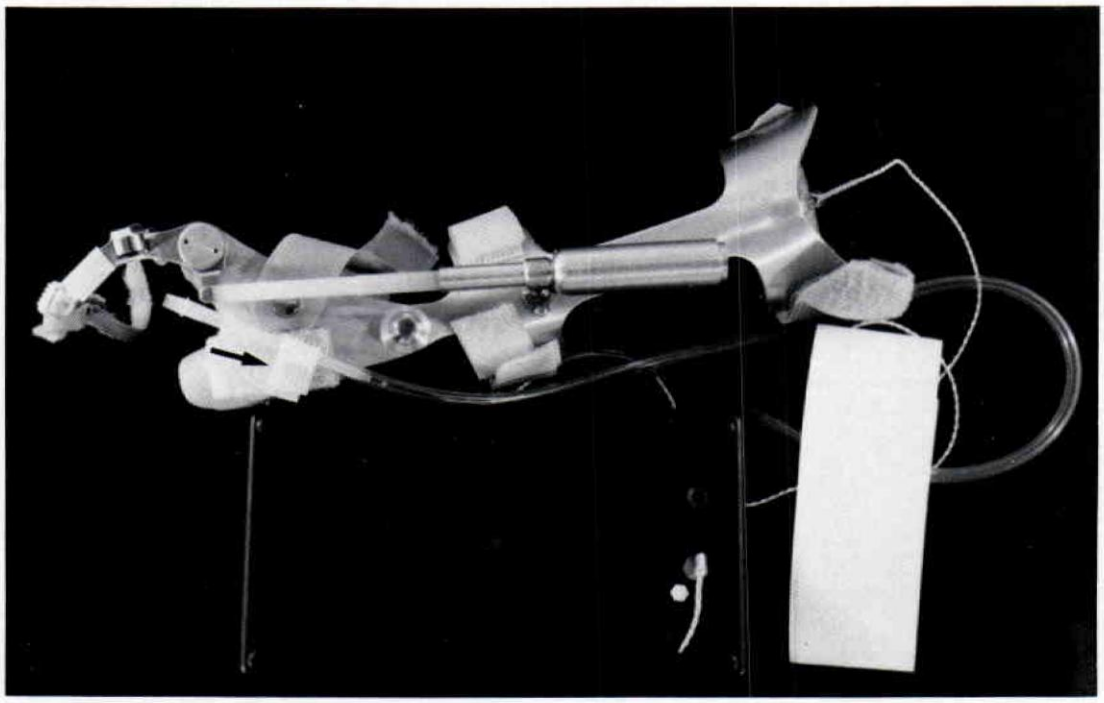


Figure 12-L. The assembled B.A.S.M./E.P.P.O.

seems to encourage the patient's participation in strengthening functions (e.g., shoulder and elbow movement) that have been spared.

The B.A.S.M. is much easier for patients to learn to use than are the other switching mechanisms. Although rehabilitative training is still important to assure optimal function and acceptance,[5,6] most of our patients have been able to operate the orthosis without difficulty after only one training session. The ease of use seems to encourage patients to try new tasks on their own with their new orthosis, for example, eating fragile finger foods such as potato chips or sandwiches.

One of the primary objectives has been to reduce the need for attendant care. It remains to be formally determined whether this objective can be achieved to a sufficient extent that it will improve the patient's abilities to attend school or engage in gainful employment. However, our patients agree that their need to request help from others has been reduced.

CONCLUSIONS

A B.A.S.M. can be simply and economically adapted for use with the E.P.P.O. to provide quadriplegic persons with easily controlled finger prehension. Operation of the B.A.S.M. does not require the muscle effort, proprioception, use of contralateral limbs or extensive training that are necessary for the use of other switching systems available for E.P.P.O. use. Therefore, the B.A.S.M. should be a useful tool to provide early restoration of independent function to certain quadriplegic persons.

ACKNOWLEDGMENTS

Special thanks to my secretary, Estella S. Rodriguez, for her time and help on this project.

Photography done by Cono Farias, Photographic Technician II, Radiology Department, The University of Texas Health Science Center at San Antonio.

REFERENCES

[1]Battye, C.K., Nightingale, A., and Whillis, J., "The Use of Myoelectric Current in the Operation of Prostheses," *J Bone and Jt Surg*, 37B:8, pg. 506–510, August, 1955.

[2]Redbrook, G.M., "Spinal Injuries with Tetreplegia and Paraplegia," *J Bone and Jt Surg*, 61B:267–284.

[3]Burtzke, J.R., "Epidemiology of Spinal Cord Injury," *Exptl Neurol*, 48:163–236, 1975.

[4]Currie, D.M., Delahunty, D., McFarland, S., and Locke, R., "Mouthstick Systems for High Quadriplegic Patients" submitted to the American Academy of Physical Medicine and Rehabilitation, July, 1983.

[5]Efthimiou, J., Gordon, W.A., Sell, G.H., and Stratford, C., "Electronic Assistive Devices: Their Impact on the Quality of Life of High Level Quadriplegic Persons," *Arch Phys Med Rehab*, 62:131–134, 1981.

[6]Engen, E.J., "Development of Upper Extremity Orthotics," *Orthotics and Prosthetics*, Vol. 24, Nos. 1 and 2, March and June, 1970, pg. 6.

[7]Orthotic Systems, Incorporation, P.O. Box 20262, Houston, Texas 77025.

[8]Prentke Romich Company, 8169 TWP Road, #513, Shreve, Ohio 44676.

[9]Young, J.S., Burns, P.E., and Wilt, G.A., "Medical Charges Incurred by the Spinal Cord Injuries During the First Six Years Following Injury," *Spinal Cord Injuries*, August, 1982, pg. 122–137.

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Orthotics and Prosthetics, Vol. 39, No. 4, pp. 40–43..

An Adjustable Writing Device for Use with a Definitive Wrist Hand Orthosis

Glenn E. Hedman, B.S.B.E., M.E.M.E.
Audrey M. Yasukawa, M.O.T., O.T.R./L.

INTRODUCTION

Writing independently is a valuable and intrinsically rewarding skill which may be necessary to improve a patient's potential for returning to school or employment. A patient with a spinal cord injury may display total or partial loss of function depending on the level of injury to the cord. He/she may lack the strength and fine manipulation skills required for doing tabletop activities such as writing, which is crucial in a vocational, avocational, or school setting.

To promote function for desk skills, a patient may use an orthotic device. Various definitive wrist hand orthoses are available to provide, augment, or substitute for grasp. Many have either a spring loop to hold a pen near the metacarpophalangel joint or a slot in which a writing device can be inserted and a pen attached with a thumb screw. There are also many commercially available writing devices or specially adapted devices that may be fabricated by an occupational therapist.

Many of the writing devices available have the disadvantage of having a permanent angle to the pen holder, and the need for assistance of another individual to change the writing tips for the user. For this purpose, an adjustable writing device has been designed to facilitate independence in changing a variety of tips (e.g. pen, pencil, eraser, crayon, etc.). In addition, the angle of the writing device can be adjusted with an allen wrench.

Some of the components needed for the adjustable writing device can be purchased commercially as a kit. This set-up is similar to the modular mouthstick system which was developed by the Northwestern University Rehabilitation Engineering Program and Rehabilitation Institute of Chicago Occupational Therapy department.[1] The commercially available kit includes: an arrowshaft with a distal round head screw; four appliance holders; an allen wrench; and an aluminum bracket attached to an adjustable camera clamp.

FABRICATION

The materials needed to fabricate the adjustable writing orthosis are as follows:

(1) control rod end
⅜"—24 male thread
⅜" inside diameter
(1) ⅜"—24 hex nut
(1) standard orthoses tab
(3) 8-32 × ⅛" set screws
(1) modular mouthstick kit
Loctite RC/609

Fabrication of the adjustable writing orthoses requires only tools normally found in an orthotics laboratory.

- In order to be able to lock the angle of the writing orthosis, two set screws need to be installed in the control rod end. Two holes, located 90° with respect to one another, are drilled and tapped for an 8-32 thread (Figure 1). The raceway of the control rod end needs to be repositioned during the drilling and threading procedure to allow access.
- The thread length of the control rod end is cut from 1¼" to ⅛" (Figure 2). This will lighten the device, yet still enable it to attach to the orthosis tab's hex nut. The remaining threaded shank is then bored longitudinally using a #1 drill to further decrease the weight.
- A ⅜"—24 hex nut is brazed at the end of a standard orthosis tab (Figure 3). This component forms the interface between the orthosis and the control rod end.
- The remaining portion of the control rod end's ⅜"—24 threaded shaft is inserted into the ⅜"—24 hex nut and fixed in position parallel to the orthosis tab by Loctite RC/609 fastener (Figure 3).
- An appliance tip and fiberglass arrowshaft from the modular mouthstick kit are now used to give the system its interchangeability. An appliance tip is cut along its central groove at the inside edge of the collar containing the set screw (Figure 4). The shortened appliance tip is pressed into the raceway of the control rod end with the collar positioned above.

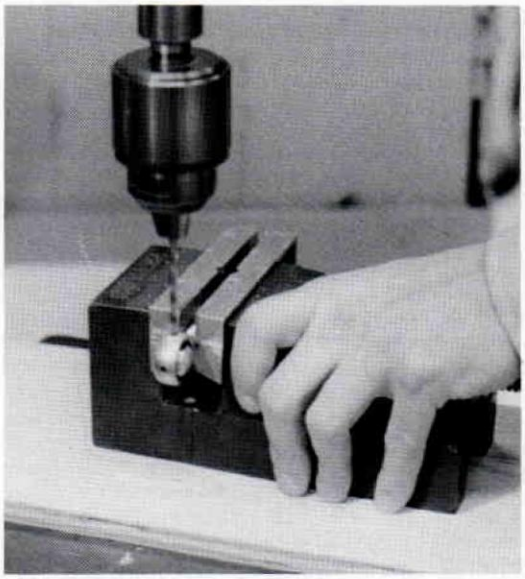

Figure 1. Drill and tap for 8-32 thread

Figure 2. Trim the control rod end.

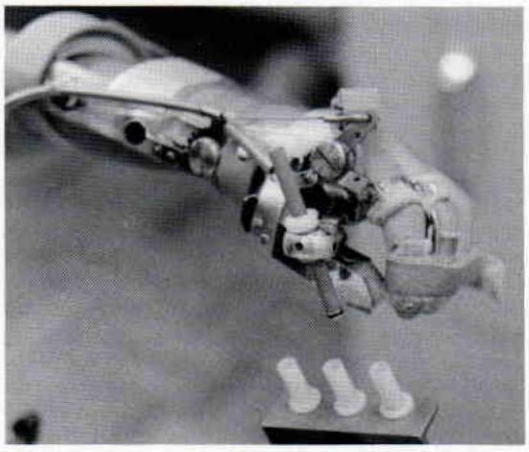

Figure 3. Control rod end, hex nut, and orthosis tab.

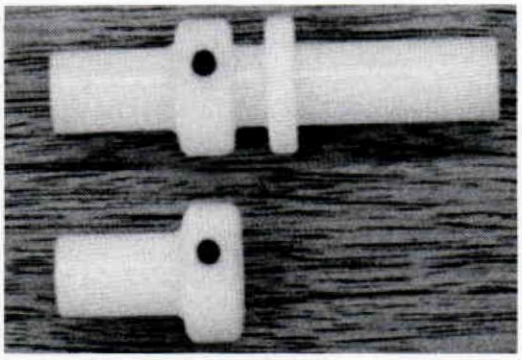

Figure 4. A trimmed appliance tip.

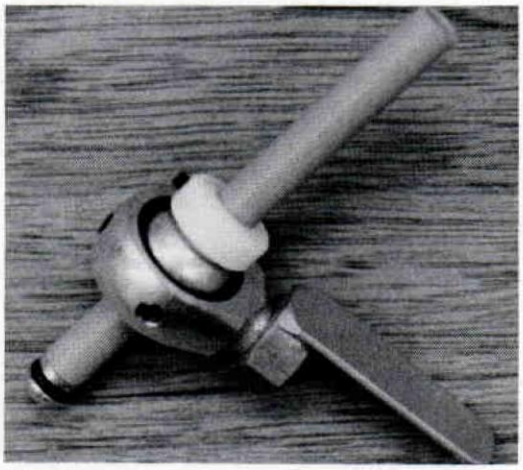

Figure 5. Adjustable writing device ready for insertion into slot of a definitive wrist hand orthosis.

A 3″ length of fiberglass arrowshaft is cut from the end containing the round head machine screw and locking O-ring. The arrowshaft is inserted into the shortened appliance tip's end. The position of the arrowshaft should be locked using the appliance tip's existing 4-40 × ¼″ set screw. The assembly is now ready to accept other tips from the modular mouthstick system (Figure 5). The weight of the device is approximately two ounces.

- The other appliance tips from the modular mouthstick kit should now be set with the desired instruments (e.g. pencil, pen, eraser end, paint brush, etc.). In all cases, the instrument's overall length needs to be cut down to approximately 2¼″. In some cases, the portion of the instrument's diameter which is to be inserted into the appliance tip will need to be reduced. The appliance tips are then ready to be positioned in the kit's stand. The stand can be mounted to the patient's wheelchair or work station and holds the tips when not in use (Figure 6).
- Once the system is set up, the optimum angle of use can be easily found and secured by using the 8-32 × ⅛″ set screws (Figure 7).

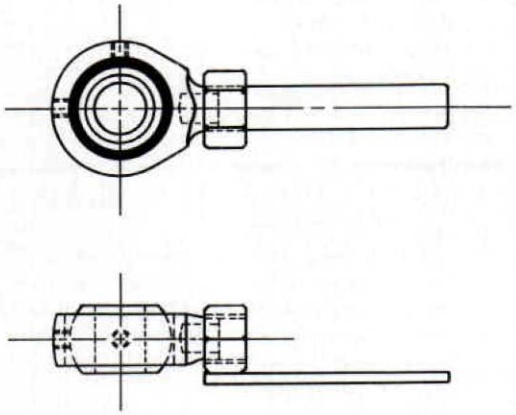

Figure 6. Completed kit stand mounted on work station.

SUMMARY

Through the use of this writing device and set-up, the therapist is able to evaluate and modify the angle of the writing device with the patient. This will eliminate the need for an involved initial angle determination or subsequent modifications by the orthotist. The patient may also prefer a different angle for different activities. In addition, the patient may choose, according to his needs, the various tips necessary to perform functional tasks. By providing

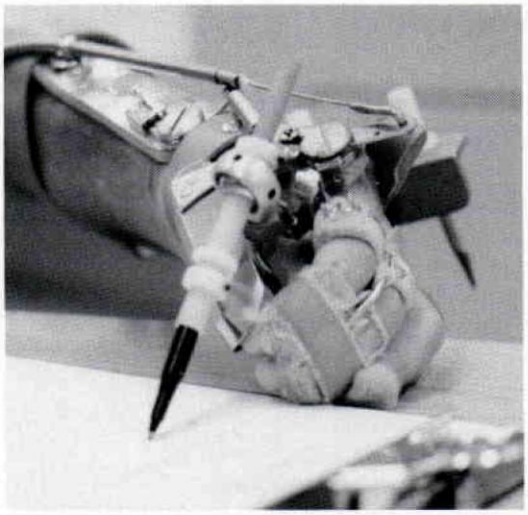

Figure 7. Completed components of adjustable writing device.

this device and set-up, the patient can independently change his tips for painting, writing, operating a typewriter, telephone, calculator, etc. For a school age child, the importance of coloring and changing different crayons is a vital and important developmental process.

With creative problem solving by both the therapist and patient, the set-up may have potential for use with other diagnoses, such as muscular dystrophy and arthrogryposis, or as a temporary device for patients awaiting a definitive prosthesis.

AUTHORS

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Audrey M. Yasukawa, M.O.T., O.T.R./L., is Clinical Supervisor in the Occupational Therapy Department of the Rehabilitation Institute of Chicago, 345 E. Superior, Room 1045, Chicago, Illinois 60611.

REFERENCES

[1]Kozole, K., Gordon, R., and Mycoff-Schultz, J., "A Modular Mouthstick System," *Proceedings of the Fifth Annual Conference on Rehabilitation Engineering*, 1982.

SUPPLIERS

Mouthstick Kit

Therafin Corporation
3800 S Union Ave.
Steger, Illinois 60475
(312) 755-1535
"Mouthstick Assembly Kit"

Don Johnston
Development Equipment
981 Winnetka Terrace
Lake Zurich, Illinois 60047
(312) 438-3476
Item #C42 Mouthstick Kit

Control Rod End

McMaster-Carr Supply Company
P.O. Box 4355
Chicago, Illinois 60680
(312) 833-0300
Item #6072K23

Orthotics and Prosthetics, Vol. 39, No. 4, pp. 44–47.

The Flexible Socket System as Applied to the Hip Disarticulation Amputee

Michael Madden

INTRODUCTION

It has long been recognized that the greatest rate of prosthesis rejection among lower limb amputees occurs at the hip disarticulation and hemipelvectomy levels. Patients will often regress to alternate forms of ambulation rather than struggle with uncomfortable and cumbersome prosthetic devices. A poor fit, improper choice of components, or the misapplication (alignment) of components, can lead to inadequate function of the prosthesis. This will often lead to an inability to achieve acceptable levels of activity in daily living.

The first major concern in fitting the hip disarticulation amputee is comfort. The hip disarticulation amputee bears weight on the gluteal musculature, as well as the ischial tuberosity, in both the active and passive stages of prosthetic wear. The entire pelvis is generally encompassed within the prosthesis, meaning that the surface areas involved are far greater than those with any other level of amputation. Accommodation must also be made for the symphasis pubis, illiac spines, as well as the spinal vertebrae and any residual head or neck of the femur involved. Scar tissue and other sensitive areas must also be considered in socket design.

The next four areas of concern are interrelated, and can be considered simultaneously. These are alignment, expenditure of energy, weight, and mobility. It is generally accepted that improper alignment and excessive prosthesis weight may cause a greater expenditure of energy, resulting in decreased mobility. These circumstances can make the difference between acceptance or rejection of a prosthesis. The application of the flexible socket principle to this level of amputation can increase the overall comfort, as well as reduce the weight of the prosthesis considerably.

CASTING AND MODIFICATION

Using a casting platform with a firm ¼" Pelite® base, set the patient's height and angulation to achieve a comfortable balance between the ischium, gluteal musculature and the non-amputated foot. The Pelite® will allow a prominent ischial tuberosity to be better defined in the cast.

Run the plaster bandage around the patient's waist from just superior to the lower aspect of the rib cage, to just below the iliac crest. Using a length of plaster bandage formed into a rope, wrap it around the pel-

vis, over the iliac crests, pulling it firmly horizontal past the iliac spines, being careful not to create excessive lordosis in the lower back. The roping will help to prevent rotation of the residual limb, serve as a guide in donning the prosthesis, and also greatly reduce pistoning during ambulation. Secure the rope with additional wraps, and complete the negative impression with minimal weight bearing through the residual limb.

Using two blocks with a 45° angulation, position one in the anterior and one in the posterior at the distal aspect of the residual limb. Place the posterior block parallel to the body's axis, while slightly rotating the anterior block externally. (The external rotation of the anterior block reduces pressure on the pubis.) If the head or neck of the femur is present, reduce the rotation to parallel of the body's axis. Use enough force to create a wedge affect, displacing fleshy tissue laterally, while keeping the ischial tuberosity in firm contact with the casting platform. This will help to distribute body weight, transferring it antero-posteriorly, thereby reducing the constant pressure present on the ischium. It will also help to increase the patient's control of the prosthesis.

The amount of modification to the positive model should now be reduced. A slight reduction of the antero-proximal area of the abdomen as well as the gluteal muscles is necessary. This will provide a slight pressure to these areas.[1] Since the motion of the prosthesis is activated by pelvic and trunk motion, tilting the pelvis slightly posterior provides greater antero-posterior control of the prosthesis. Relieve the pubis, iliac spines, as well as the area superior to the roping channel and the lower aspect of the rib cage. This will prevent excessive pressure from the proximal brim of the socket.

FABRICATION

The first step in socket fabrication is the vacuum forming of the flexible inner shell. The material best suited for this purpose is Surlyn.® Because of its co-polymer properties, it resists shrinking better than low density polyethylene, which could also be applied.

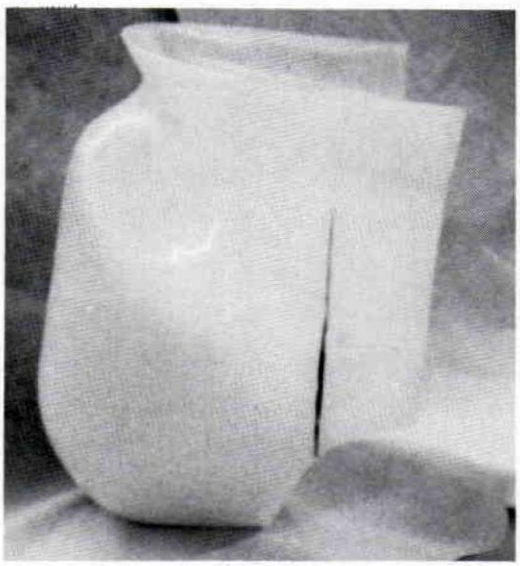

Figure 1. The flexible inner shell. Low density polyethylene or Surlyn® can be used.

After the "inner shell" is formed and allowed to cool, trim it laterally to both the anterior and posterior midlines. The extended anterior section will act as a tongue. The posterior section will provide a flexible lumbar support, thus allowing the medial posterior trim line to be lowered on the frame. By trimming the flexible "inner shell" to just past the midpoint of the model, the adverse effects of any of the plastic's shrinking properties will be minimized. It will also eliminate any separations which occur between the "inner shell" and the outer frame on the contralateral side due to the differing flex rates of the materials. Lastly, it will help to reduce the overall circumference of the socket.

Over the inner shell, laminate a one-half rigid, one-half flexible outer frame. The use of acrylic is highly recommended because of its superior "marriage" characteristics and its resistance to delamination, a property common with polyester resins.

The layup should consist of three layers of perlon stockinette, to create the inner surface. Over this, place a "half shell" of two layers of fiberglass stockinette, ex-

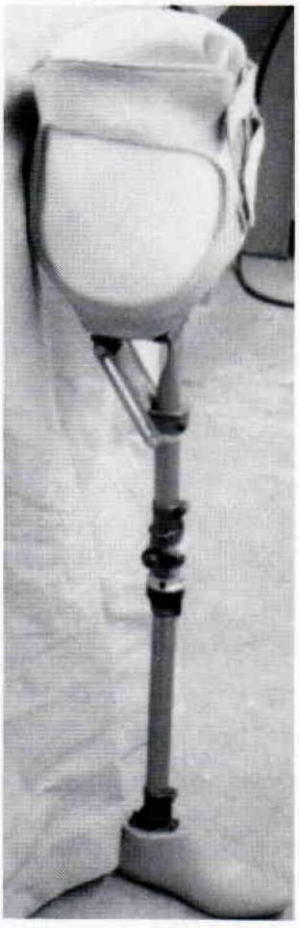

Figure 2. The flexible inner shell mounted in the outer frame of an endoskeletal set up. A pelite liner was used, but did not cover the flexible window, so as not to reduce heat transference.

tending from the anterior midline, to lateral to the posterior midline on the contralateral side. Pull two layers of perlon stockinette over this. Place the hip joint attachment plate in position with fiberglass matting and pull over this two more layers of perlon. Place two more fiberglass "half shells" as before and follow this with three more layers of perlon.

If extra strength is required, additional layers of fiberglass and perlon can be added in the layup. The use of one inch carbon fiber tape can also be added if extreme strength and rigidity are desired.

Laminate over the positive model so that the outer frameworks gradually form a rigid frame on the ipsilateral side to a flexible lamination on the contralateral side. After the lamination has cured, remove the outer frame, being careful not to damage the "inner shell."

Trim the proximal brim of the frame, just inferior to the lower aspect of the costal margin. Lower the trimline at both the anterior and posterior midlines to allow greater movement in bending and sitting. To create the "flexible window," trim the frame only from the lateral most aspect of the pubis on the ipsilateral side, to just lateral to the anterior iliac spine on the same side. Extend the "window" from just inferior to the iliac spines, to just superior to the ischium.

Attach the inner shell to the outer frame, and align and finish the prosthesis with the conventional methods applied to modular prosthetics.

SUMMARY

It has been observed that the comfort of the prosthesis and the application of a total contact socket with suprailiac crest suspension gives the patient a sense of the prosthesis being considerably lighter than the conventional Canadian style prostheses. This, along with the weight reduction achieved with the flexible socket, increased the overall performance of the prosthesis. With the addition of Titanium components, which are now available, it will be possible to reduce the weight even further.

DEDICATION

To John Neilson, C.P., who for the first 15 years of my rehabilitation saw to it that despite everything, I was provided with the best care possible.

Special thanks also to all the people at Otto Bock Inc. (especially Lawrence Mott), I.P.O.S., and Durr Fillauer, for all of their technical assistance and direction in developing this technique.

AUTHOR

Michael Madden has been a hip disarticulation amputee for 20 years. He is a graduate of the 916 Area Vo-tech program and is in the prosthetics program of the N.Y. State Dept. of Labors Apprenticeship program. He is presently head of prosthetic fabrication—under the supervision of Timothy Lacy, CP—at LaTorre Orthopedic Lab of Schenectady, New York. He is working on his baccalaureate degree as well as certification in prosthetics.

BIBLIOGRAPHY

Lower Limb Prosthetics, New York University Post Graduate Medical School, January 1977, pp. 23–25, 243–253.

Össur Kristinsson, "Flexible Above Knee Socket Made from Low Density Polyethylene Suspended by a Weight Transmitting Frame," *Orthotics and Prosthetics*, Volume 37, Number 2.

Tony van der Waarde, C.P.(C), F.C.B.C., "Ottawa Experience with Hip Disarticulation Prosthesis," *Orthotics and Prosthetics*, Volume 38, Number 1, Spring 1984, pp. 29–35.

Otto Bock Industries Inc.
Titanium Endo-Skeletal Components;
Technical Information Bulletin #20;
Technical Information Bulletin #21.

I.P.O.S. Flexible Socket Bulletin, "A revolutionary technique in fitting amputees."

Fabrication Procedures for the I.S.N.Y. Flexible Socket, Prosthetics and Orthotics, N.Y.U. Post Graduate Medical School, January, 1984.

Conversations with prosthetist, therapist, and patients, and personal experience.

REFERENCES

[1]Lower Limb Prosthetics, N.Y.U. Post Graduate Medical School, January, 1977, pp. 243–253.

Orthotics and Prosthetics, Vol. 39, No. 4, pp. 48–54.

TECHNICAL NOTE:

The "Overlap" Bisectional Forming Technique in Orthotics

David C. Showers, C.P.O.

INTRODUCTION

For over 10 years, vacuum forming sheet plastics has been an accepted routine fabricating process, especially in orthotics. Originally, vacuum forming sheet plastic was accomplished by placing the plastic between metal holding frames and then pulling the hot sheet of plastic over the modified positive plaster model.

Although this forming process is still used by many practitioners and technicians in prosthetics, drape vacuum forming has become the more popular technique used in orthotics today.

The advantages to drape molding vs. the frame molding method are:

1. The orthotist is not restricted to the certain size of mold which must fit within a metal frame.
2. Maintaining uniform thickness in the plastic during the forming process is enhanced.
3. There is minimal chance for error once the process is mastered.

These are just a few of the advantages to this simple forming process. However, limitations may still exist in many facilities; not from the drape molding process itself, but from the lack of an adequate size oven. This article will discuss an alternate way of vacuum forming sheet plastics utilizing the drape molding method for those facilities which do not have an oven large enough to house the size of plastic sheet needed to cover an adult size knee-ankle-foot-plaster positive mold.

STEPS IN THE FORMING PROCESS*

- Measure the proximal and distal sections of the positive plaster mold to determine the appropriate sizes of the plastic sheets (mark ½" superior and ½" inferior from the knee center) (Figure 1).
- Cut plastic to the size required and place these sheets on separate shelves in the oven. Note: A multi-shelf oven is necessary for this technique (Figure 2).
- When the plastic has reached its molding state, remove the distal section first. Place the hot plastic sheet over the plaster positive mold by draping, as is commonly done in forming for an ankle-foot orthosis (Figures 3 and 4).
- Quickly remove the second (proximal)

*At least two experienced staff are required for successful completion of this technique. Familiarity with the standard drape molding technique is recommended.

section and place this sheet on the proximal end of the positive mold and "overlap" the distal section by approximately one inch (Figure 5 and Figure 2).

- Working swiftly, seal the plastic around the model as if it were one complete section and evacuate the air as is commonly done in the vacuum forming process (Figure 6).
- Trim excess plastic and allow vacuum machine to run until the plastic has adequately cured (Figure 7).
- Remove the overlap section of plastic around the knee (Figures 8A, 8B, and 8C).
- The model is now ready for attachment of the knee joints to the thigh and calf sections (Figures 9A and 9B).

ADVANTAGES

- The orthotist has greater control during the forming process with two smaller sheets of plastic rather than one large sheet.
- Different types of plastic may be used for each section, i.e. a polypropylene distal section with a polyethylene proximal section.
- Different thicknesses of plastic may be used simultaneously during the forming process.
- Negative models do not have to be cut in sections.
- Saves time in fabrication, and the practitioner maintains control of the entire process.

DISADVANTAGES

- Process requires more technical staff during the forming.
- An oven with more than one shelf is needed.
- Greater skill is required due to the limited working time during the forming, since the distal section is placed on the positive mold approximately 20 seconds before the proximal section.

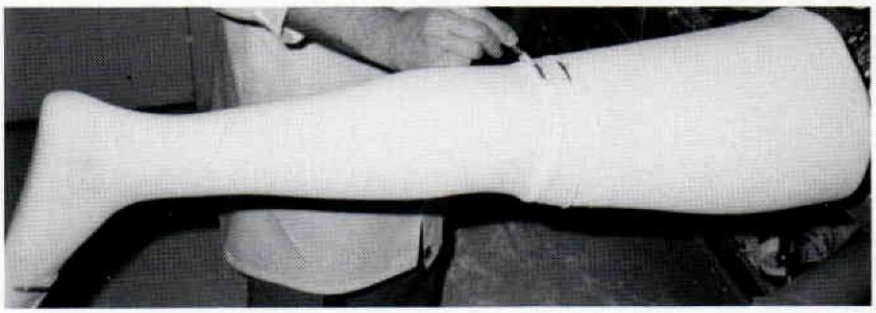

Figure 1. Marks on the positive model eliminate guessing the location of the overlap area during the forming process.

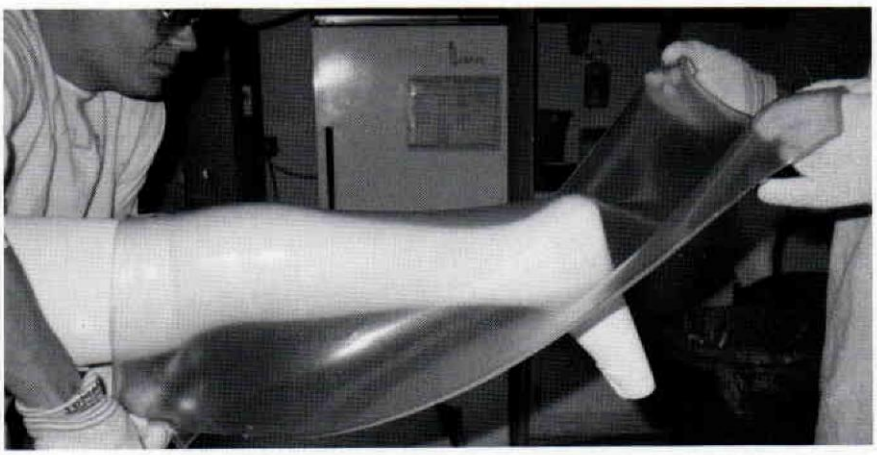

Figure 2. Two staff members place the distal section on the positive model to insure accuracy.

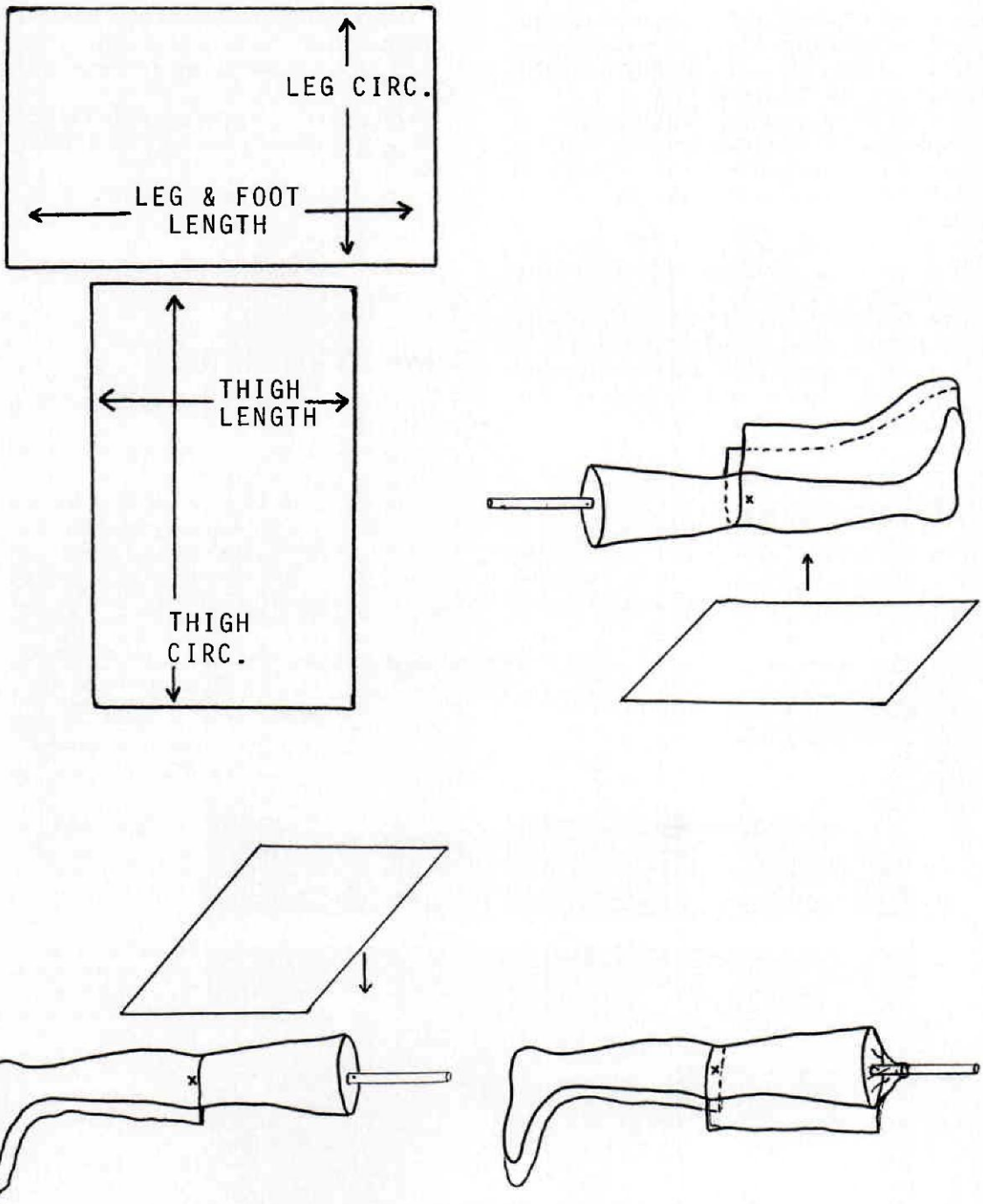

Illustration A. The procedure for overlap is shown.

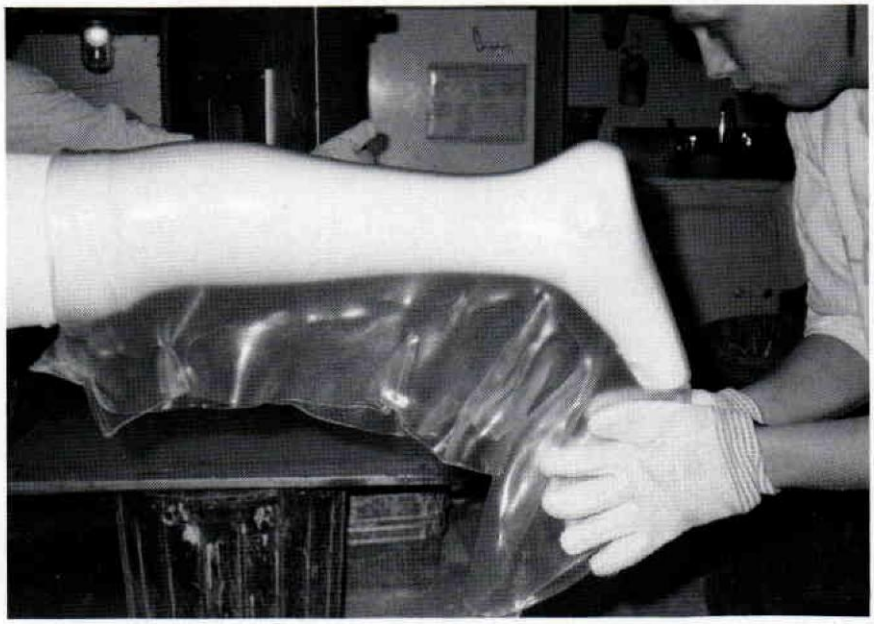

Figure 3. While one staff member seals the hot plastic, the other individual removes the proximal section from the oven.

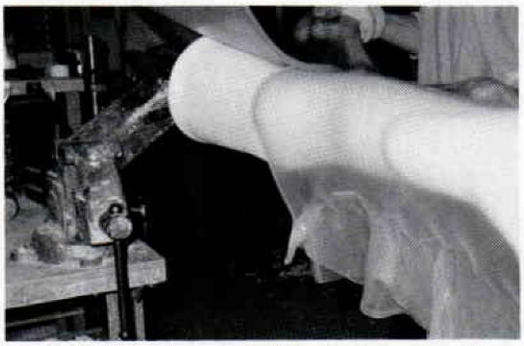

Figure 4. When the proximal section is removed from the oven both staff members work together and place the proximal section on the positive model with the full length going around the thigh.

Figure 5. Continue to check for areas not sealed.

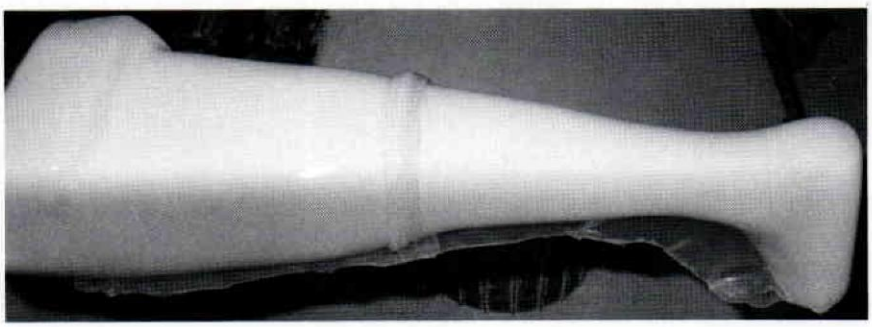

Figure 6. Forming is complete.

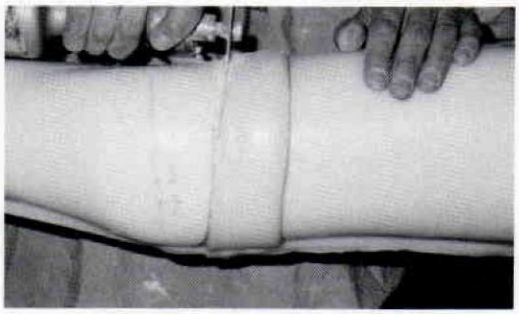

Figure 7-A. Overlap area is located superior to the knee axis.

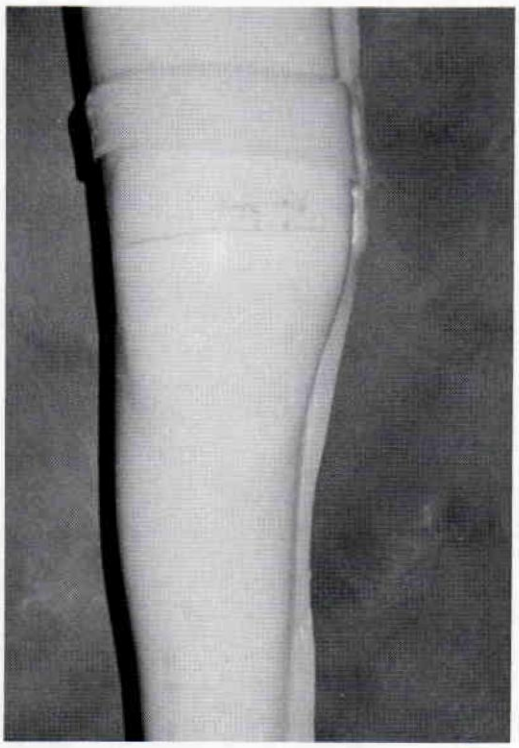

Figure 7-B. Form of knee ankle foot orthosis for a patient with genu valgum.

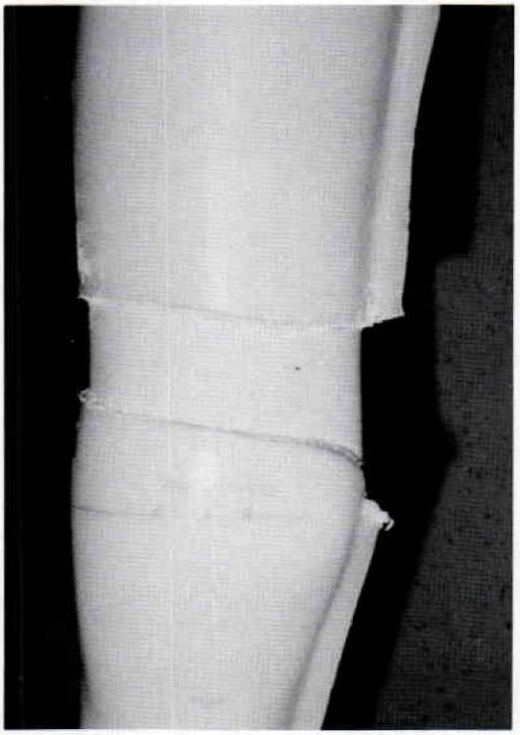

Figure 7-C. The knee ankle foot orthosis form with overlap removed from the distal thigh. Increased surface area is maintained at the medial tibial area for support of the genu valgus deformity for a patient afflicted with arthritis.

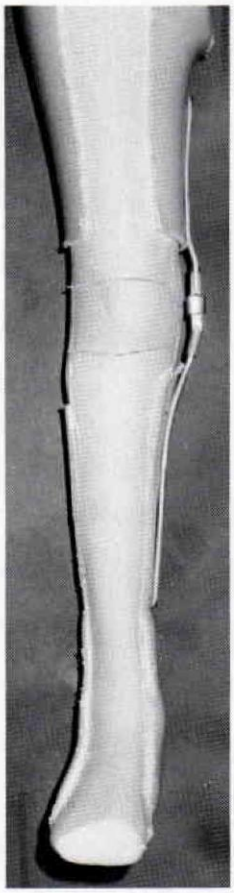

Figure 8-A. Anterior view of the knee ankle foot orthosis showing medial knee joint only.

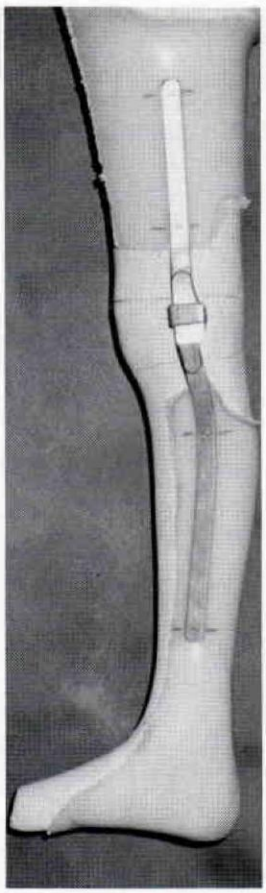

Figure 8-B. Medial view of the knee ankle foot orthosis with knee joint in proper alignment in antero-posterior plane for a patient with paraparesis.

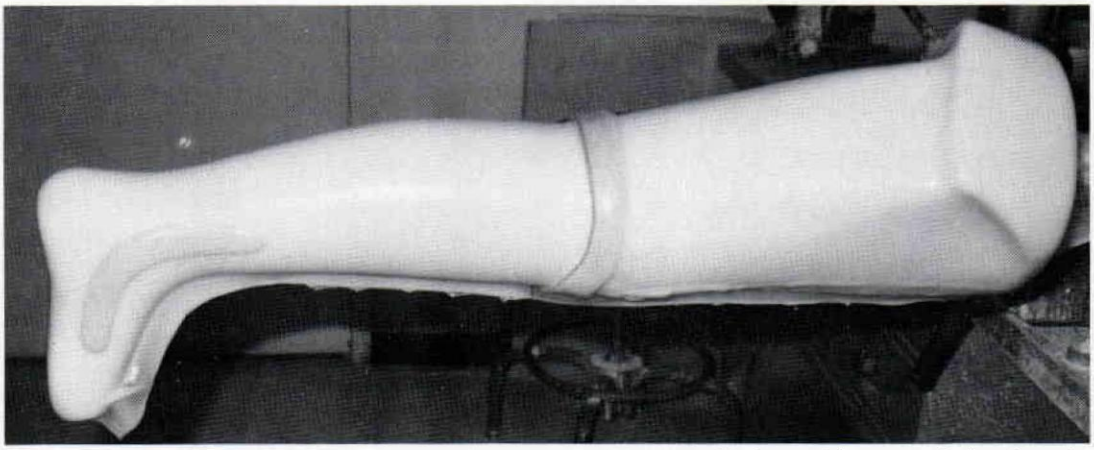

Figure 9. A left knee ankle foot orthosis formed for a patient with an unstable femoral fracture and a hemiparesis due to a right cerebral vascular accident.

CONCLUSION

The Orthotics-Prosthetics division of the Physical Medicine and Rehabilitation Department at the Hospital of the University of Pennsylvania has utilized this fabrication process for its knee-ankle-foot orthosis projects for more than four years. There have been minimal failures since the implementation of this technique. Successful forming has routinely been accomplished on such projects as forming over single and double bar knee joints, over single and double mechanical articulated ankle joints, over carbon fiber composite inserts (See Figure 10), and over other reinforcements such as requested by the practitioner. It is recommended by the author that the single section forming process be the practitioners' first choice. But for those facilities which meet the criteria previously mentioned, the "Overlap" bisectional forming technique is offered as an extension to an already accepted vacuum forming process.

AUTHOR

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ACKNOWLEDGMENTS

I would like to thank Martha Strunck, C.P., Staff Prosthetist-Orthotist, Orthotic-Prosthetic Division, Physical Medicine and Rehabilitation, Hospital of the University of Pennsylvania, for her assistance in preparing the sketches.

I would also like to thank Laird David, R.T.(O.P.) and Edward Sharer, R.T.(P)., for their assistance in the preparation of the illustrations.

Abstracts from the 1985 AOPA Annual National Assembly

As a service to all those unable to attend the 1985 AOPA Annual National Assembly in San Diego—October '85—below are reprinted the abstracts of the papers that comprised the Assembly's Scientific Sessions. The speaker's names are italicized.

Medical and Surgical Management of Geriatric Amputees, *James M. Malone, M.D. and Joseph M. Leal, CP,* University of Arizona/Tucson VA Medical Center, South 6th Avenue, Tucson, AZ 85763.

Our presentation will be based upon the performance of approximately 600 lower extremity amputations over the past seven years. Two-thirds of our patients are over 65 years of age, and approximately 20 percent have diabetes mellitus. We will focus on primarily three areas of interest: current criteria for amputation level selection; postoperative patient rehabilitation; and evaluation and management of coexistent medical and vascular diseases. Criteria to be presented for amputation level selection include the use of intradermal Xenon-133, transcutaneous oxygen and carbon dioxide, doppler ankle pressures, IV fluorescein dye, and the photoplethysmograph. Discussion on postoperative management after lower extremity amputation will focus on early and rapid immediate prosthetic fitting with early physical rehabilitation. The diagnosis and management of ancillary medical problems and vascular disease during the preoperative and postoperative period will be discussed in detail. For the non-diabetic geriatric amputee, life expectancy approximates normal and there is no reason not to aggressively rehabilitate such patients. Although the diabetic geriatric amputee has a limited life expectancy, usually due to cardiac disease, rehabilitation and independent ambulation is still a reasonable approach for the management of these patients.

Prosthetic Management of the Geriatric Amputee, *Joseph M. Leal, C.P.,* University of Arizona/Tucson VA Medical Center, South 6th Avenue, Tucson, AZ 85723.

No abstract available.

Above Knee Prosthetics for Geriatrics, *Joseph H. Zettl, C.P.,* c/o American Artificial Limb Company, Inc., 1400 East Pike Street, Seattle, WA 98122.

Postsurgical management, fitting principles, socket designs and modifications as applied clinically for geriatrics are reviewed and discussed. Applicable auxiliary suspension systems and optimum component selection are also detailed for this group of patients.

Total Management of Geriatric Patients in Prosthetics, *Charles F. Schultz, C.P.,* Acme Laboratories, Inc., 10702 West Burleigh Street, Milwaukee, WI 53222.

Treatment of the amputee from the time of the surgical amputation through final fit of the definitive prosthesis. Treatment includes, but is not limited to, IPSF applica-

tion, rigid dressings, intermediate prosthesis application, stump shrinkers, elastic bandaging, check socket application, and final fit. Included is discussion regarding determination of the course of treatment to follow in particular cases.

Myoelectric Prostheses Versus Body Powered Prostheses with Unilateral, Congenital, Adolescent Below Elbow Amputees, *Shirley A. Weaver, B.S., L.O.T.R., and Lawrence R. Lange, B.A., C.P.O.,* c/o Shriners Hospital for Crippled Children, 8400 Roosevelt Blvd., Philadelphia, PA 19152.

The purpose of this research was to study the feasibility of fitting adolescent, congenital, unilateral below elbow amputees with respect to fit, function, cosmesis, and cost efficacy. All patients studied were originally fit with body-powered, harness suspended prostheses, though two of the 10 patients studied had discontinued prosthesis usage prior to this project. All patients were given exams relating to function both prior to and after myoelectric fitting. In addition, detailed prosthetic histories were taken. At the end of the study, evaluations were made based on subjective and objective criteria related to fit, function, maintenance, and cosmesis.

Biomechanical Evaluations of the ISNY Flexible Above Knee Socket, Jiro Kawamura, M.D., Department of Rehabilitation, Osaka Rosai Hospital, 1179-3, Nagasone, Sakai, Osaka, Japan and *Ichiro Kawamura, M.A.,* Kawamura Orthopedic Appliance Company, Ltd., 1-18-18, Renjinbashi, Kitaku, Osaka, Japan.

Over 50 prostheses incorporating the ISNY flexible above knee sockets have been fabricated in our facility. The subjective patient's evaluations for the sockets apparently seem to be very good. Using some biomechanical ways, we have evaluated the socket regarding the shape and the inner pressure at every phase of walking for three patients. We have found out that the socket shape has been changed to strictly correspond to the muscle activity which is predominate in each walking phase. The inner pressures between the residual limb and the socket walls have been measured for the ISNY socket and conventional hard socket using some inner pressure sensors, and the result shows the pressures were lower in the ISNY socket.

Children's Titanium Modular System, Otto Schultz, C.P.O., IPOS GMBH and Company K.G., Post fach 1845, 2120 Luneburg, West Germany and *Dale Berry, C.P.(C),* IPOS-USA, 155 Portage Road, Lewiston, NY 14092.

On April 18 and 19, 1984 in Ottawa, Canada, seven year old Matthiew Parent, sponsored by the War Amputations of Canada CHAMP programme, was fitted with a flexible A/K socket and the first modular titanium above knee system for children in North America. A year has passed and we will review this young boy's progress and how his lightweight (three lb.) prosthesis has held up.

ADEPT Voluntary Closing Biomechanical Hands for Children: Experiences and Case Studies, *Bob Radocy, M.S., T.R.S.,* Therapeutic Recreation Systems, Inc., 1280 28th Street, Suite 3, Boulder, CO 80303-1797.

ADEPT biomechanical hands are the first voluntary closing terminal devices ever produced commercially for children. They are designed to imitate the proven function of the larger GRIP terminal devices for adults but use materials deemed more appropriate for children with regards to safety and cosmesis. Two models were introduced in the Fall of 1984: the "F" for youngsters aged one to five, and the "B" for adolescents 10 to 14 years of age. Through a no obligation educational trial program offered by the manufacturer, over two hundred ADEPTs have received exposure and/or have been examined and evaluated with limb deficient children, their parents, therapists, physicians, and pros-

thetists. General experiences from these sources will be summarized to indicate acceptance/rejection, conversions, use, applications, success, failure, and suggestions/comments resulting from the first year's exposure to the devices. Case studies will be focused on the application of ADEPTs to specific children to highlight aspects of the general experiences which are discussed. New product developments and existing product improvements resulting from the first year's experiences with the ADEPTs will be discussed and will complete the presentation.

The ICEROSS System, *Össur Kristinsson, C.P.O.*, Ossur hf., Hverfisgata 105, Box 5288, 125 Reykjavik, Iceland.

A new method for fitting below knee and above knee amputees is presented. ICEROSS stands for Icelandic Roll on Suction Socket. The system consists of: a) an injection moulded silicone socket that is relatively unstretchable axially but highly elastic radially, b) a coupling device for bottom to bottom connection to c) a rigid total contact socket, or alternatively, a flexible socket type ISNY. The silicone socket is fabricated over a high density plaster of paris model that is somewhat smaller in circumference than the original model. A Pelite® socket dummy is made over the model and a thin rigid socket is then laminated over the dummy. The dummy is removed and silicone injected into the two part mould thus created. The silicone socket is fitted over the original model and a rigid or a flexible socket made thereover. When donning the socket, the amputee turns it inside out and rolls it over the residual limb. The coupling device is connected to nylon tape that goes through the bottom of the rigid or flexible socket to a buckle on a posterior socket wall. The silicone socket adheres to the skin and acts like a second skin, transferring the action of interface friction from the skin-stump sock level to the interface level between the silicone and the supporting socket. The result is a total contact suction socket with excellent suspension and load distribution properties, even for very short residual limbs.

An Ultralite Scandinavian Above Knee Prosthesis, *Glenn F. Hutnick, C.P.*, Clinical Instructor, Department of Rehabilitation Medicine, College of Physicians and Surgeons, Columbia University, and David Sussman, Orthotist/Prosthetist, G.F.H. Orthotic and Prosthetic Laboratories, Inc., 128 Fort Washington Avenue, Suite C, New York, NY 10032.

The idea of an ultra light prosthesis for the geriatric amputee is not a new one. With the new availability of titanium modular components, lightweight SACH feet and Scandinavian socket designs, this area can now be revisited. The new titanium modular lower limb components in conjuntion with lightweight SACH feet are making a large contribution to the management of the geriatric amputee. However, current socket designs are still increasing the weight of these prostheses. This paper is an attempt to demonstrate a lightweight design for the Scandinavian socket. Current techniques call for a laminated frame to support the Surlyn® socket. We will discuss a vacuum molded polypropylene frame designed to support the socket and function as attachment to the knee unit. The presentation shall include socket design, plastic molding techniques, fabrication, as well as fitting and finishing. Biomechanics of this system will also be introduced. Our goal is to review the benefits of such a lightweight system.

The Application of ISNY Principles to the Below-Knee Prosthesis, *Sidney Fishman, Ph.D.*, Norman Berger, M.S., David Krebs, M.A., William Webb, B.S., C.P.O., Prosthetics and Orthotics, New York University Medical School, 317 East 34th Street, New York, NY 10016.

The ISNY below-elbow prosthesis consists of a thin, thermoplastic socket connected via volar and dorsal struts to the laminated distal portion. As in the above-

knee ISNY design, the socket is soft and flexible rather than hard and rigid; and the frame, while allowing for length, shape, and component attachment, is minimal in size and extent. Six unilateral, below-elbow amputees (ages eight to 18) have been fitted with this new socket utilizing a new cast, plaster model, and wrist unit, but the terminal device and harness type were unchanged. All subjects indicated that the ISNY was more comfortable than the conventional socket, being lighter, cooler and permitting the input of sensory stimuli. They also reported that wear times increased; however, reactions to cosmesis were variable. In summary, all subjects reacted enthusiastically to the new sockets. The fabrication methods involved included: a) vacuum forming the socket; b) frame lay up; c) frame trim; d) attachment of socket to struts; and e) harness attachment, will also be discussed.

Bracing for Back Pain, *Lyle J. Micheli, M.D.*, 319 Longwood Avenue, Boston, MA 02115.

The use of bracing for back pain in adults and adolescents has been facilitated by recent developments in brace design and fabrication. Using prefabricated thermoplastic polypro or polyethylene braces with 0°, 15°, or 30° of brace lordosis, we have successfully managed more than 90 percent of our athletically active patients with back pain. Eighty percent of our adults with back pain have improved.

In order to successfully use bracing for back pain, an accurate initial diagnosis must be made. In adolescent back pain, spondylolysis and mechanical back pain are best treated with a 0° lordosis brace; discogenic pain with a 15° brace, and apophyseal fractures with 15° or 30° braces.

In adults, the 0° brace is ideal for spondylolysis, but may not, initially, be well tolerated, and a 15° brace may be required. Discogenic and arthrogenic pain is usually best treated with a 15° brace. No brace, of course, will successfully relieve back pain due to spinal trauma—so the importance of accurate initial diagnosis must be emphasized.

Lower Back Pain in Children and Adults, *M.E. Miller, C.O.*, 40 Parkwood Drive, Milton, MA 02186.

No abstract available.

The Boston Scoliosis System—A Follow-Up Study, *John E. Hall, M.D.*, John E. Emans, M.D., M.E. Miller, C.P.O., Children's Hospital, 300 Longwood Avenue, Boston, MA 02115.

Four hundred patients have been followed for a minimum of 18 months since the last time they wore their orthosis after treatment of idiopathic scoliosis using the Boston Scoliosis System. Half of the patients were fitted with low profile braces and the other half with an additional Milwaukee type superstructure. It was concluded that bracing does affect the natural history of idiopathic scoliosis because a subset of patients with curves over 30° at the onset of bracing, with two years of additional growth remaining, were successfully managed. The curves in that group were arrested in their progression in 90 percent of cases.

There were several interesting and unexpected findings. Results were as good in the group of patients who wore them full time. The low profile brace gave as good a correction as the brace with the superstructure in curves of T8 and below. Neither brace gave satisfactory results in curves with an apex of T7 and above. Total noncompliance with bracing led to surgery in a high proportion of cases. Compliance did not seem to be related to the type of brace, whether it was a high one or a low one. Adverse factors were the young age of the patient, increasing severity of curve, severe rotation, and a flat back with less than the normal amount of expected thoracic kyphosis.

Pelvic Stabilization as a Treatment for Low Back Pain, *James H. Tyo, C.O.*, Tyo and Tyo, Limited, 633 East Walnut Street, Green Bay, WI 54301 and Lester A. Owens, D.O., Neurology and Rehabilitation As-

sociates, 704 S. Webster Avenue, Green Bay, WI 54301.

Our intent is to show the correlation between the motion of the SI joints and the L5/S1 junction as they relate to low back pain. A review of the results of 100 patients treated with a Pelvic Stabilization System will be presented. In addition, we will describe the system itself from an orthotic and from a medical viewpoint.

Clinical Considerations in the Orthotic Treatment of the Cervical Spine, *George Boyer, C.O.,* 1815 East Workman Avenue, "D", West Covina, CA 91791.

The purpose of this paper is to identify various types of cervical fractures and other cervical anomalies that require orthotic treatment. It will review cervical anatomy, range of motion, discuss radiological identification, and demonstrate types of motion that are undesirable in the care of these conditions. Jefferson, dens, body, pedicle and handmans fractures, subluxations, malignancies, infectious processes, and degenerative cervical disease will be identified, and orthotic indications and contraindications from the presenter's experiences will be presented.

The Houston Halo—A Unique System for Providing Cervical Stability, *Raymond F. Allen, B.B.A., C.O.,* City Brace Company, Inc., 7227 Fannin, P.O. Box 20506, Houston, TX 77225.

Over 12 years in development and after more than 1,500 applications, the Houston Halo is a new concept in cervical orthotics. This extremely lightweight system offers many advantages. The anterior/posterior opening two-piece jacket allows minimal patient movement during application and convenient access to the thorax without interrupting traction. A unique superstructure utilizing serrated discs for flexion/extension adjustment and ring clamps for anterior/posterior and rotational adjustment provides accurate and easy cervical positioning. Sping loaded shoulder attachment posts reduce pin erosion and combine with L-shaped threaded uprights to allow a clear x-ray field and provide desired distraction/compression forces.

The Lerman Minerva Orthosis, *Max Lerman, C.O.,* 8710 Wilshire Blvd., Beverly Hills, CA 90211.

This paper is presented giving our experience with a new cervical orthosis called the Lerman Minerva. Cervical injuries lend themselves to orthotic management. Readily available soft collars, Philadelphia collars, multiple post cervical braces, etc., have proven to be highly effective in the treatment of cervical injuries.

Over the past five years, this orthosis has been applied in our practice on 96 patients. In 93 cases, the orthosis was well accepted with little or no complications, complaints or adjustments. Sixty-five patients were fitted with the Lerman Minerva as a primary treatment. Ten patients were transferred to the Lerman Minerva from other orthoses. Seven patients with severe cervical injuries were transferred to halo vest fixation. Fourteen patients were fitted with the Lerman Minerva postoperatively for cervical fusions. Three patients rejected the Lerman Minerva for non-compliant reasons.

A New Development in Upper Limb Orthotics, *Arthur W. Guilford, Jr., C.O.,* 18437 Mt. Langley Street, Suite E, Fountain Valley, NY 10028.

No abstract available.

Upper Limb Orthotic Options, *Joseph Wanchick, C.O., O.T.R.,* Rehabilitation Institute, Inc., 261 Mack Blvd., Detroit, MI 48201.

The purpose of this presentation is to acquaint the orthotist with a wide variety of options available in the selection of orthoses for upper limb treatment. Numerous factors need consideration before a

final choice is made. The skill of the orthotist, his rapport with the referring physician, the availability of central fabrication, and restrictions of third party payers may influence the approach to treatment. Other factors may be the choice of materials used for fabrication, whether the orthosis can be made from measurements or a positive mold, or if it can be directly formed to the patient. Presently, there are a variety of commercially available orthoses for the upper limb that can be custom-fit. Slides depicting these options will be shown and a handout of sources of prefabricated upper limb orthoses will be distributed.

Double Flexure Designs for Orthotic Ankle Joints, *J. Martin Carlson, C.P.O.*, Bruce M. Day, Orthotist, Gillette Children's Hospital, 200 East University Avenue, St. Paul, MN 55101.

The orthotic and prosthetic laboratory at Gillette Children's Hospital has developed two designs for double flexure orthotic ankle joints. The double flexure design approach retains the weight and cosmetic advantages of plastic while providing three advantages over the posterior leaf design. The flexures can be located for congruency between anatomic and orthotic joint axes. The desired ankle range of motion is almost totally free of resistance, and the degree of motion restraint can be easily and precisely controlled. During the past several years, we have provided several hundred of these orthoses with primary application in the areas of cerebral palsy and post-op orthotic treatment of resistant clubfoot deformities. At the present time, more than 25 percent of the ankle-foot orthoses provided at Gillette Children's Hospital include a double flexure type ankle joint.

Experiences with a Rotational Control, Reduced M-L Orthotic Brim for Knee Ankle Foot Orthosis, *Glenn Ham-Rosebrock, C.O.*, 9258 Gardendale, Bellflower, CA 90706.

This is a report of experiences with an alternative thigh shell design, as opposed to the quadrilateral brim, in the treatment of post polio in the lower extremities. The design was originally developed in an attempt to stabilize atrophied tissue, which is lacking in the patients studied with the quad brim shape. It also eliminated the technical difficulties encountered with the negative and positive cast modifications by the orthotist. Between 1981 and the beginning of 1985, we have treated approximately 100 patients, 10 percent of whom were bilateral. Indications and contraindications will be discussed. We have conducted careful clinical analysis of the remaining patients. A majority of the patients had totally flail lower extremities, from the hips distally, with associated genu valgus/recurvation, leg length discrepancies, and external rotation instability of the hip. The average age of the patients treated was approximately 13, ranging from five to 65. These findings appear to support our concept that function of the patient is benefitted with a reduced M-L.

Conservative Management of Sports Related Traumas with Foot Orthotic Devices, *Richard D. Schwartz*, President, APEX Foot Health Industries, 330 Phillips Avenue, South Hackensack, NJ 07606.

Sport orthotic devices discussed in detail, including their applications for preventive medicine and treatment. Complete analysis of running injuries: an assessment of foot shape, foot trauma, and footwear design, appropriate shoe fitting, shoe style and design, and orthoses. Diagnosis and fabrication of sports orthoses. Specific diagnoses and indicated fabrications discussed in detail. Protecting and relieving over use and stress from sports activities: shock absorbing materials, heel-to-toe design, flexible materials, educating patients, achieving proper foot position. Background presentation and injury statistics (*The Injured Athlete*, Daniel N. Kulund, M.D., 1982) relating to pronated, cavus, and neutral foot: metatarsal and intermetatarsal ligament injuries, arch pain, plantar fasciitis, periostitis, posterior tibial tendonitis, achilles tendonitis.

Sports Medicine Knee Injuries: The Use of Orthotics, *Michael F. Dillingham, M.D. and Gary W. Prout, C.O.,* 3250 Alphine Road, Portola Valley, CA 94025.

Indications for prophylactic bracing in sports, as well as post-injury and post-surgical bracing will be discussed. Factors influencing brace acceptance and availability will also be reviewed. Factors influencing either physician acceptance of bracing or physician willingness to bypass the certified orthotist will also be reviewed. These will include the quality of bracing, availability, and quality of service and financial incentives to the physician and/or orthotists that may interfere with traditional referral patterns. Basic varieties of braces used in sports injuries and their appropriateness will also be discussed for issues ranging from ligament damage to soft tissue inflammation.

Bracing in Sports, *Lyle J. Micheli, M.D.,* 319 Longwood Avenue, Boston, MA 02115.

Sports bracing has a number of very different objectives, depending on the specific problem being addressed, and the demands which the athlete and sport will place on the apportioners. Braces may be used for injury prevention; protection of a joint after injury; to limit motion of a ligamentously unstable joint; or to allow continued play while on injury or disorder in healing.

The use of preventive bracing has taken on additional importance in contact sports such as gridiron football—particularly for the knees. Each anatomic site—spine, upper extremity, and lower extremity—will be reviewed with discussion of braces used at each site for the four functions indicated.

A Biomechanical Study of the Static Stabilizing Effect of Knee Braces Used for Medial Stability, *Edward P. Van Hanswyk, C.O.,* Clinical Instructor, State University of New York, Bruce Baker, M.D., Associate Professor, Orthotic Surgery, S. Bogosian, M.D., Resident, Orthotic Surgery, Fred Werner, Dennis Murphy, B.S., Technical Specialist, Orthotic Surgery, State University Hospital, 750 East Adams Street, Syracuse, NY 13210.

Disruption of the medial supporting structures of the knee occurs commonly in contact sports such as American football. Return to competition following treatment and rehabilitation is frequently enhanced by orthoses, particularly in those patients with some residual laxity. Current advertising and media coverage in the U.S. not only promotes bracing following injury, but infers that a significant prophylactic effect can be achieved by bracing prior to injury in high risk situations. The purpose of this project was to determine if commercially available bracing could be shown to produce objective evidence of medial stabilization of the knee. Commercially available athletic braces were evaluated for their effect on abduction forces applied to a cadaver knee with no instability and with experimentally created medial instability. Under computer control, abduction forces were applied while simultaneous data was obtained from a three plane electrogoniometer and transducers applied to the anterior cruciate ligament and the superficial medial collateral ligament at 15–45° of flexion and 1–15° of external rotation. Our results showed a range of reduction in medial collateral ligament stress of up to 45 percent with various commercially available orthoses.

The Effects of Bracing on Selected Movements Performed by Skilled Athletes, *Michael R. Farmer, R.P.T., A.T.C.,* Jack L. Groppel, Ph.D., In-Sik Shin, M.A., 118 Cypress, Lees Summit, MO 64063.

This study investigated the effects of bracing on selected movements in the athlete. Subjects were eight athletes, six suffering previous knee injury with surgical repair and two with no history of knee trauma. Tibial rotation was measured with and without the Lenox Hill Brace using a rotating disc attached to the subject's foot.

Subjects were measured in the sitting, loading position. Two high speed cameras (set at 100 frames/sec) analyzed subjects while sprinting and performing cutting maneuvers, with and without the knee brace. An AMTI force platform measured ground reaction forces during these maneuvers.

Tibial rotation was reduced in all cases with the use of the brace, with a mean reduction of 14.4 ± 2.68. Results of high speed cinematography demonstrated faster acceleration and horizontal velocity during sprinting and reduced deceleration required for completion of cutting maneuvers in the braced lower extremity. In all cases but one, the vertical ground force (as measured by AMTI force platform) was less in the braced condition, indicating that the subject's injured leg exerted (and encountered) less vertical force when contacted with the ground.

The authors concluded that the brace provided favorable support for the athlete as well as enhanced movement. The individuals moved faster, and encountered less force to the braced lower extremity.

Functional Requirements of Preventative Knee Orthoses, *David J. Hoy, C.P.O.*, Hans J. Georg, R.A. (O.P.), James N. Tilton, R.T.(O.P.), 240 Marion Avenue, Mansfield, OH 44903.

Greater emphasis is currently being placed upon the concept of providing preventative orthotic protection to the knee in sports activity. Critical evaluation of this concept reveals a need for clear guidelines centering upon orthotic design features and biomechanical/clinical data. This presentation will explore the current modes of mechanical stabilization and review recent studies done to determine the present levels of efficacy in protecting the vulnerable structures of the knee. Mechanism of injury and magnitude of disruptive forces will also be examined. A new orthotic concept designed to provide prophylactic knee protection will be presented and discussed.

Orthotics in Sports Medicine, *Michael D. Brncick, C.P.O.*, 809 Kurt Lane, Crete, IL 60417.

No abstract available.

A Canadian Approach to Custom Footwear, *Colin Campbell, C.O.(C)*, 2075 Bayview Avenue, Toronto, Ontario, Canada M4N 3M5.

The challenge of balancing the need for function and cosmetic acceptability in custom footwear will be discussed. A case presentation of a difficult footwear management problem will highlight the options available to the practicing orthotist for this type of patient.

The Sunnybrook Aids-for-Living Centre possesses a Custom Footwear Manufacturing Programme which provides a comprehensive clinical component along with central fabrication on a local and national scale. The structure and capabilities of the programme will be reviewed.

The growing need for training of footwear specialists and shoemakers will be examined. An overview of educational programmes in existence throughout the world will be presented to reinforce the critical need to revive a dying trade.

Suggestions for training programmes and the creation of professional standards will be offered.

The Non-Manageable Meningomyelocele Patient—An Alternative Approach, David P. Roye, M.D., Assistant Professor of Orthopaedic Surgery, College of Physicians and Surgeons, Columbia University, and *Glenn F. Hutnick, C.P.*, Clinical Instructor, Department of Rehabilitation Medicine, College of Physicians and Surgeons, Columbia University.

Orthotic management of the meningomyelocele patient is a widely discussed topic. The areas of discussion usually include knee ankle foot orthotics, standing frames, and reciprocating orthoses. How-

ever, there are many orthopedic problems that contradict the application of these devices. The problems include flexion contractures, angular deformities, and abnormal range of motion. Prior to fitting, surgical intervention is usually the rule. This paper is an attempt to discuss an orthotic design for these patients who demonstrate these problems, but are not surgical candidates. The orthosis is a plastic thoracolumbar-hip-knee-ankle-foot orthosis that is utilized for both static and dynamic functions. Fabrication, fitting, and final delivery of the device will also be discussed. We hope to demonstrate how a larger population of patients can now be managed.

The Impact and Shock to the Lower Extremities, Including the Foot, Ankle, Knee, Hip and Back, *M.R. Davidson, D.P.M., D.A.B.P.S.,* 11647 Aliento Court, San Diego, CA 92127.

The paper deals with the author's experience in dealing with shock to the lower extremities, which include conditions caused by shock to the heel, specifically apophysitis in children, heel spurs, heel neuroma in adults, heel fasciitis, degenerative types of arthritis in adults, including degenerative ankle and knee arthritis, shinsplints, muscle pulls and tendonitis. The author examines the most common cause of lower extremity pain in the child and adult, which is the shock of walking on unyielding surfaces like cement and asphalt, on which the modern Homosapien spends 90 percent of his time. The author demonstrates cinemagraphically the components of heel strike and the shock wave generated into the lower extremities, a most dramatic visualization for those involved in lower extremity medicine. The author also offers some mechanical devices and aids to relieve the painful conditions mentioned above, to avoid the degenerative changes caused by this remarkable shock wave generated through the lower extremity in heel strike.

Components for the Fabrication of Prototype BK Prostheses and Development of a BK Ultra Light Fabrication System, *Carlton E. Fillauer, C.P.O.,* Durr-Fillauer Medical, Inc., Orthopedic Division, P.O. Box 5189, Chattanooga, TN 37406.

A prototype prosthesis is a transparent check socket mounted on a dynamic alignment unit so that the patient can walk on the assemblage. Use of such a device allows the prosthetist to check the fit of the socket under dynamic conditions and define the proper fit and alignment of the prosthesis as a whole prior to the fabrication of the actual prosthesis. This has important implications. The development of an integrated system features Durr-Plex check sockets. Hardware for coupling them to various alignment units will be described. Further, one of the possible alternatives the technique makes possible, an ultralight BK prosthesis, will also be described.

Replant Surgery: Its Effect on Prosthetics Practice in the 1980's, *David W. Vaughn, C.P.O.,* James A. Nunley, M.D., P.O. Box 6123, Kingsport, TN 37663.

This paper will cover criteria for replant, for amputation, for immediate fit, for amputation as optimal treatment for injuries that can be treated with either questionable replant management and a great deal of time, or with the more immediate rehabilitation aspects afforded by amputation and immediate postoperative prostheses. We will deal primarily with the lower limb, where replant surgery in the upper limb is generally the preferred treatment, if feasible. In the lower limb, reconstructive amputation surgical techniques generally are indicated, advised, and implemented.

The ICEPOSS System, *Össur Kristinsson, C.P.O.,* Ossur hf., Hverfisgata 105, Box 5288, 125 Reykjavik, Iceland.

A new concept for fitting TE, TK and TA (Syme) amputees is presented. ICEPOSS

stands for: Icelandic Pull on Suction Socket. The system consists of an injection moulded silicone socket of 10-15 cm. length and an open, ISNY type frame with a full-ring proximal brim. The silicone socket is secured to the distal cup of the frame by screws or by a specially designed coupling device. The silicone socket fabrication is quite similar to the ICEROSS socket fabrication. The socket is a compressive suction socket and is donned by inserting the residual limb, forcing all the air out. When doffing, the amputee inserts a finger down into the socket and lets air in to break the seal. Three TK, one TE, and two TA amputees are using this type of socket in Iceland.

Soft Tissue Supplement and Flexible Brim Socket Design for the Above the Knee Amputee, *Wayne A. Koniuk, C.P.*, 324 Divisadero Street, San Francisco, CA 94117.

Recently we have developed a technique using a cast ring of pure silicone to encompass the proximal four to six inches of the above knee socket. Each ring is individually manufactured for the patient to assure intimacy of fit. Thickness, shape, and duramater of the pure silicone can be precisely controlled without the often unwanted results created by vacuum laminating techniques, i.e., thinning over prominent areas. The control of pure silicone allowed some impressive possibilities: 1) thickening of the ischial seat to provide weight bearing comfort, 2) lowering of the anterior and medial walls to provide a truly elastic and flexible brim without the sharp edges commonly found using thin thermoplastics, and 3) torque absorption characteristics of the silicone are maximized because no base material (i.e., Dacron, nylon) is used in manufacture. The characteristics of pure silicone allow for improvements and address most of the problems found in the traditional quad socket design. The pure silicone ring may be used in combination with any of the new fitting techniques, including CAT-CAM and ISNY.

Feasibility of Improvement in Body-Powered Arm Prosthesis, *Maurice A. LeBlanc, M.S.M.E., C.P.*, Rehabilitation Engineering Center, Children's Hospital at Stanford, 520 Willow Road, Palo Alto, CA 94304.

Standard body-powered upper-limb prostheses have not changed significantly since the 1950's. They still employ aircraft technology using shoulder harnesses and steel cables for operation. Work is being undertaken to assess the feasibility of improvement in these prostheses. A survey of arm amputees and professionals has been conducted, which shows that function is clearly the most important feature for users, and uncomfortable harness and poor appearance are the most negative features. Testing of various force transmission systems has been completed which shows that a hydraulic system has some promise of providing higher efficiencies, reducing the forces on the harness, and allowing the control system to be buried in the prosthesis for better cosmesis.

Interviewing the Amputee: A Step Toward Rehabilitation, *Dee Malchow, R.N.*, Orthopaedic Department, Harborview Medical Center, 325 Ninth Avenue, Seattle, WA 98104.

The impact of an amputation will affect every aspect of a person's life. Those who work closely with the amputee will better understand the perspective of this individual with a thorough, well-conducted interview as illustrated in the format we have utilized. This will provide valuable insight into the areas of their life which are being affected most. It also serves as a key in establishing a positive rapport. The prosthetist, or other health care professional, who invests the time to identify the amputee's needs and concerns, demonstrates the sensitivity and caring which is greatly appreciated by the person as they attempt to adjust to the loss they have experienced.

Inteviewing the Amputee: A Step Toward Rehabilitation, *James D. Clark, Ph.D.,* The Clark Group, 5256 17th N.E., Seattle, WA 98105.

There is a need for better understanding and support for the amputee during this most severe of orthopaedic traumas. Given the wide range of emotional, psychological, and social problems inherent in the amputee's reaction to loss of a limb, it is important that orthotists and prosthetists recognize how much their own sensitivity to these problems is a crucial part of the care they provide.

Too often, orthotists and prosthetists avoid discussion about psychosocial adjustment issues with their parents. As a result, considerable guesswork is required to determine if the appliances that patients receive will actually be used by them. However, by skillfully interviewing patients about treatment issues that include psychosocial concerns, considerable time and energy can be saved by ensuring that the products given patients actually match their lifestyle needs.

The "Orthotic Arm": A Case Report, 1985 Article of the Year Award Winner from *Orthotics and Prosthetics; William D. Nancekivell, B.Ed., C.O.(C),* Chedoke-McMaster Hospital, P.O. Box 2000, Station 'A', Hamilton, Ontario, Canada L8N 3Z5.

Capitalizing on the Changing Orthotic and Prosthetic Marketplace, *Walter L. Racette, C.P.O.,* Vice President, Professional Services, Orthomedics, Inc., 2950 East Imperial Highway, Brea, CA 92621.

The changing medical consciousness has left many questions for the orthotic and prosthetic professional. This paper will discuss the potential availability of new markets for the profession as well as suggesting some necessary changes we will need to make to capture our share of the market. The paper will discuss the impact of prefabricating, the impact of other paramedicals doing orthotic/prosthetic care, and address the question of professional business compromise needed to make an impact.

Stress in the Medical Profession, *Dr. Norman Spencer,* 1963 Turk, San Francisco, CA 94115.

No abstract available.

Alcoholism: The Family Disease, *Carol A. Clayton,* Community Presbyterian Counseling Center, 222 West El Pintado Road, Danville, CA 94526.

Alcoholism affects approximately one out of 10 persons in the United States. That person in turn affects the lives of an average of four other people—relatives, employers, and friends. The difference between an alcohol abuser and an alcoholic is that an abuser, or problem drinker, knows that drinking causes problems in his personal relationships, job, etc., and he is able to stop the drinking when he sees the consequences. The alcoholic, on the other hand, will continue to drink regardless of the consequences and has great difficulty stopping. In order to cope with this devastating disease, family members take on certain survival roles: enabler, hero, scapegoat, mascot, and lost child. The person most affected is the spouse, called the co-alcoholic, or the enabler. As the disease progresses, the co-alcoholic's behavior changes drastically. While the alcoholic is in denial about his problem with drinking, the co-alcoholic is becoming more fearful, resentful, helpless, and preoccupied with the alcoholic's drinking. Both partners exhibit depression as well as physical and emotional deterioration. The spiraling destruction can be reversed once the family begins treatment and the alcoholic is motivated to abstain from drinking.

Alcoholism: The Impact on the Corporation, *William B. Smith, C.O.,* Knit-Rite,

Inc., 2020 Grand Avenue, P.O. Box 208, Kansas City, MO 64141.

No abstract available.

Burnout in Orthotics and Prosthetics, *Joseph Wanchik, C.O., O.T.R.*, Rehabilitation Institute, Inc., 261 Mack Blvd., Detroit, MI 48201.

The orthotist/prosthetist is a care-giver who spends a significant amount of time dealing with the physical and emotional problems of his clients. The results of his work must not only satisfy the client, but also the rehabilitation team, third-party insurance carriers, and governmental agencies. This intensity of involvement and the stress produced in providing quality orthotic/prosthetic service can lead to burnout. This condition is contrary to genuine caring commitment, creativity, and enthusiasm normally displayed by members of this profession. This paper will include a discussion of the symptoms of burnout, the factors leading to it, and some methods of coping with this condition.

Reviews

Home Care for the Chronically Ill or Disabled Child, Monica Loose Jones, Harper & Row Publishers Inc., 10 East 53rd Street, New York, New York 10022. Paperbound, 305 pages, index; $12.95.

The title of this book describes its contents perfectly. It even contains a chapter about dealing with death. Much of the book therefore, is beyond the purview of this review. It does contain material about adaptive equipment, orthotics, and prosthetics. Considering this portion of the book, it would seem that it would be appropriate and useful for a parent or other caretaker.

A practitioner heavily involved with such children might well find it worth reading so as to learn more about the problems encountered by the child and its parents. Further, he might well wish to have it available in the office as a resource.

The information about orthotics and prosthetics is general in nature and, while non-controversial, some practitioners might bristle about some of the material. An informed consumer that is ready to question and comment freely is not necessarily one with whom all practitioners are comfortable. The process is, however, necessary and well worthwhile. This book could well serve as an adjunct to the process of sitting down and discussing the use of an orthosis or prosthesis with the family.

Charles H. Pritham, C.P.O.

Reader's Forum

The following letters and responses refer to articles recently published in Orthotics and Prosthetics. *After receiving the letters from our readers, we felt that it was both enlightening and in the interest of fairness to give the authors an opportunity to respond. We encourage other readers who have comments, questions, additional information, or criticisms to write to Editor,* Orthotics and Prosthetics, *American Orthotic and Prosthetic Association, 717 Pendleton Street, Alexandria, VA 22314.*

The first letter concerns an article entitled, "Experience with the Scandinavian Flexible Socket," Vol. 39, No. 2, Summer, 1985, by Charles H. Pritham, C.P.O., Carlton E. Fillauer, C.P.O., and Karl Fillauer, C.P.O. The response is from Mr. Pritham.

Dear Editor,

I have read with interest your recent article, "Experience with the Scandinavian Flexible Socket," Volume 39, No. 2, 1985.

The authors have given a clear explanation of the indications for and fabrication of this popular technique. The background information they cited confirms that new materials often make old ideas worthwhile.

I noticed that their illustrations used exoskeletal prostheses to explain the fabrication. It is obvious that heat dissipation and proprioception would be at their maximum using this type of prosthesis.

In our laboratory in Minneapolis, we are requested to apply foam covers to endoskeletal prostheses which have the SFS style socket. This amounts to a fair amount of extra work, in that in order to have access to the prosthesis for service, a removable cover is needed which still provides cosmesis. That generally means covering the socket with the foam cover. A laminated sleeve to which the cover is bonded is fabricated over the interface and support strut.

This process could be made easier if the cover sleeve is fabricated earlier in the development of the prosthesis. Prior to removing and trimming of the support strut, a cover sleeve could be fabricated and saved for finishing. It could be used as a model for hollowing out the cover and then trimmed as necessary to allow stretching of the foam.

Using this system of fitting in combination with endoskeletal components leads me to wonder if the insulating effect of the cover decreases the amount of heat dissipation or disrupts proprioception. A sleeve which is fabricated late in the process and comes in direct contact with the flexible interface would certainly affect sitting and changes for muscle expansion expected from this design.

Is there any data being kept to compare the effects of endo versus exoskeletal prostheses and their effects on the benefits of this fitting technique?

Sincerely,
Larry Mott, Director
Otto Bock Central Fab. Dept.
Minneapolis, Minnesota

Dear Editor,

Thank you for the opportunity to respond to Larry Mott's letter of August 28. I have discussed the letter with Carlton Fillauer, C.P.O., and Robert Gilley, C.P., who is in charge of our prosthetics central fabrication department.

Mr. Mott in his letter raises a number of interesting questions and his suggestion about laminating the inner sleeve (to be applied to the soft foam cover) prior to trimming of the frame is well worth considering, if you use a rigid laminated inner sleeve to reinforce the cover.

It has been Robert Gilley's practice for quite a few years to reinforce foam covers with a layer of cotton stockinette glued inside the proximal cover with contact cement. The results as reported by our central fabrication customers have been quite satisfactory. This technique is used whether the prosthesis is endoskeletal or exoskeletal, S.F.S. or conventional.

We have not kept records of endoskeletal or exoskeletal construction and the effects of the two on the benefits to be accrued from the S.F.S. I know that amputees report

that S.F.S. sockets are cooler than conventionally constructed sockets, and the likely explanation for this is the difference in wall thickness and presumably a difference in heat transmitting ability. Quite frankly, this phenomenon puzzles me, for, as I understand it, by far and away the most effective means of surface cooling in the human body is evaporation of perspiration—a factor unaffected by wall thickness and the presence or absence of a foam cover. My personal opinion is that any differences in coolness results from psychological factors (a placebo effect), a fact that I never would suggest to a patient. If they are cooler and more comfortable for whatever reason, then more power to them!

Sincerely,
Charles H. Pritham, C.P.O.
Technical Coordinator
Durr-Fillauer Medical, Inc.
Orthopedic Division
Chattanooga, Tennessee

The second letter refers to "Orthoses and the Dynamic Knee: A Basic Overview," Vol. 39, No. 2, Summer, 1985, by Carrie Louise Beets, C.O., Frank Clippinger, M.D., Patricia E. Hazard, C.O., and David W. Vaughn, C.P.O. We asked Ms. Beets to respond.

Dear Editor,

In reference to the article entitled "Orthoses and the Dynamic Knee: A Basic Overview," which appeared in *Orthotics and Prosthetics*, Volume 39, Number 2, pp. 33–39, it should be noted that the TKS orthosis referred to on pg. 36 is improperly described.

1. TKS is an acronym for Three-way Knee Stabilizer, and,
2. carries a registered trademark which was omitted in the reference on pg. 36 (although properly indicated on the chart on pg. 39) yet, Teufel was listed as a registered trademark, which is incorrect.
3. The design description is incomplete, e.g., the proximal anterior band is pivotally attached, as is the posterior band.
4. The indications for the TKS orthosis listed on the chart on pg. 39 are incomplete, i.e., the TKS orthosis provides AP, collateral ligamentous, recurvatum, and varus/valgus control, in addition to those listed on the chart.

Please note that this orthosis was developed at the RIRM-NYUMC,* to which no reference has been made. I would request that the above information be brought to the attention of your readers.

Sincerely,
H.R. Lehneis, Ph.D., CPO
Director, Orthotics & Prosthetics—RIRM
NYUMC
New York, New York

Dear Editor,

For the practitioner who does not provide knee orthoses on a frequent basis, the recent proliferation of available orthotic designs for managing the knee can be frustrating and confusing. The article "Orthoses and the Dynamic Knee: A Basic Overview" was written as an orientation to the more common knee injuries encountered in an orthotics practice. The authors' intent was to present a logical method of determining the orthotic design needs of a patient based on the biomechanical deficit induced by an anatomical injury. Orthoses included in the article were presented as categorical examples. Therefore, the history and development of individual orthoses was not included. Dr. Lehneis' expectation that singular preference should have been given to the orthosis with which he is associated seems inappropriate.

The chart provided at the close of the article listed the TKS orthosis as providing M-L stability and recurvatum control. The indications listed were based on available literature. The manufacturer's brochure lists indications for the TKS as genu recurvatum and valgum/varum, with M-L stability mentioned in their more detailed explanation, and no mention of valgum/varum. The authors interpreted the val-

*Rusk Institute of Rehabilitation Medicine—New York University Medical Center.

gum/varum aspect to be the M-L stability discussed by the manufacturer. It was felt that due to the extremely short lever arm in the TKS system, the orthosis was not intended to attempt control of significant dynamic valgum/varum. Furthermore, in spite of Dr. Lehneis' assertions, the manufacturer's information does not include claims to providing anterior control. Likewise, neither is any reference made to the TKS providing collateral ligamentous control.

The omission in the description of the TKS of the proximal anterior band as pivoting was an editorial oversight and the authors do apologize for the error. The photo included in the article did clearly show the proximal pivoting anterior band.

As stated in the article, the orthotic designs and their intended applications were categorical in orientation. Continued improvements in existing designs as well as the many new designs becoming available make providing an exhaustive overview of available knee orthoses and their indications prohibitive, not to mention outdated, by the time of actual publication.

Carrie L. Beets, C.O.
Unversity of Virginia Dept.
of Prosthetics & Orthotics
Charlottesville, Virginia

The incorrect use of the trademark and inadvertent omission of same was in error. Orthotics and Prosthetics *regrets the error.—Ed.*

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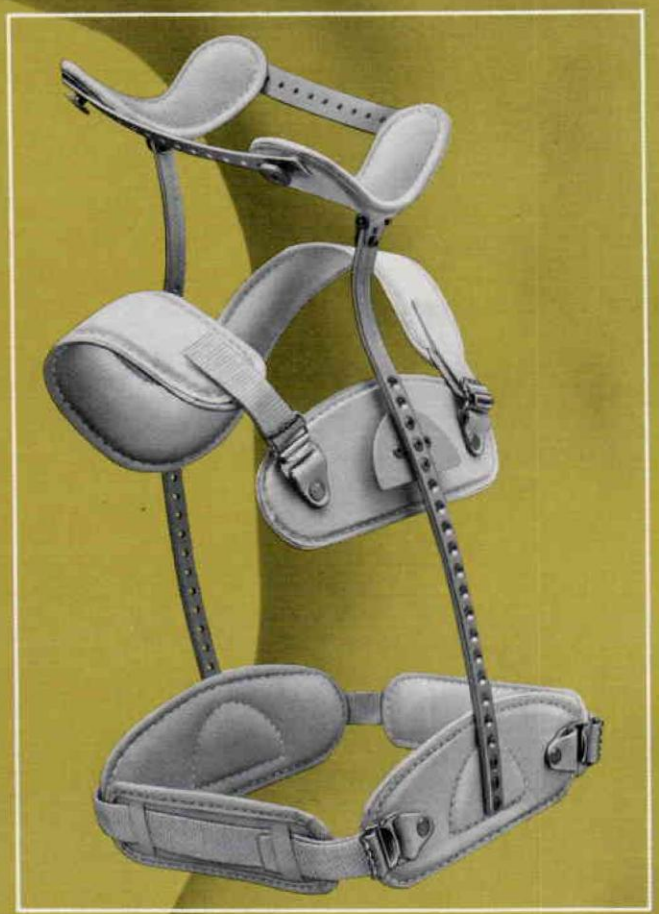

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Orthotics and Prosthetics, a quarterly journal published four times yearly by the American Orthotic and Prosthetic Association, 717 Pendleton Street, Alexandria, VA 22314, was available in 1985 at subscription rates of $24.00, $28.00, and $48.00 annually. The publication number is 412-420. The publisher, known office of publication, and general headquarters of the publisher—the American Orthotic and Prosthetic Association—are located at 717 Pendleton Street, Alexandria, VA 22314. The Editor is Lawrence R. Lange, CPO, c/o Orthotics/Prosthetics Department, Shriners Hospital for Crippled Children, 8400 Roosevelt Boulevard, Philadelphia, PA 19152. The Managing Editor is Christopher R. Colligan, 717 Pendleton Street, Alexandria, VA 22314. Full name and address of the owner of *Orthotics and Prosthetics* is the American Orthotic and Prosthetic Association, 717 Pendleton Street, Alexandria, VA 22314.

The average number of copies printed each issue for the past volume year was 4,112. Of these, 3,414 were distributed through mail subscription, and an average of 135 were distributed by other means, for an average total distribution of 3,549. An average of 563 copies were left over, used as office copies, or unaccounted. For the issue nearest the filing date (Vol. 39, No. 2), 3,900 copies were printed; of these, 3,596 were distributed through mail subscriptions, and 219 were distributed through other means. A total of 3,815 were distributed, leaving 85 copies left over or for office use.

I certify that the statements made by me above are correct and complete.

Christopher R. Colligan
Managing Editor
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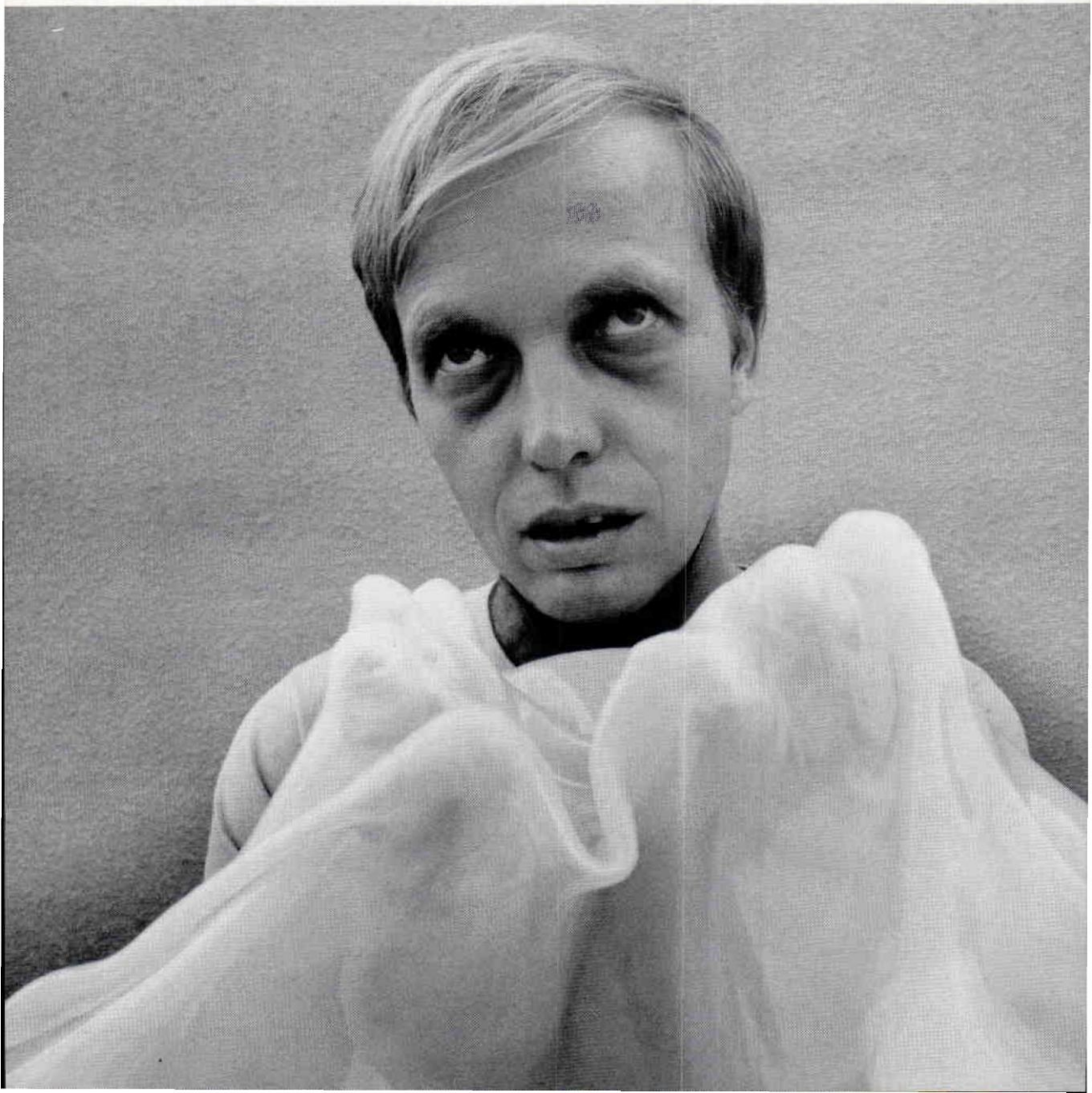

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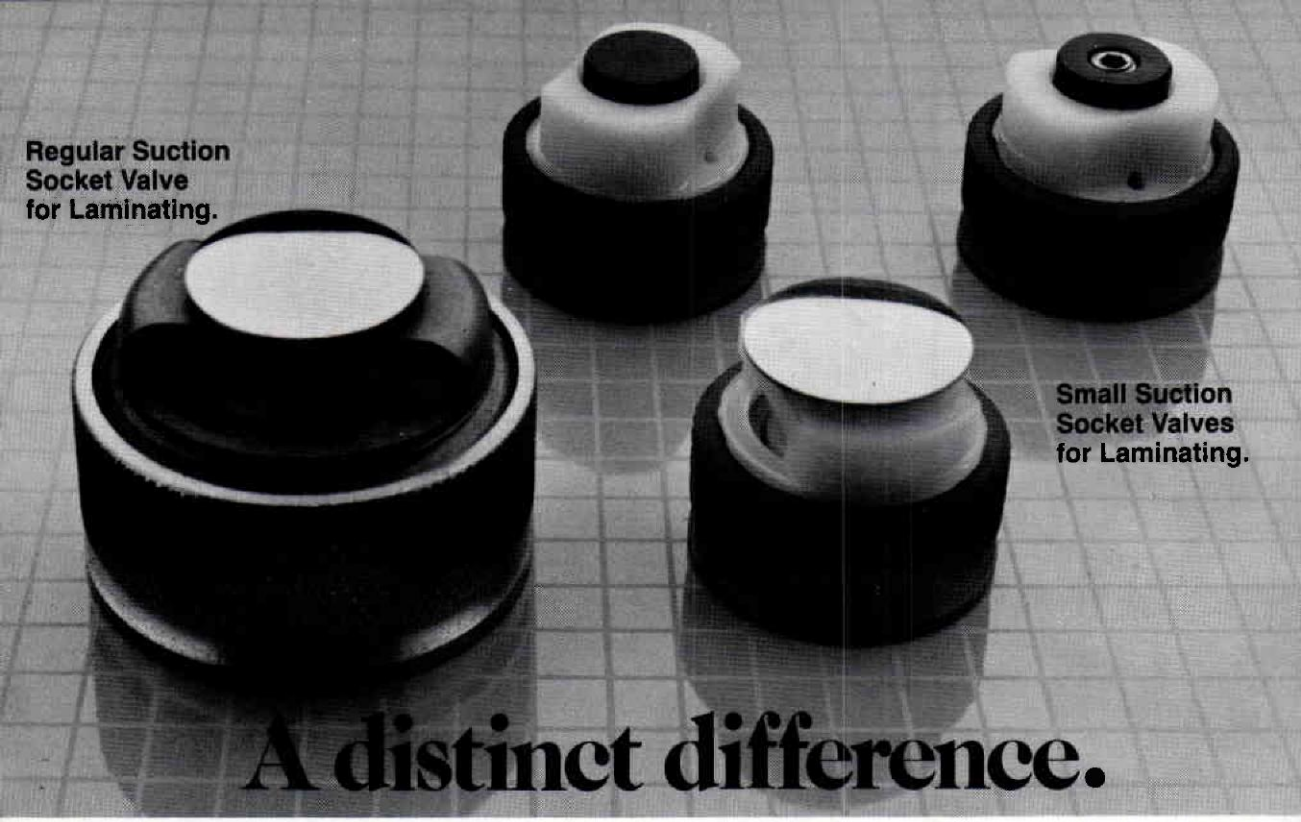
Number 4



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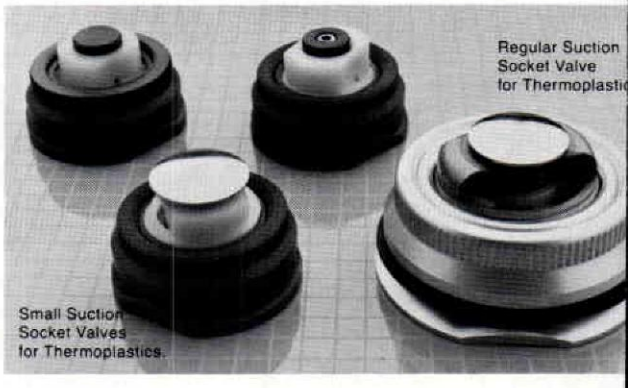

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A. SUBMISSION 60 DAYS PRIOR TO PRESENTATION. (If presenters or subject matter changes within the sixty days notify ABC directly.)

B. Time frames must be presented: *example—9:00 to 9:45* (in & out)

C. Brief description of subject matter.

D. Along side of, or under the presenters, his or her credentials.

E. What categories they are applying for Continuing Education Units in: *example—Scientific, Business, etc.*

Comments

_____

_____

_____

_____

For Official Use Only

Course received late: Yes ☐ Date Received _____ No ☐

Course Approved: Yes ☐ Date Received _____ No ☐

If Disapproved or Number of Credit Units Reduced, Please State Reason(s).

_____

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_____

Received in National Office: _____.

Sent Committee: _____.

Final Committee Action: _____.

_____ _____

Signature Date

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A four master might not get all the wind, but she sure gets her share. If, while sailing, you ever had one of these tall ships pass you upwind, you haven't forgotten how calm it became while your air was blocked. Under way, she's one of the magnificent sights on the ocean blue.

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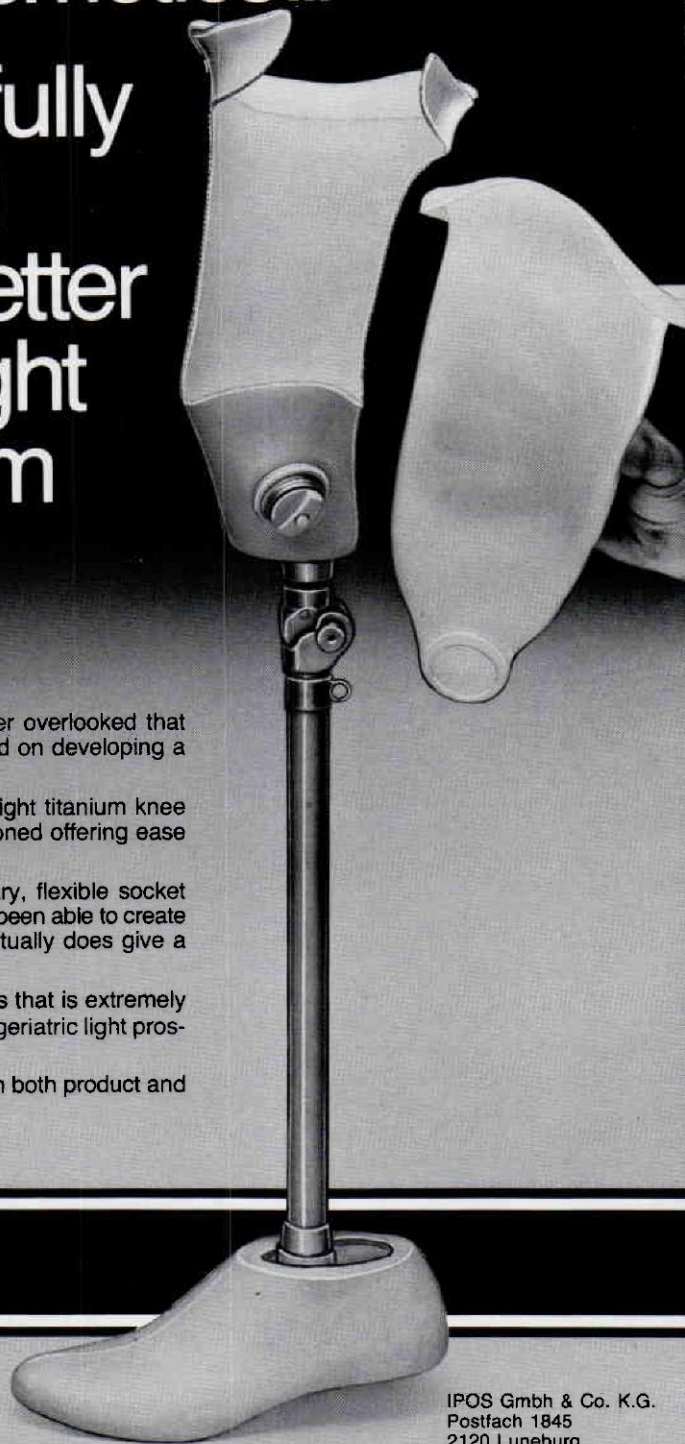

Sure, cosmetics are important and we have never overlooked that aspect, but all of our research efforts have concentrated on developing a better technology for prostheses fabrication.

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TO: PERSONS WORKING IN REHABILITATION

FROM: SIEGFRIED PAUL, CPO(E), SCIENTIFIC PROGRAM CHAIRMAN

RE: CALL FOR CONTRIBUTED PAPERS FOR THE 1986 ASSEMBLY SCIENTIFIC PROGRAM

The American Orthotic and Prosthetic Association's 900-plus membership consists of firms involved in the design, manufacture, and fitting of orthoses and prostheses. The primary objective of AOPA is to promote high levels of orthotic/prosthetic patient care services to the orthopedically handicapped. To aid in achieving this goal, each year the Association provides a forum, via its annual National Assembly, for orthotics and prosthetics professionals to share information on the many new ideas and/or concepts of or relating to orthotics/prosthetics. Nearly everyone working in orthotics and prosthetics in the United States attends the Assembly, along with many professionals from abroad. The 1986 Assembly will be held at Marriott's Orlando World Center, Orlando, Florida, November 4–9, 1986.

AOPA invites all interested persons to submit an abstract(s) for presentation during the Assembly's Scientific Program. The subject(s) for the abstract(s) should be new ideas, techniques, devices, and/or research that have a practical application in orthotics and prosthetics or a related field. Interested persons are invited to submit more than one abstract. Most presenters will be given 15 minutes for their presentation.

If you are interested in participating in the 1986 Assembly, please complete the abstract form on the reverse and return it to the AOPA National Headquarters no later than March 31, 1986.

Don't hesitate! Do it now and be a part of one of the major rehabilitation education meetings of the year!

Thank you.

AMERICAN ORTHOTIC AND PROSTHETIC ASSOCIATION ABSTRACT GUIDELINES

START THE ABSTRACT TITLE HERE USING *CAPITAL LETTERS*. Follow with authors' names, *Business Addresses, Zip codes*. Underline *Speakers'* Name.

Leave a space between heading and abstract proper. Indent as shown. Keep all lines as wide as possible without touching or going beyond the lines at either side. Keep the text in one paragraph. If literature citations are needed, insert them in parentheses and not as footnotes. Credits, if any, should be added at the end of the abstract, but not as a new paragraph. Before submitting your abstract, check format, nomenclature, and spelling.

AOPA National Headquarters
717 Pendleton Street
Alexandria, VA 22314
U.S.A.

American Orthotic and Prosthetic Association
ABSTRACT FORM

TITLE OF PAPER:

AUTHORS:
(Underline speaker)

ADDRESS (Include Zip Code):

PHONE:

OCCUPATION:

___ Orthotist	___ P.T.	___ M.D.
___ O.T.	___ C.P.O.	___ Other (Specify)
___ Prosthetist	___ Engineer	

AUDIOVISUAL REQUIREMENTS:

___ 35mm slides
___ Overhead projector
___ 16mm sound movie
___ Other (Specify)

ABSTRACT: Maximum of 200 words or equivalent. Include Title of Paper, Authors' names, Addresses with zip code. Use single space typing. Use full width of ruled area.

MAIL ABSTRACT TO: AOPA National Headquarters
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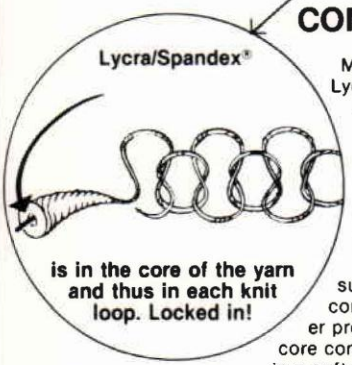
THE KNIT-RITE
STUMP SHRINKERS

TAPER KNIT
Full Fashion Like A
Prosthetic Sock
To Provide
Proportioned Compression

TWO TAPERS
Regular and Double

TWO COMPRESSIONS
Medium and Heavy
3 Widths and
3 Lengths



UNIQUE CONSTRUCTION

Made from Avril® rayon Lycra/spandex® core yarn. Softer, more comfortable, easy to put on and may be machine washed/dried, (Warm temperature, **no bleach**).

The full fashion, taper knit, construction insures proportion fit and compression, with greater pressure distally. Use of core construction yarn results in a softer fabric, better fit and permits stretch over the compression range. The Knit-Rite Stump Shrinker better accommodates irregularities and may be tailored or altered to meet special fitting problems.

BK STUMP SHRINKERS

REGULAR TAPER

P/C	Pressure Weight	Width	Flat Meas. Toe	Flat Meas. Top	Fits Cir. Toe	Fits Cir. Top	Length
2HP-HRN-10 12 14	Heavy	Narrow	3"	5"	9-11"	13-14"	10" 12" 14"
2HP-HRM-10 12 14	Heavy	Medium	4"	6"	12-14"	15-17"	10" 12" 14"
2HP-HRW-10 12 14	Heavy	Wide	5"	7"	15-17"	18-20"	10" 12" 14"
2HP-MRN-10 12 14	Medium	Narrow	3"	5"	9-11"	13-14"	10" 12" 14"
2HP-MRM-10 12 14	Medium	Medium	4"	6"	12-14"	15-17"	10" 12" 14"
2HP-MRW-10 12 14	Medium	Wide	5"	7"	15-17"	18-20"	10" 12" 14"

*Mid-Width on: 10" Length: 7" upper 3" lower
12" Length: 7" upper 5" lower
14" Length: 7" upper 7" lower

DOUBLE TAPER

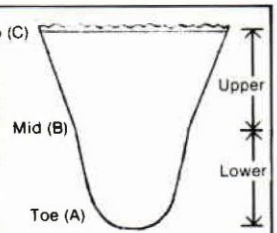
P/C	Pressure Weight	Width	*Flat Meas. Toe	Mid	Top	Fits Cir. Toe	Fits Cir. Top	Length
2HP-HDN-10 12 14	Heavy	Narrow	3	3.5	6"	9-11"	15-17"	10" 12" 14"
2HP-HDM-10 12 14	Heavy	Medium	4	4.5	7"	12-14"	18-20"	10" 12" 14"
2HP-HDW-10 12 14	Heavy	Wide	5	5.5	8"	15-17"	21-24"	10" 12" 14"
2HP-MDN-10 12 14	Medium	Narrow	3	3.5	6"	9-11"	15-17"	10" 12" 14"
2HP-MDM-10 12 14	Medium	Medium	4	4.5	7"	12-14"	18-20"	10" 12" 14"
2HP-MDW-10 12 14	Medium	Wide	5	5.5	8"	15-17"	21-24"	10" 12" 14"

Select proper size according to distal circumference of stump; then select proper taper (Regular or Double) of Stump Shrinker, according to proximal circumference.

**DOUBLE TAPER

Fashion knit, with gradual taper distally, flaring to a wide top. Flat widths are expressed as toe/mid/top in the size chart. The mid-point flat width of the "Double Taper" model is slightly less than the corresponding mid-point flat width of the regular taper model.

The length of the upper portion of all lengths of "Double Taper" socks is 7 ". The length of the lower portion is 3", 5" or 7" on the 10", 12" and 14" length socks respectively.



Sight Taper Distally (Lower Portion)

CAUTION: Compression proximally should not be greater than compression distally.

TWO PRESSURES—

Heavy compression (green top) exerts 25-30 mm Hg pressure at 50% stretch for reduction of edema and shaping of stump.

Medium compression (gray top) exerts 10-15 mm Hg pressure at 50% stretch for tender stumps, nighttime wear and stump size maintenance.

50% Stretch is Required to render the desired compression of 25-30 mm Hg for the heavy weight Green Top or 10-15 mm Hg for the medium weight Gray Top. 50% stretch is calculated as follows for 3" Toe (flat) Width: 3" x 2 = 6" (Relaxed Circumference). The 6" x 50% = 3" of stretch. In this example the distal circumference of the stump should be in the range of 9" to 11" to insure proper compression by the stump shrinker. Top (proximal) circumference should fall within the 30% to 50% stretch range. Top stretch percentage should not exceed the toe stretch percentage. The sizing chart sets out the toe and top "fit range".

FOR SPECIAL SOCKS: Send Measurements:

BK: 1 inch from distal end_____; 3 inch from distal end_____; 6 inch from distal end_____; top_____ length of stump_____ Length of sock_____

AK: 1 inch from distal_____; 3 inch from distal_____; 6 inch from distal_____; waist_____; length distal to groin_____; length distal to waist_____

2HP-HBK-SP BK Stump Shrinker, Heavy Pressure, Special
2HP-MBK-SP BK Stump Shrinker, Medium Pressure, Special

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