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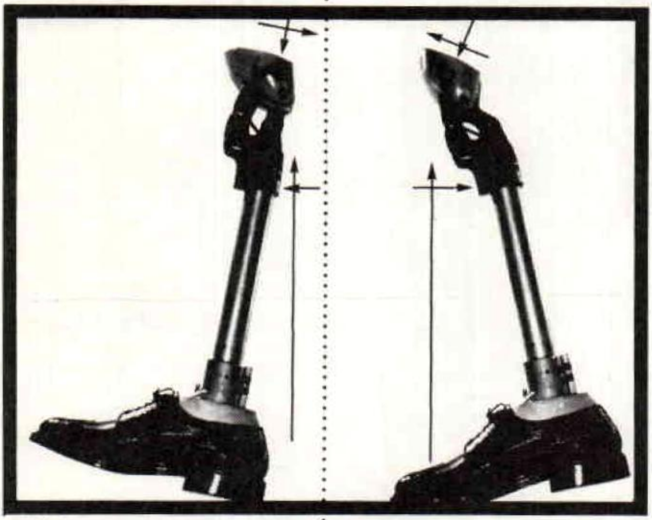

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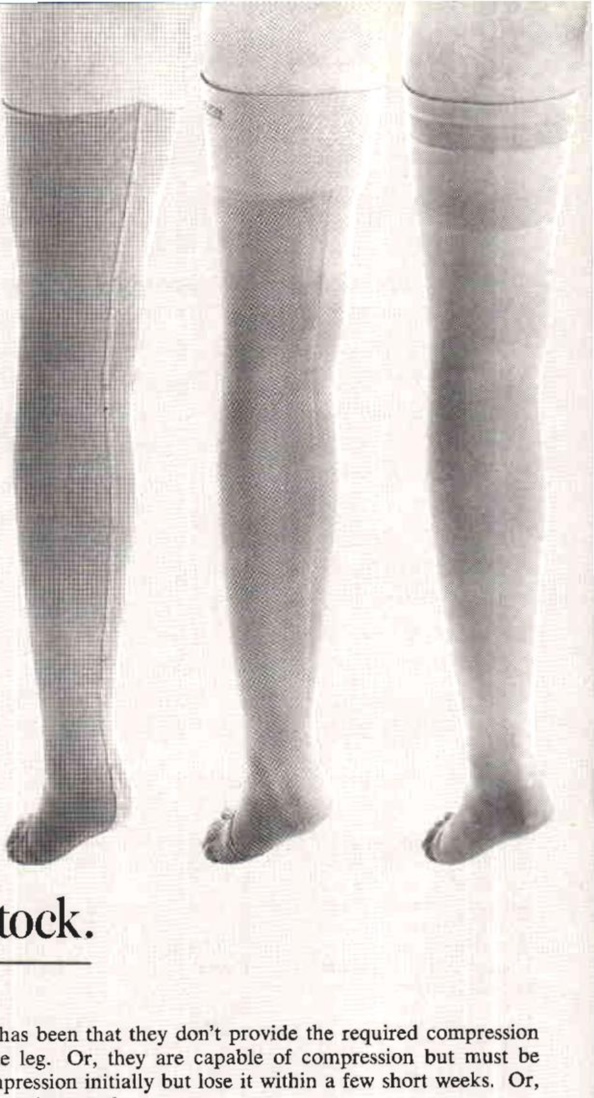

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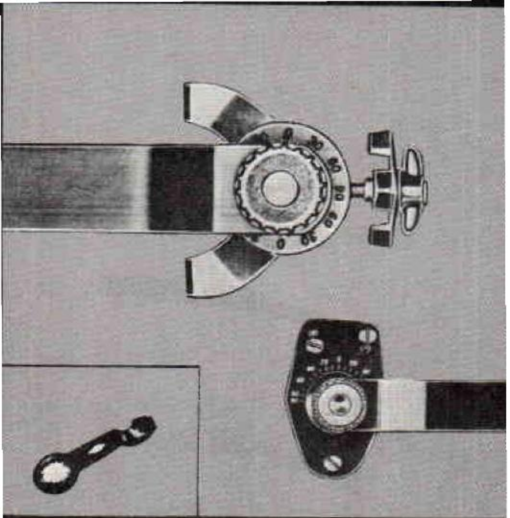

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EDITORIAL

What is the Role of the "Restorations Prosthetist" In Rehabilitation?

Appearance is important to most people—men and children as well as women. It is infrequently discussed in clinics but is frequently in the minds of patients.

People in need of cosmetic restoration include amputees, various orthotic patients, women with mastectomies, those with facial disfigurements, and many others. Whether it is minor such as a missing finger or major such as a missing arm, successful cosmetic treatment enhances body image and makes people happy.

To provide acceptable cosmesis is a difficult job, for it includes not only static appearance but how something looks in motion and how it feels, sounds, and smells. An artificial eye is much more effective if it moves with the good eye. An upper-limb prosthesis appears much more natural if it swings, feels soft, and makes no mechanical clicking noises.

By and large, most of the prosthetic and orthotic facilities are more occupied and better trained to provide functional restoration rather than cosmetic restoration to patients with artificial limbs and braces. There are several maxillofacial centers whose work involves facial buildups and replacements of the nose and ears; most are related to dental schools and clinics. Twelve Veterans Administrations hospitals and the VA Prosthetic Center provide cosmetic care for VA patients. And finally, there are a small number of individuals practicing privately to provide cosmetic service.

One manufacturer supplies most of the gloves, leg covers, and maxillofacial materials being used. This manufacturer has repeatedly tried to avoid dealing directly with patients. The company has given courses, written instructions, and provided kits to allow cosmetic work to be done in the field. However, so many people in the field are so busy providing function and just trying to stay abreast of new developments that they neither have the time nor desire to do the rather meticulous and time consuming work of providing cosmesis. The result is that many patients end up knocking at the manufacturer's door or being shuffled to the few people around who perform this service. In general, the present situation seems to be that patients are obtaining cosmetic treatment one way or another, but that more can be done for more people.

The "restorations prosthetist," or "anaplastologist" as coined by Mr. Peyton Massey, is an individual who provides cosmetic restoration service for patients. There are only a handful of them yet there are many patients who can benefit from this "added" service. In many respects, he is to rehabilitation as the industrial designer is to household products; he beautifies the product and enhances its use for the consumer.

Why not put the restorations prosthetist in the rehabilitation center so his services are available to patients as part of a comprehensive treatment program? He would certainly get referrals from prosthetic, orthotic, dental, and eye clinics and from various surgeons. It probably would not be a large service in numbers but could be a very important one.

There was a Negro man who refused his below-elbow prosthesis three times under the guise of mechanical difficulty until someone had the idea of making it a shade lighter in color. There are several young post-polio girls with atrophied legs who walk more confidently now with leg buildups. There are people with prosthetic eyes, noses, and ears who can at least face the public even though function has not been restored. These things are what the restorations prosthetist can do.

If the discipline of "anaplastology" were added to the rehabilitation center, it would help to bring together the scattered efforts in cosmetic restoration; it would relieve many prosthetists, orthotists, and dentists of work they would just as well not bother with; and it would give a big psychological boost to patients in serious need of it. And if it were really successful, a new allied-health specialty could be developed with its own education, training, and qualification program. It seems like a possibility at least worth exploring.

MAURICE A. LEBLANC, C.P.
Committee on Prosthetics
Research and Development
National Research Council

Prosthetics Considerations for the Female[1]

Mary S. Dorsch, C.P.O.[2]

I am very happy to have been invited to participate in this symposium on patient management. I do feel that this is an area that has been completely neglected in our professional thinking. In striving to perfect the technology, we have forgotten the patient—and above all—the FEMALE patient. It has been said that there is no difference between the male and female patient. Well, to that, I say 'Vive Le Difference', and will discuss now the problems of the female patient.

To all men, women are an enigma, but no greater problem has any man, than one who must try to rationalize amputation to a female patient. Understanding of the emotional and physical problems of the female patient can influence her adjustment and acceptance of the prosthesis. In many instances, we may eliminate some of the problems by approaching the situation with a little more finesse and better understanding.

One of the very important things that we must not do—that is not to de-personalize the patient. Do not label her—do not call her 'an above-knee amputee' or 'a below-knee amputee' or a 'hip-disarticulation' case. There is no need for that because the patient is a whole being, and it is very important to consider this. Total rehabilitation requires planning by the entire team, beginning with the surgeon and terminating with the fitting of the prosthesis.

The following considerations will be a great help to the patient and to the members of the team. First, a

1 This paper was presented at the Amputee Management Symposium sponsored by the Amputee Center, Rancho Los Amigos Hospital, University of Southern California, in association with the American Academy of Orthotists and Prosthetists and the National Academy of Sciences, March 20-22, 1972.

2 109 East 29th Street, New York, N.Y. 10016.

woman is a woman, then a patient. Any indication that she is considered only an 'amputee' would be an emotional and psychological setback to her vanity. The physician, in trying to alleviate the initial shock of the amputation, will describe the subsequent prosthesis in such a manner that the prosthesist cannot meet the mental image in the patient's mind. Although the modern prosthesis is an excellent substitute, functionally and cosmetically, for the missing member, there are limitations within which the prosthetist must work.

In my conversations with physicians, many have told me of their unawareness of new developments in our profession. Therefore, I firmly believe that the prescription for a prosthesis should be a cooperative venture between the physician and the prosthetist. The physician being responsible for the medical aspects, the fitting or fashioning of the prosthesis is the responsibility of the prosthetist, and that is where his or her expertise will prevail.

Psychological setback is seen in some surgeons as well as in the patients. And it may surprise you to learn that some surgeons equate amputations to death. (They are not alone in this feeling as insurance companies equate double amputations to death.) However, with immediate post operative fitting procedures, as well as early fittings, I do believe a closer follow-up by the surgeon will relieve him of this frustration and help him to realize he has given the patient the ability to return to being a normal human and leading a useful life.

Many of us in the profession rarely stop to consider the mental image our words convey. Try not to use the word 'stump' which is a degrading and painful word. It has been said that a picture is worth a thousand words, and yet, there are just two words that conjure up most gruesome pictures to persons who have lost limbs. It is our responsibility to replace these words, as well as the limbs. The words are 'amputee' and 'stump'. While these words affect men severely (although they are supposed to be the hardier of the species, in spite of the Women's Liberation Movement), the loss of a limb becomes a traumatic experience to a woman, and not only for vanity's sake.

Little girls are likely to have fewer anxieties and vanities, so they are just great to work with. However, when you go into the teen-age stage, you really have a problem in their manner of dress and how their friends, male and female, are going to accept them.

Then from the teen-ager, we go into the adult stage and you have a young woman who is planning courtship, marriage, and motherhood. There are many problems to be considered at this stage. I wonder how many doctors or prosthetists here have had a young girl request your advice regarding pregnancy. The first trimester does not present too many problems, but during the second trimester, adjustments for comfort and control are necessary. I feel that we should be more aware of these very personal situations, and, of course, we should have the answers.

The below-knee prosthesis presents little problems. However, prostheses for higher amputations and hip disarticulation cases require adjustments to suspension and refashioning of the socket in the anterior aspect, with perhaps a leather replacement from time to time until confinement.

At the time of confinement, the prosthesis should remain on the patient, as this will permit better positioning on the delivery table and also comfort the patient both physically and mentally.

Now, as you consider higher levels of amputations, this will have to be evaluated by the obstetrician.

We are in a great era regarding clothes for the females—the skirts are long—pant-suits are in—and the shoes are great. However, speaking of shoes, do fit the young ladies, and the not-so-young ladies, with several feet at the initial fitting—that is, high heel, low and flat heels. This will eliminate a bilateral frustration. They will have a selection of shoes and you will have a happier patient, one who is satisfied because she realizes that you fully understand her situation.

I respect whatever procedures you prefer—that is the immediate post-surgical procedure—or a rigid dressing with early fitting—as long as the patient leaves the hospital wearing a preparatory prosthesis with good cosmetic effect. This is true for lower limb cases as well as for upper limb cases. We have been fitting modular prostheses for upper extremities for the last thirty years. The interscapulothoracic amputation is very disfiguring, and a prosthesis should be fitted before the patient goes home.

The measurement and cast can be made prior to the amputation, and final fitting can be carried out when the sutures are removed.

We advise that you fit the patient with an interscapulothoracic joint as well as a complete prosthesis. When relaxing at home this arrangement will be a little more comfortable and will give a better cosmetic effect since it supports clothing in a presentable manner.

I sincerely hope what I have said will answer some little problems you may have. I also hope it will arouse some questions.

In closing, keep this in mind, please—limbs suggest parts of beautiful trees as well as bodies, and in a measure block out the horrendous bloody picture of a sawed off part of one's body. Trees lose limbs through storms or judicious pruning, yet we never refer to a tree as having an amputation. Treat patients as gently with words as you do with your actual treatment.

Try hard—Thank you.

Experience With the Stuttle Spinal Brace

Paul Campbell, M.D.[1]

The problem of lumbosacral disease is universal after the age of twenty, and a fairly high percentage of those involved at one time or another require orthopedic management. Most of these patients can be controlled without bracing, but a signicant percentage have enough instability or degenerative changes in the "low back" to require the use of external support.

The history of back bracing goes back many centuries but became somewhat scientific approximately only about a hundred years ago with the development of the Taylor "Spinal Assistant" (Fig. 1 & 2). The Taylor brace is effective and is still used commonly. Various modifications have been made including the Knight and Goldthwait braces. A shorter version that extends only to the lower thoracic region is the most commonly used modification, called either a chair-back brace or cage brace. Another commonly used brace that produces hyperextension is the Jewett brace. All of these devices are rigid in construction and attempt to immobilize the lumbosacral region by grasping the pelvis below and a portion or all of the thoracic regions above by encirclement of the chest. All of these braces are ineffective to some degree because the pelvis cannot be grasped adequately to prevent motion in the sagittal plane of the two lower joints in the lumbosacral spine in movements like sitting and bending forward from a standing position.

A definitive study of these types of braces was made by Norton and Brown in the early fifties (1). A few of their comments are worth repeating because they elucidate this problem. They stated that the effective-

[1] Portland Orthopedic Clinic, Portland, Oregon.

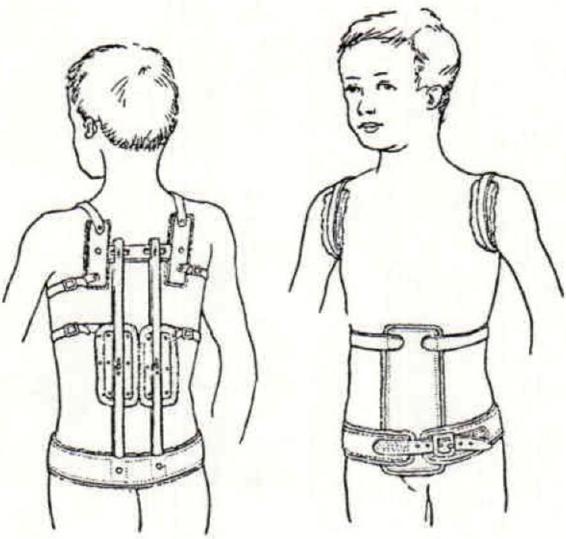

Figure 1
The Taylor "Spinal Assistant" (from 2).

ness of a brace is related to the patient's comfort in using a brace. In other words, a brace that is uncomfortable in use will not be effective because it will not be worn snugly enough to be effective. They further commented that "if the object of treatment is to immobilize the lumbosacral spine, either sitting must be avoided or the apparatus must be effective in the sitting position." Since our culture involves sitting in most of our daily activities including eating, transportation, working and recreation, it is obvious that an effective brace must function in the sitting position. It is in this position that the rigid braces mentioned before are ineffective because they are unable to adjust to the change in relationship between the pelvis and spine when the position of sitting is changed to standing. The third comment that is pertinent is, "It seems highly unlikely that any device applied to the exterior of the body can effectively splint the lumbosacral region." This is the significant problem facing those prescribing or making "low back" braces.

In an attempt to solve this problem Williams developed a functional brace incorporating a hinged bar as the fixation device across the lower thoracic spine region and a fixed bar beneath the buttocks with the third point of fixation being a broad apron across the abdominal region. (Fig. 1 & 2). The hinge in this brace allowed it to accommodate to the changes in posture from the standing to the sitting position, maintaining the lumbosacral and the L4-5 joints in a flexed position throughout. The Williams brace incorporates lateral uprights to prevent rotation and lateral bending, thus affording the maximum degree of rigidity while still allowing essential function.

Experience with the Williams

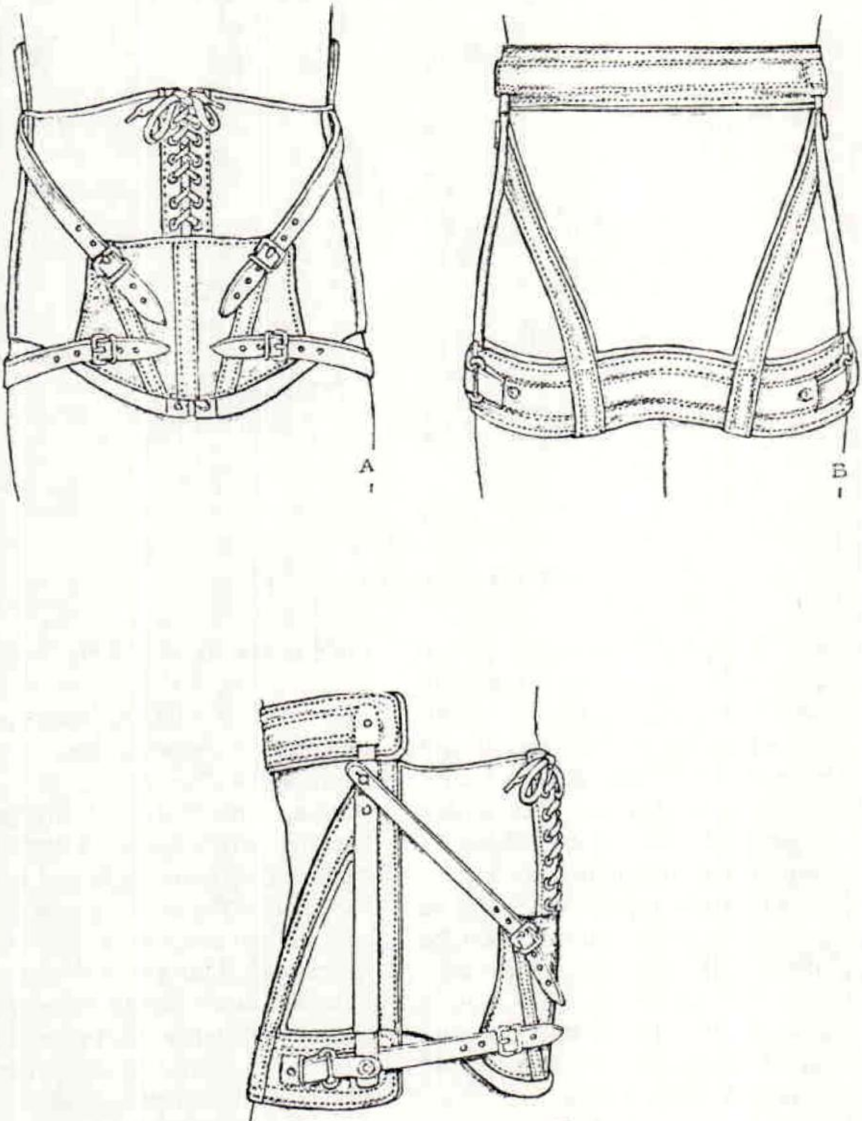

Figure 2
The Williams Brace (from 2).

brace was disappointing in that the patients complained of pressure in the lower thoracic spine region and tended to either wear the brace too loosely or to discontinue its use against advice. Occasionally a patient would return with the brace applied in an upside down position stating that despite the fact the brace did not fit too well in such a position, it was more comfortable and could be tolerated better in an upside down position. Our practice was to admonish the patient to wear the brace properly and to follow the instructions of the surgeon and orthotist.

Dr. Fred Stuttle of Peoria, Illinois, evidently had similar experience with patients, but was wise enough to listen to the patients and to respond to the strong hint that perhaps improvements in the design of this brace were possible. It was a very simple modification to change the arrangement of the posterior bars so that the hinged bar was placed across the well-padded gluteal region and the fixed bar across the less protected lower thoracic spine area. No other significant modifications were made to the Williams brace by Stuttle who presented his version (Fig. 3) in a scientific exhibit at the 1962 Annual Meeting of the American Academy of Orthopaedic Surgeons. Because of the obvious advantage in function of the Stuttle brace compared to the Williams design, we adopted this brace for use in our clinic.

For the last ten years we have used more than 700 Stuttle braces and are continuing to use approximately three each week for treatment of low back disease. Minor modifications in design have been made by our chief orthotist, Mr. Dale Butler, but the essential functional ele-

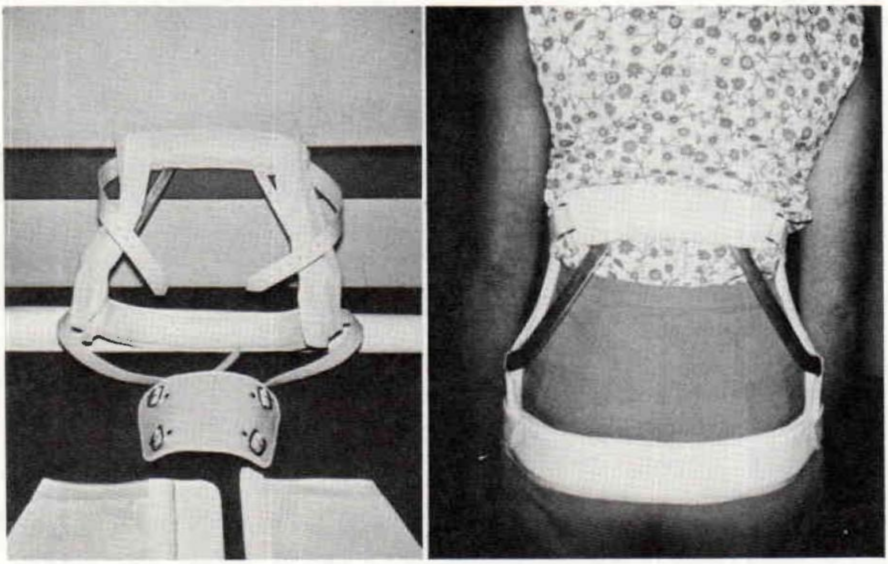

Figure 3
The Stuttle Brace.

ments as first devised by Dr. Williams and modified by Dr. Stuttle have not been changed. Patients almost uniformly tolerate this brace well and continue to use it as long as prescribed. In fact, occasional patients have continued to use the brace even after they were advised to discontinue it because they felt more secure with the brace and could see no reason to discontinue it. There have been no serious complications in using the brace and only occasionally have patients been bothered with irritation of the lower lumbar spine requiring a more rigid type of fixation. This brace is not effective in treating the upper lumbar spine area; it is only effective for the lower two joints of the lumbosacral spine. These two joints are normally hyperextended owing to the pelvic tilt, and thus are best protected by bracing in flexion, because straightening the lordotic curve lessens the sheer component of the forces applied.

We do not consider this brace as corrective of postural abnormalities even though it has been recommended for such use. This brace functions by immobilizing the spine in a flexed position, but does not carry a spine into a greater range of flexion than was possible prior to the application of the brace. The immobilization in a flexed position has the added advantage of tending to open the intervertebral foramina when used for immobilization to achieve spinal fusion, thus affording maximum room for the nerve roots to pass from the spine. The fact that this brace acts to maintain flexion of the lumbosacral spine in all body positions helps it achieve maximum immobilization as the patient's posture changes from standing to sitting and vice versa. It is obvious that the less sitting a patient does while wearing the brace, the less motion will occur at the involved joints and so our instructions to patients in whom we hope to achieve spinal fusion is "avoid sitting as much as possible during the immediate postoperative period."

CONCLUSION

We have such confidence in the efficacy of this type of low back brace that we use it for many types of diseases of the lumbosacral spine region where immobilization in a functional position is indicated. Where less stringent support is required we still use a canvas type of low-back support, usually incorporating a pad to fit into the lumbar lordosis. Occasionally for compression fractures in this region we use a hyperextension brace or a Jewett type of back brace. For all other conditions requiring external immobilization, the Stuttle brace is our choice. Specifically we use this brace after spinal fusions, after lumbosacral laminectomies, or for those patients treated conservatively who require more rigid support than the reinforced canvas support can afford.

It can be concluded that a brace to immobilize the lumbosacral spine will be effective only if it is firmly applied, only if it is used continuously, and only if it is tolerated long enough to be effective. We believe that the Stuttle modification of the Williams flexion brace makes it possible for these requirements to be fulfilled.

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Fabrication of the Stuttle Spinal Orthosis

Dale O. Butler [1]

In 1962, Dr. Fred Stuttle presented to the American Academy of Orthopaedic Surgeons a new concept of flexion-type spinal orthoses, utilizing the true Williams pattern of back bracing, but reversing the thoracic and pelvic band and placing the pelvic area where pressure is more easily tolerated, and less pressure in the lower thoracic area where there is very little natural body padding and where even slight pressure is difficult to accept. (Refer to the preceding article by Campbell.)

Dr. Paul Campbell of the Portland Orthopedic Clinic was favorably impressed with Dr. Stuttle's presentation, and upon his return to Portland from the Academy meeting took immediate steps to make this orthosis available for trial.

A working model of the Stuttle orthosis was obtained from Plattner Orthopedic Appliance Company of Peoria, Illinois, the facility which makes Dr. Stuttle's orthoses.

Since 1962 the Portland Orthopedic Clinic's Orthotic Facility has produced several hundred of these orthoses with great satisfaction to the patient, gratifying results to the orthopedic surgeon, and few problems to the orthotist.

MATERIAL

The basic metal used is 20-24-T4 aluminum. The pelvic and thoracic bands are cut from sheet stock .080 thick. The two lateral uprights which extend from the end of the pelvic band upward to within half the width of the thoracic band are one-eighth inch by three-fourths inch 20-24-T4 aluminum bar. The two posterior uprights are attached to the lateral uprights three inches from where the lateral uprights are attached to the pelvic band.

[1] Chief Orthotist, Portland Orthopedic Clinic, Portland, Oregon.

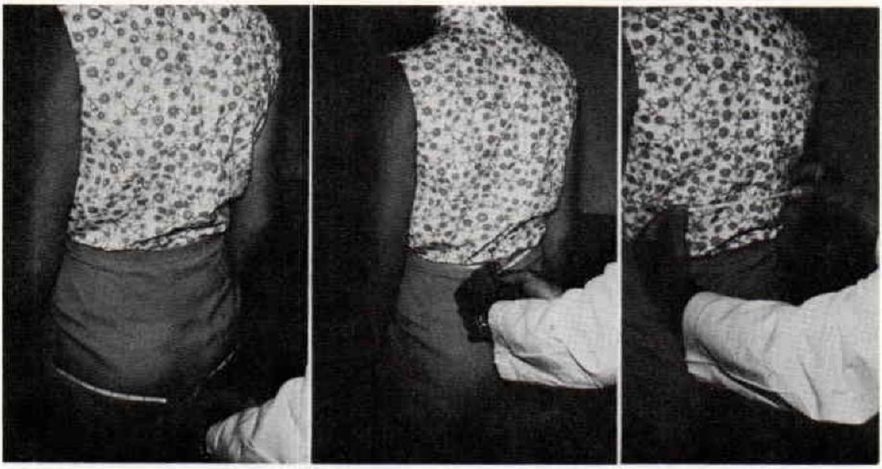


Figure 1
Measurements Required for Fabrication of the Stuttle orthosis.

FABRICATION PROCEDURES

Procedures for fabrication of Stuttle orthosis are given below.

Measurements needed are:

1. Circumference around hips at the level of the greater trochanters (Fig. 1, left).
2. Circumference around waist just above crest of ilium (Fig. 1, center).
3. Length of thoracic band—this band should be only long enough to bear pressure on the flat surface of the back. It should not extend around the rib cage (Fig. 1, right).

The pelvic band (Fig. 2, left) as a rule will vary in length between twenty inches for a very large person to sixteen or seventeen inches for smaller individuals. The length of the

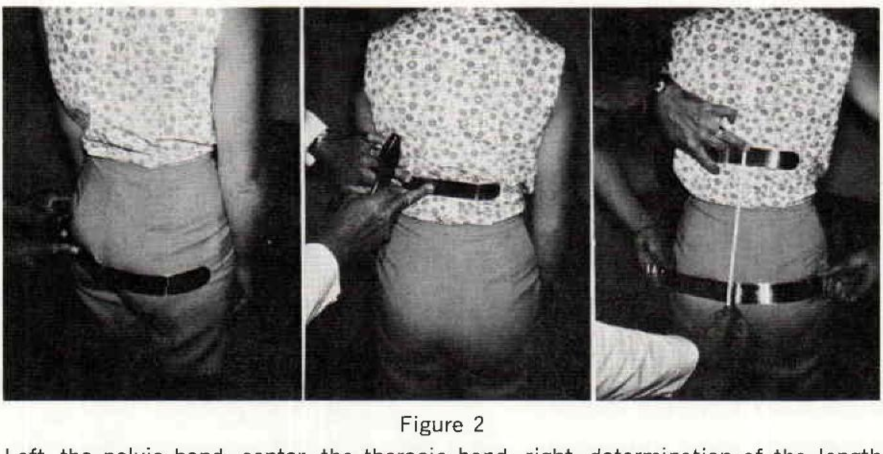


Figure 2
Left, the pelvic band; center, the thoracic band; right, determination of the length of the orthosis.

pelvic band is easily determined. It extends around the hips at the greater trochanter level, but must not touch or exert any pressure on the greater trochanters. Straps, of course, do extend around and over the area of the greater trochanters without any problems, but the pelvic band must not exert any pressure on the greater trochanters.

The thoracic band (Fig. 2, center) is never longer than 11 in., the average being between 9 and 10 in. Iron wagon head rivets 3/16 in. dia. are used to fasten the joints, one rivet at each joint, in such a manner as to provide free motion.

Length of the orthosis is determined by measuring from the lower side of the pelvic band to the upper side of the thoracic band. The thoracic bands should always extend to the T11 level and should, if possible, extend to a point between the T9 and T10 levels (Fig. 2, right).

It is important to note that the lateral uprights are attached only to the pelvic band, allowing the top of the upright to swing free. Heat is needed to bend the posterior uprights away from the lateral uprights and the 45° bend to place the posterior uprights on an upward plane to be attached two and one-half inches from each end of the thoracic band (Fig. 3).

Holes for straps and "D" rings are placed at each end of the pelvic and thoracic bands and at the upper end of the lateral uprights.

Heavy leather straps are attached at the pelvic band, extending forward, just behind the point of attachment of the lateral upright.

Another heavy strap is attached at the top of the lateral uprights ex-

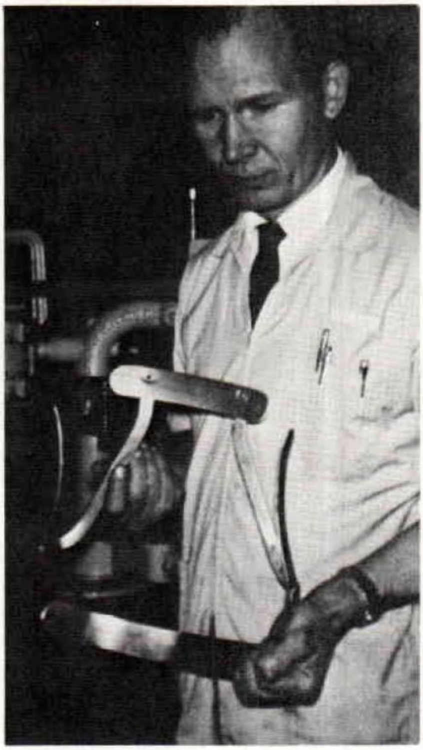


Figure 3

View of the Stuttle orthosis during fabrication to show configuration of the uprights.

tending back towards the end of the thoracic band where "D" rings are placed. The strap is threaded through the "D" rings and then brought around to the front where the top straps and the lower straps are attached to a heavy leather apron by four buckles placed in a manner that makes attachment easy. Average dimensions for the leather apron are 9 x 4½ in., and the buckles are placed more or less at each corner.

All that remains is covering, padding, and fabrication of the elastic apron. We all know it helps to have a nicely finished orthosis. It is some-

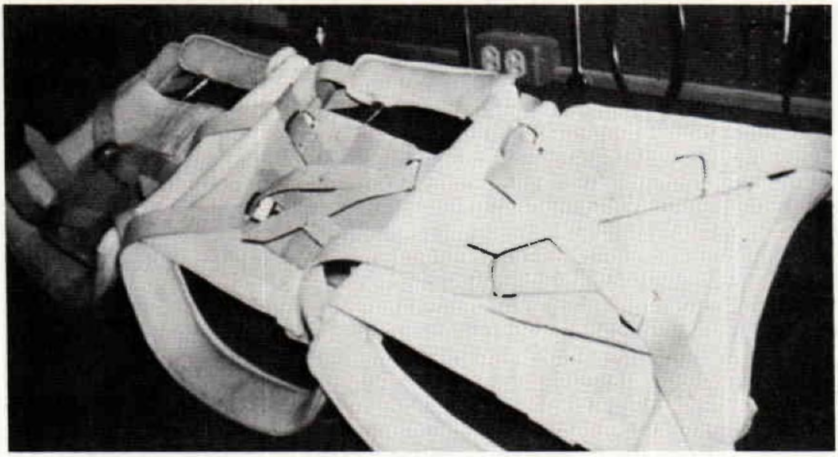


Figure 4
The Completed Stuttle Orthosis

times difficult for patients to accept the idea of wearing a support, but if the orthosis is finished attractively, the patient is much more apt to accept it.

We cover the outside of the orthosis with white elk leather. The inside is lined with soft pearl cowhide or horsehide. Most orthotists have their own ideas on what they like to use for padding, and if they have a material that they like to use, it certainly could be used on this orthosis. We use one-half inch thick sponge rubber for padding the thoracic band, the pelvic band, and the lateral uprights. It is important to remember when covering the lateral uprights to leave a one-inch flap of leather extending forward for attachment of the elastic apron.

THE ELASTIC APRON

The elastic apron is made from Swiss weave elastic, eight inches wide with an eight inch open detachable zipper for a closure.

To determine the length of each side of the apron, the pelvic and waist measurements are needed.

The formula is:

From the circumference of hip, subtract six and divide by four to give one-half the length of the apron at the hip.

The same procedure using the waist measurement gives one-half the length of the top of the apron.

When the waist or hip circumference is uneven, *subtract* one inch to make it an even number.

For example:

The waist measurement of a patient is	29″
and hips	37″
Subtract one inch from the 37″, making it	36″
(Only if an uneven number; if even number do not subtract) Then subtract	6″
Then divide by 4″	30″

This gives you the lower

length of one side of your apron. 7½″

Now, do the same for the waist.

It being an uneven number, subtract one inch	28″
Subtract	6″
Divide by 4″	22″
	5½″

So your apron would consist of two pieces of Swiss weave elastic:

5½″ at the top

7½″ at the bottom

An eight inch detachable zipper is sewn to one end of each piece and each piece is sewn to the flap on the lateral uprights. The complete orthosis is shown in Figure 4.

Once a general knowledge of this construction of the Stuttle orthosis has been acquired, much satisfaction can be gained by the orthotist. It is our hope that you will find this orthosis as gratifying to produce as we have at the Portland Orthopedic Clinic's Orthotic Department.

Polyethelene Girdle for the Milwaukee Brace

By Jerome E. Skahan, C.O.,[1] John J. Skahan, C.O.,[1] and Walter E. Dase, Technician [1]

Since the inception of the "Milwaukee Brace" orthotists have been searching for a material to substitute for the leather originally recommended for fabrication of the girdle.

Leather can be molded readily, it can breathe, and is quite compatible with the outer body tissues. However, leather has its drawbacks. Good grades are much in demand, and not always readily available. An otherwise good hide may have small imperfections which make it unusable. Leather must be mulled and molded while wet. The drying time is long, and molded leather must be lined with horsehide or some equivalent. The procedures are time consuming, and therefore expensive.

Some plastics with promising characteristics were presented a few years ago for replacement of leather. Unfortunately, these materials had drawbacks that were not noticed immediately. Experiments with these plastics in our facility showed them to be acceptable but not ideal.

A material that we have found to be most satisfactory is low-density Polyethelene. Polyethelene has a smooth finish, and it has presented no problems of chafing or reddening the skin owing to abrasion, especially in the waist area. It does not need to be lined. It has the "snap" and flexibility similar to leather so that it can be bent, yet does not lose its ability to control. More than 30 braces using Polyethelene have been fitted during the past year.

Polyethelene is commercially available in 4′ x 8′ sheets, 3/16″ thick, at a cost of less than $20.00 per sheet. When properly laid out at least ten pieces 12″ x 36″ can be cut from one sheet and there will still remain material for making pads, etc. (Fig. 1).

[1] Central Orthopedic, 2031 Auburn, Ave., Cincinnati, Ohio 45219.

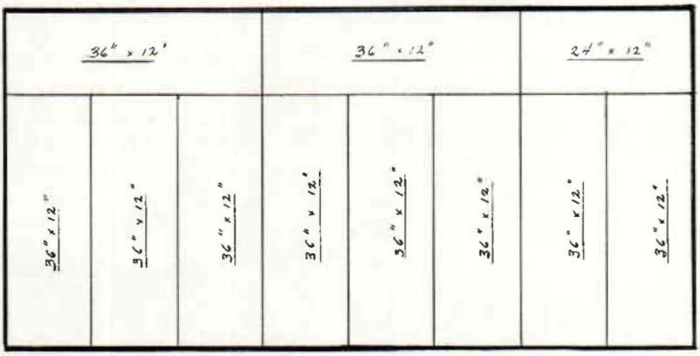


Figure 1

Layout for 4 ft. by 8 ft. sheet of Polyethylene sheet to obtain maximum number of girdles for the Milwaukee Brace.

TOOLS AND MATERIALS NEEDED

1. Forced air oven capable of 230° F.
2. Cloth covered wood frame.
3. Commercial Talc (Merck).
4. Heavy elastic strap.
5. China marker.
6. 2-3 pr. insulated gloves.
7. Hammer and nails.
8. Knife.
9. Heat gun.
10. Felt cone or muslin wheel.

The cast is smoothed and vertical-fabrication lines are marked anteriorly and posteriorly. Trim lines can be marked on the cast also at this time (Fig. 2). A piece of the plastic is cut to the desired height and length according to the measurements of the cast. A vertical centerline is marked on the plastic with a china marker or similar marking pencil. The plastic is placed in an oven pre-heated to 230° F, for eight minutes (Fig. 3). Use a well-powdered heavy cloth stretched over a wood frame for a non-adhering surface. After the plastic has been heated properly it is carefully removed from the oven and transferred to the cast, making certain that the center line on the plastic is aligned with the anterior vertical fabrication line on the cast. An elastic strap, 2″ wide and 36″ long, is stretched around the waist while the rest of the plastic is held manually next to the cast. Nails are used along the posterior edges to hold the plastic to the cast (Fig. 4).

N.B. Avoid overheating. If the material is allowed to heat for a longer period of time or at a higher heat than indicated, it will distort e.g., reduce in length and width but

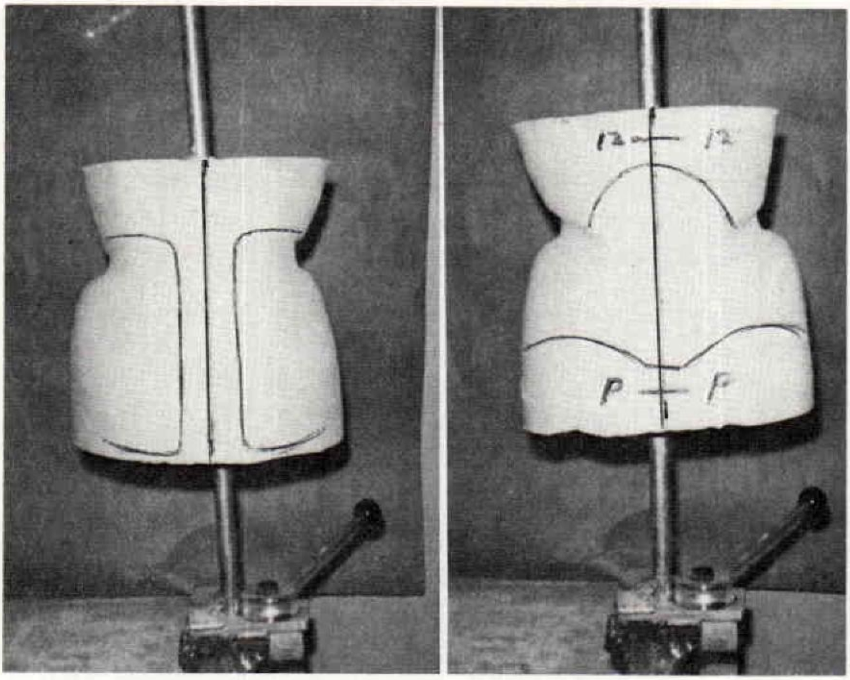


Figure 2
Trim lines marked on cast for the Milwaukee Brace.

become thicker, softer than desirable, tacky, and the surface will become uneven or bubbly. While the material is still quite warm, the excesses posteriorly can easily be trimmed with a knife.

Three people are needed for a very short period for the actual molding procedure. One person is needed on each side of the cast in order to position the hot plastic while a third person stretches the elastic strap into the waist area. This same person can then hand the elongated ends of the strap to the people on each side while he nails the plastic to the cast. The elastic strap is then removed and the excess plastic material is cut away.

After it has cooled and "set," the plastic may be cut along the trim lines marked on the cast (Fig. 5) with a heat gun and sharp knife. Because Polyethelene is translucent when heated the lines are visible at this time. The edges are smoothed initially on a felt cone and, finally, on a muslin wheel at 3450 RPM. The material will not "burn" or melt at this speed.

The attachment of anterior and posterior uprights to the Polyethelene girdle is done with jiffy, or speed rivets (Fig. 6). The use of copper rivets for attachment is not recommended, because the plastic can be cut slightly by the head of a copper rivet, thus inducing splitting of the plastic.

It has not been necessary to use

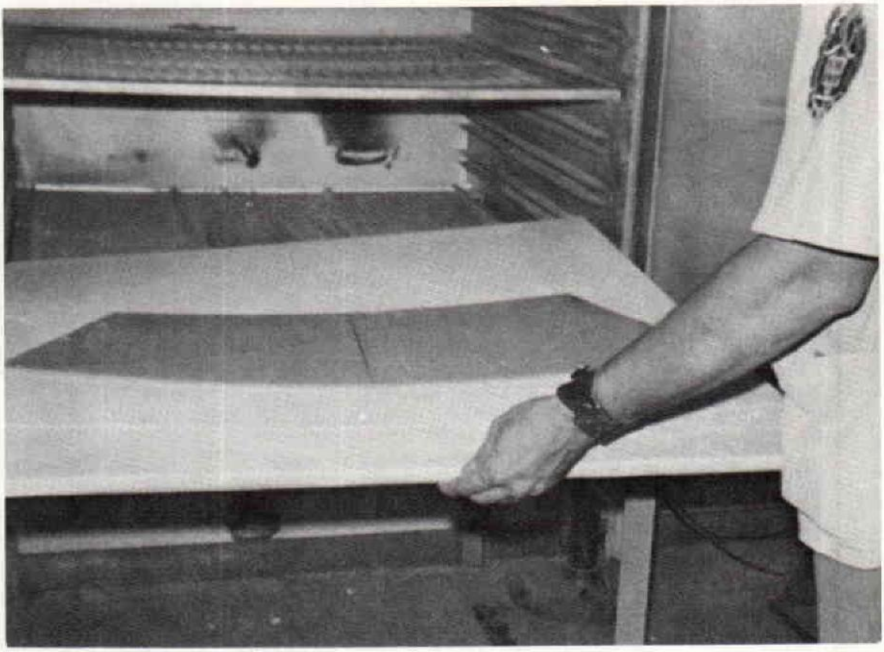


Figure 3
Polyethylene sheet being put into oven on a cloth-covered wood frame.

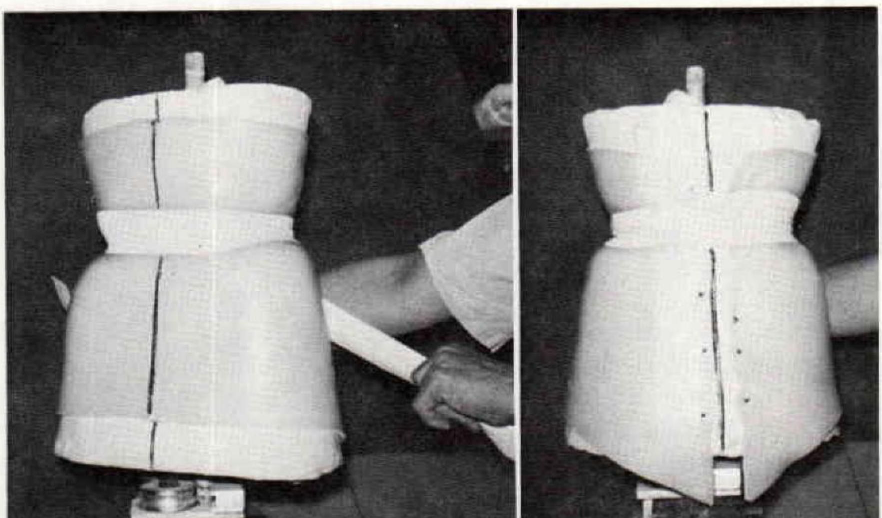


Figure 4
Use of elastic strap for molding the Polyethylene sheet, left, and anterior view showing the use of nails to hold the sheet in proper position over the mold.

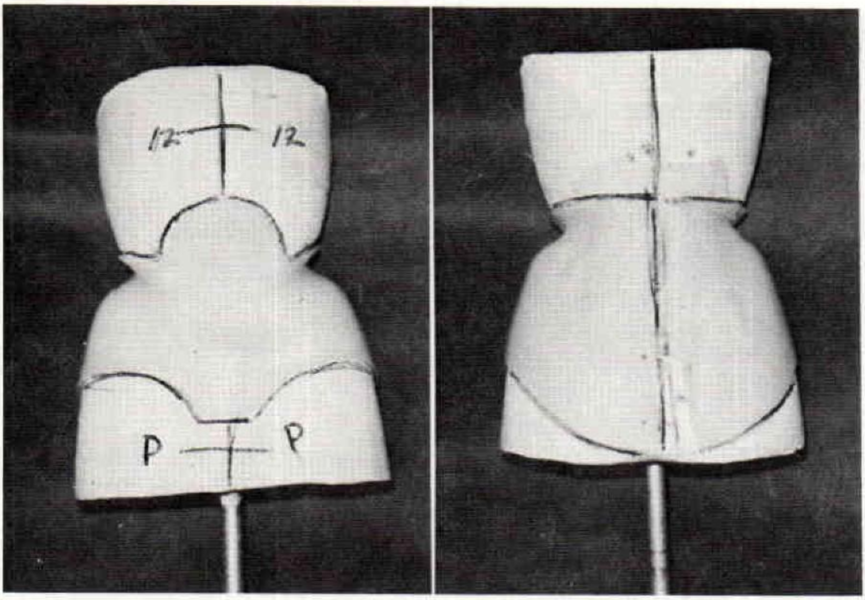


Figure 5
The Polyethylene girdle after being trimmed on the cast.

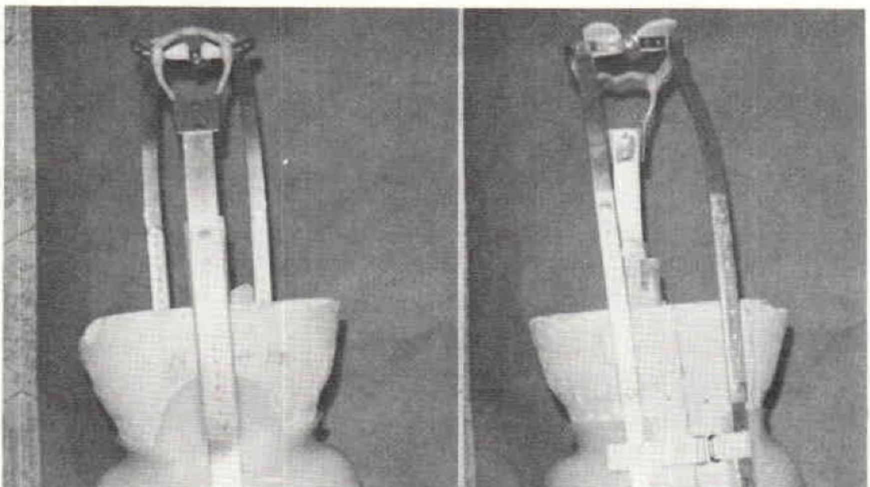


Figure 6
The Anterior and Posterior Uprights in Place.

a pelvic hinge on any of the Milwaukee braces made with Polyethelene. There have been no fractures or failures due to repeated flexure.

Polyethelene is washable and is impervious to most cleaning solutions. Heating with a heat gun permits slight adjustments. Polyethelene of this same thickness can also be used for making the correctional pads for scoliosis and kyphosis. The pads are lined with Plastazote and a Dacron strap is used for attachment. Plastazote is washable also.

Low-density Polyethelene has answered many of our problems concerned with the girdle of the Milwaukee brace. It is inexpensive, relatively easy to form, easy to keep clean, relatively easy to adjust, and is flexible but firm.

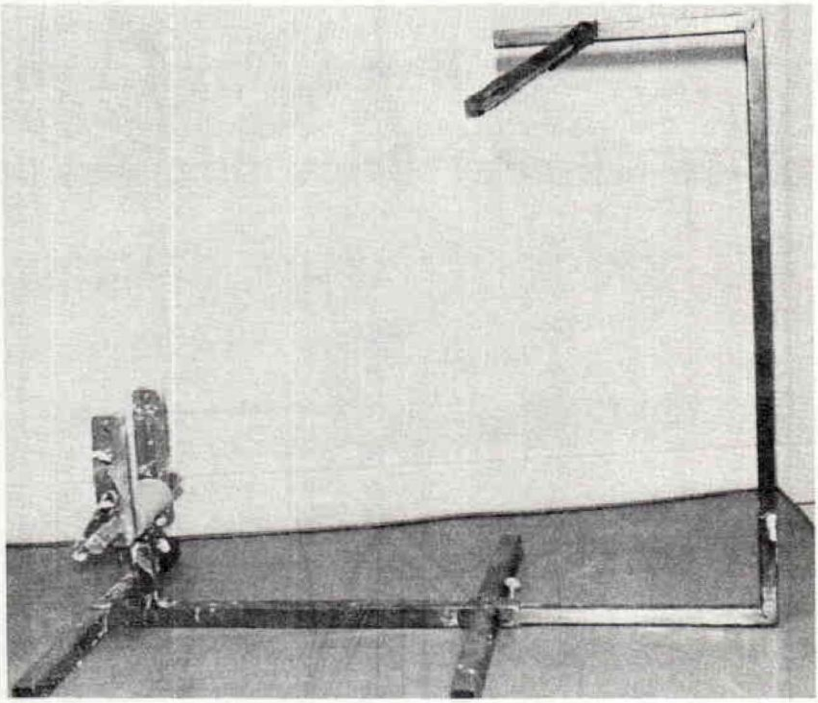
Polyethelene is not considered to be the last word in materials for the girdle of the Milwaukee brace but at this time appears to be the best for this purpose.

Use of a Cast-Brace Application Device, Plaster Brim, and Ankle Support for Fracture Bracing

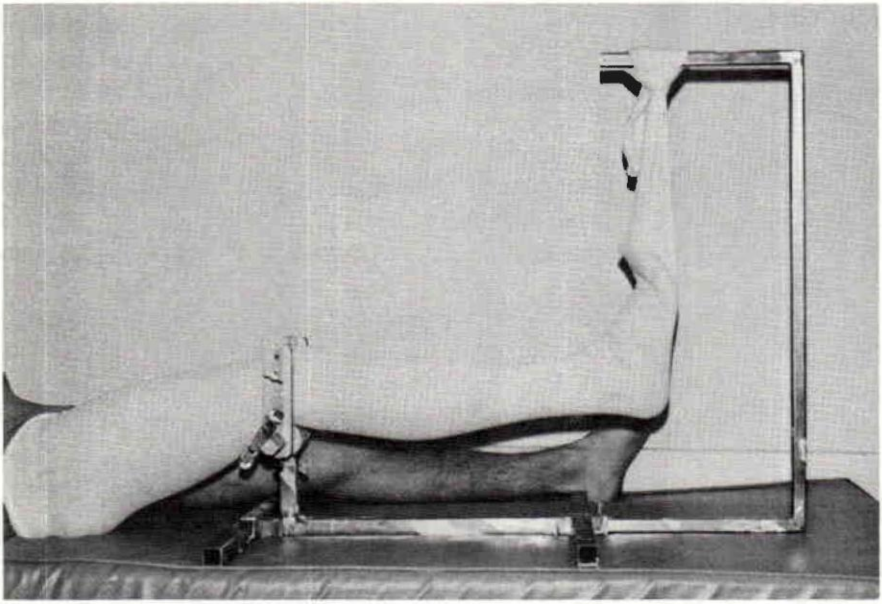
Max Lerman, C.O.[1]

A device has been designed to permit one man to apply cast braces for lower-limb fractures (1, 2) in a faster time and with more accuracy than is the case with present procedures.

[1] Lerman and Son, 8710 Wilshire Boulevard, Beverly Hills, Calif. 90211.

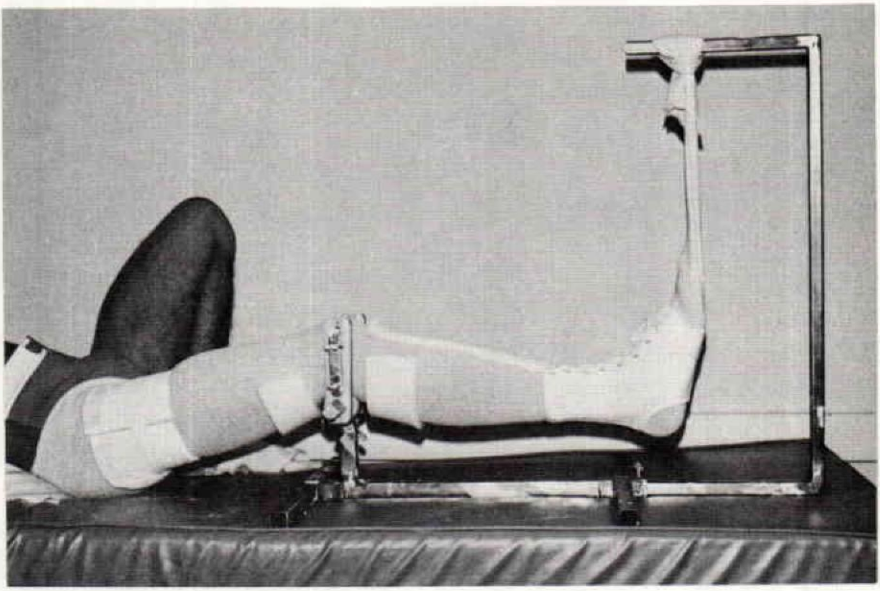


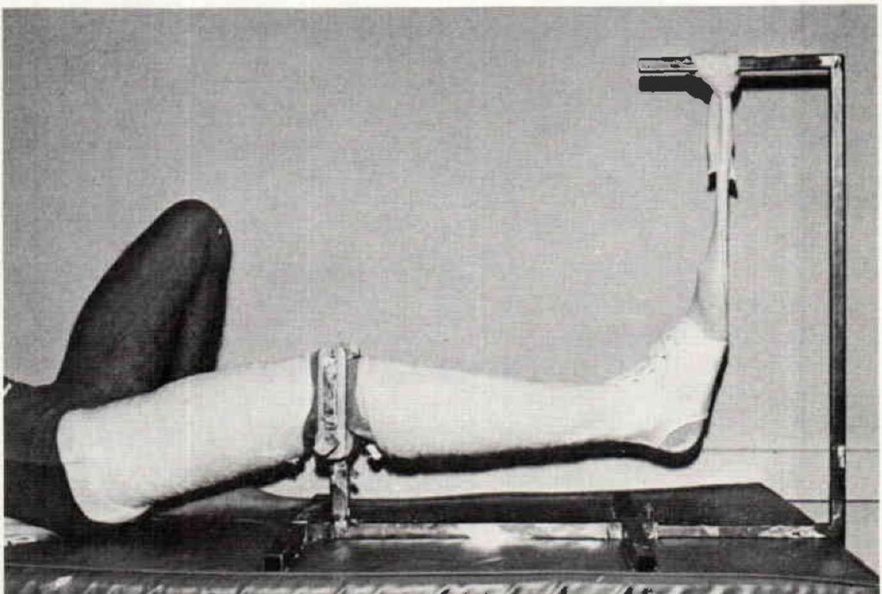
The present joint-alignment fixture is used as the basic knee support. When the joint alignment fixture is reversed it can hold the knee as in a vise. It can be raised or lowered to accommodate some knee flexion. A tilt adjustment feature makes it possible to accommodate for knee or tibial rotation. An ordinary crutch handgrip serves as padding under the popiteal area.



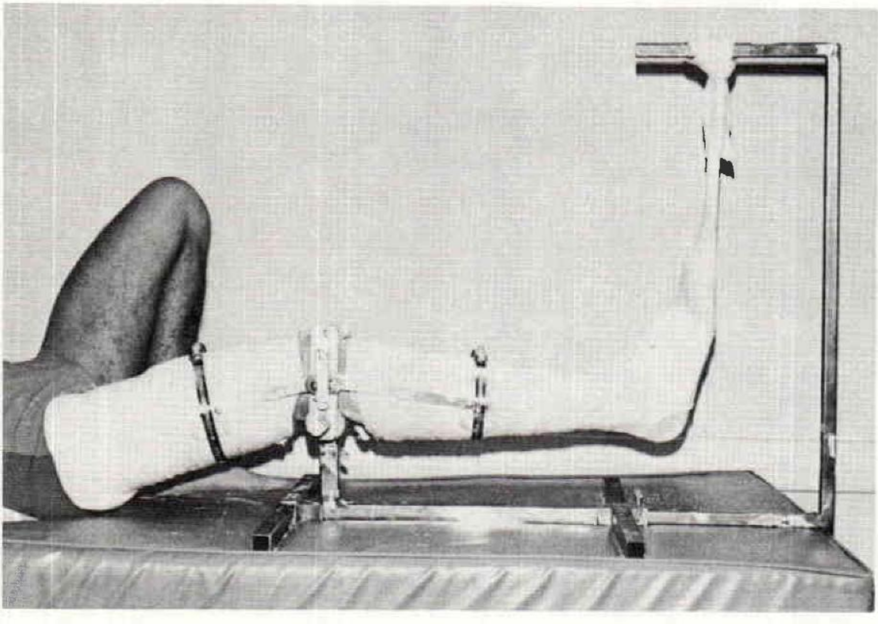
Stockinette is applied over the usual interface material, and the foot is suspended by tying the stockinette to the suspension bar. When the heel is centered with the device the knee hinges will always be horizontal. When valgus or varus knee stress is required, the stockinette may be attached to an outrigger, which can be reversed so as to serve on each side.

A plaster brim (see below), a Truform No. 782 cloth ankle support lined with ¼ foam rubber, and relief padding are applied.





The proximal and distal casts are applied.



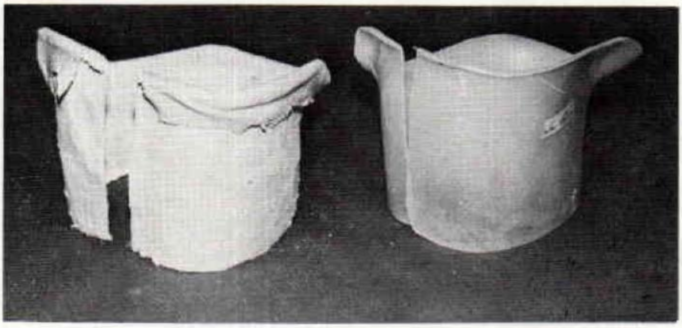
Knee hinges are applied outside the device. A clamp with screws above and below holds the hinges firmly in place. The hinges are set slightly posterior to midline. The use of hose clamps is recommended. The thickness of the knee jig uprights provides the proper clearance between the knee hinges and the knee.

The hinges are secured with plaster in the usual manner.

I find that the cast-brace alignment device helps us to make the brace better fitting and more comfortable. It also saves time by making a difficult job easier.

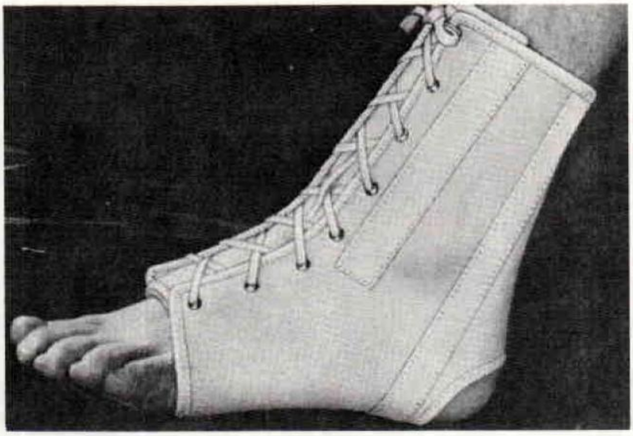
The development of the cast-brace application device would not have been possible without the cooperation of Dr. J. P. Harvey of the Los Angeles County Medical Center, University of Southern California and Dr. Vert Mooney of Rancho Los Amigos Hospital, under whose auspices and guidance cast braces are applied.

U.S. Manufacturing Company, Glendale, California will soon distribute this new cast-brace application device.



THE PLASTER BRIM

The plaster brim is made out of one roll of 4 inch or 6 inch plaster over stockinette using a plastic brim for the quadrilateral shape. The opening is on the lateral side. Use of plaster has reduced skin problems because of its breathing properties, and made trimming and relieving easier.



ANKLE SUPPORT

When the ankle support is used problems of ankle-joint alignment are avoided because slight motion in pronation and supination, plantar and dorsiflexion are allowed. The foot is in normal contact with the floor while weight-bearing and an ordinary slipper can be worn. Heel pressure sores have been eliminated. The brace weighs about three pounds less. The use of the ankle brace is limited to femoral, knee and tibial plateau fractures. It is not indicated in the case of fractures located more distally.*

LITERATURE CITED

1. Committee on Prosthetics Research and Development, Cast-bracing of fractures National Academy of Sciences, Washington, D.C. 1971.
2. Mooney, V., V. L. Nickel, J. P. Harvey, Jr., and R. Snelson, Cast-brace treatment for fractures of the distal part of the femur. J. Bone Joint Surg., 52-A:8:1563-1578, December 1970.

* It should be used in selected cases only, and is by no means a substitute for the rigid plaster. I lace the anklet proximal to distal so that the patient can adjust the laces when he is reclining.

Use of Photography in Cast Preparation

James H. Tyo [1]
George Hall, Jr., C.P.[2]

Cast modification may well be considered the single most important phase of prosthetic service because it is the key to the provision of a comfortable, functional socket. This is, obviously, the basis for all prosthetic treatment.

The prosthetist draws on a wealth of knowledge in preparing the plaster model, not the least of which is his memory of each individual amputation. It was felt that a method of recording the visual appearance of the stump at the time of casting might be quite helpful to the prosthetist.

The Polaroid "Big Shot" camera (Fig. 1), type 108 film, and batteryless magicubes were selected because of low initial investment, convenient operation, and the immediate results provided by the Polaroid process. The time added to the normal casting and measurement procedure is thus less than four minutes.

The basic procedure is quite simple. When possible, we position the patient against a dark background, normally a piece of brown paper taped to the cast room wall, and place an 18 in. ruler parallel to and directly beside the amputated side. On the stump, we mark the reference point for measurement of length (i.e., on the BK the patella tendon). The photo is taken from the front (Fig. 2).

There are obvious advantages when the photographs are used, the visual reminder of shape and condition being the most important (Fig. 3). There is, however, a secondary advantage. During the testing of this procedure, we noted an immediate

[1] Prosthetic Services, Frees and Tyo, Inc., 1124 East Fayette St., Syracuse, New York 13210.

[2] Prosthetic and Orthotic Services of Buffalo, C. B. Winn, Inc., 699 Hertel Avenue, Buffalo, N.Y. 14207.

Figure 1
The 'Big Shot' camera.

Figure 2
The frame shown attached to the camera has been designed to eliminate the problem of focusing at an uncomfortable level.

Figure 3

The photograph is attached to the patient's file as a 'visual' record of the stump. Its primary use is during the cast modification procedure.

improvement in patient response to treatment.

Our feeling at this time is that the patient responds to the quickly available photograph as a demonstration of our interest in offering the best prosthetic care possible. This, of course, is a highly subjective analysis that can only be proved by the passage of time.

This addition to the normal cast and measurement procedure should be viewed as just that, an addition. It is not a replacement, or substitute for thorough prosthetic examination of the stump, and not a "short-cut" method of recording prosthetic information. The procedure has been developed as an accurate, simple, and inexpensive means of providing a picture of the amputee's stump while preparing the plaster model. The prosthetist can "see" his patient, thus adding to the written information and his memory of shape, structure and texture.

Population and Access to Prosthetists[1]

G. E. (Ned) Snarples, Ph.D.[2]

Concern with delivery systems for health care has become widespread within government and within many of the professional groups involved in the provision of care. As part of this concern, much attention has been focused upon locating health facilities so as to enable maximum access for populations in need of services. It is recognized that location factors do not produce or explain utilization, nor necessarily effect quality of health services. Still, the location of facilities is a basic determinant of *potential* access to services, whether or not utilization occurs. Without a facility to use there is no utilization. With a facility accessible, there may be some utilization. Judgments of the adequacy of services begin, but do not end, with the question of availability or potential success within geographic territories.

This paper describes the geographic dispersion of certified prosthetists and certified facilities in the United States. It also presents an imperfect but useful analysis of the potential access which certain general populations have to prosthetists, based upon ratios of facilities to population. In general, the accessibility of prosthetic services seems extremely uneven.

Caution in interpreting these findings must be exercised. Again, results do not necessarily relate to quality of services and no such implication should be drawn. Also, there are

1 Based on research supported by the Maternal and Child Health Service under grants PC-1003 and MC-R-260044-05-0 titled: Child Amputees: Disability Outcomes and Antecedences.

Major contributions to this analysis were made by Miss Rochelle Coonley and Miss Roseanne Allevato. Their help is gratefully acknowledged.

2 Assistant Professor of Maternal and Child Health and Director, Child Amputees Research Projects, School of Public Health, The University of Michigan.

many additional factors which influence actual accessibility and real utilization of prosthetic services. Among these are the additional number of competent but uncertified prosthetists, the restriction of practice by some prosthetists to institutionalized or other special populations (e.g., VA), transportation, economic, and many other social factors influencing decisions to use health services.

While this analysis cannot yield conclusions about the quality of services nor the efficacy of utilization in relation to population needs, it is useful in several ways. It identifies a number of geographic areas and cities where there is reason to believe that prosthetic services are insufficient by being absent, or nearly so. Questions about service quality in such areas are unnecessary if there are no services. The analysis also identifies areas and cities where further investigation of actual accessibility would be likely to be most fruitful. This preliminary work provides a basis for selecting areas or cities for comparison purposes in further work seeking to define adequate prosthetic services for populations. It offers a starting point to the profession for self-examination and eventually may enable the profession to set goals, plan education programs, and influence the availability of services.

Our interest in the access problem results from intensive interviews with upper- and lower-extremity amputees throughout the country during the last five years. The more than 500 amputees with whom we talked gave clear evidence that the accessibility of adequate prosthetic services has considerable influence upon continuity of prosthesis wearing, decision to permanently discontinue use, and general levels of physical and social performance. Further, we heard claims that access to prosthetic services varies considerably by geographic areas.[3]

To better comprehend the availability of such services, we plotted locations of all certified limb facilities on a map of the United States. This exercise clearly demonstrated that tight clusters of facilities occur in and around certain big cities and that many large areas of the country have no certified prosthetists. Such a pattern can be expected because of the variation in population density.

The question then becomes: Does the distribution of prosthetic services match the distribution of population such that potential access is equal throughout the country? A further question, not investigated here, is: Are the human problems of obtaining prosthetic services within reasonable limits throughout the country?

The second question requires original field data which can only be obtained at considerable expense, requiring special funding. The first question can be attacked using al-

[3] Experiences of the amputees we interviewed were not known to be representative of all amputees, or of those in any one area. Our respondents were the widely dispersed patients of a single clinic caseload. Their reports could not yield a systematic picture of the availability of prosthetic services within any one geographic area, or the country as a whole. But they were highly suggestive. Patients were dispersed from Alaska to Puerto Rico, from Los Angeles to New Hampshire, from North Dakota to Texas. In all, 345 people were extensively interviewed, less extensive data was collected for over 500.

ready existing information. The issue is whether the geographic distribution of facilities is consistent with the distribution of people needing prosthetic services. An estimate of this relationship can be made by comparing population figures to the number of prosthetists in the same area.[4] There is certainly no ratio of population to prosthetists which is known to be satisfactory; that is, representative of optimum service accessibility. It would be hazardous to estimate the size of population which could be satisfactorily served per average prosthetist.

However, we can still detect regions with high and with low ratios of population to certified prosthetists and interpret the ratios using added knowledge of areas and services.[5] Variation in a series of such ratios for different areas would suggest, at the least, that in some areas prosthetic services are potentially less available than in others. Extreme variation would suggest that inadequate availability exists in some areas, if need is constant, and/or oversupply might exist in others, the latter being much less likely according to our respondents. Using existing data, and avoiding the problem of establishing an expected patient volume per prosthetist, our method of comparing ratios is as close as we can practically and inexpensively come to estimating whether there are satisfactory numbers of prosthetists for populations.

Following this logic we sought to learn whether access to prosthetists is likely to be a problem in the 25 most populous metropolitan areas of the country. United States Census population figures for 1970 were obtained for each metropolitan area.[6] Counts were made of all certified prosthetists and facilities in each metropolitan area using the *1971 Registry for Certification* published by the Board for Certification. Ratios of total population to certified prosthetists and ratios of total population to certified facilities were computed for each area and are shown in Table I.

Inspection of the ratios reveals a striking degree of variation even among our most populous areas. Within our 25 largest cities, the highest ratio was almost eight times the lowest for the number of facilities. The number of certified prosthetists varied by a factor of about three and one-half. Thus, Newark has eight times as many people per certified facility as Cleveland. Milwaukee has about three and one-half times as many people per certified prosthetist as Cleveland.

[4] Provided we accept certain assumptions specified later.

[5] For example, certain facilities utilize personnel in ways that effectively serve more clients, especially using uncertified prosthetists. The numbers of such people may vary in different regions. Cities vary in the degree to which their services are depended upon by people living outside the metropolitan area limits defined by the census. Reputations about quality and speed of services are certainly relevant qualifications to any ratios. I am indebted to A. Bennett Wilson, Jr., Executive Director, Committee on Prosthetics Research and Development, for examples illustrating this important point. The need for a thorough study by AOPA should be obvious.

[6] Population figures were obtained from the U.S. Bureau of Census, *Number of Inhabitants* (1970), by state. The AOPA 1971 listing of individual prosthetists was used. Hand counting was done carefully but may be subject to slight error. Census data for each state was used to compile lists of political divisions included in each SMSA. Judgment was required when a listed address was near an SMSA which was incompletely defined.

TABLE 1

POPULATION RELATIVE TO CERTIFIED PROSTHETISTS AND FACILITIES IN THE 25 LARGEST U.S. METROPOLITAN AREAS

STANDARD METROPOLITAN STATISTICAL AREAS		CERTIFIED		RATIOS	
				Population in Thousands	
Area	1970 Total Population	Facilities	Prosthetists	Facilities	Prosthetists
New York	11,571,899	12	49	964:1	236:1
Los Angeles-Long Beach	7,032,075	17	25	414:1	281:1
Chicago	6,978,947	10	23	698:1	303:1
Philadelphia	4,817,914	8	13	602:1	371:1
Detroit	4,199,931	4	12	1050:1	350:1
San Francisco-Oakland	3,109,519	8	13	389:1	239:1
Washington, D.C.	2,861,123	3	10	954:1	286:1
Boston	2,753,700	6	11	459:1	250:1
Pittsburgh	2,401,245	2	5	1201:1	480:1
St. Louis	2,363,017	3	9	788:1	263:1
Baltimore	2,070,670	3	8	690:1	259:1
Cleveland	2,064,194	1	3	2064:1	688:1
Houston	1,985,031	2	5	993:1	397:1
Newark	1,856,556	7	7	265:1	265:1
Minneapolis	1,813,647	5	9	363:1	202:1
Dallas	1,555,950	2	5	778:1	311:1
Seattle-Everett	1,421,869	3	6	474:1	237:1
Anaheim-Santa Ana-Garden Grove	1,420,386	0	4	—	355:1
Milwaukee	1,403,688	3	7	468:1	201:1
Atlanta	1,390,164	2	5	695:1	278:1
Cincinnati	1,384,851	2	3	693:1	462:1
Paterson-Clifton-Passaic	1,358,794	1	3	1359:1	453:1
San Diego	1,357,854	2	3	679:1	453:1
Buffalo	1,349,211	1	2	1349:1	675:1
Kansas City	1,253,916	2	3	627:1	418:1

SOURCES: Population figures were obtained from the U.S. Bureau of Census, **Number of Inhabitants (1970)**, by state. **1971 Registry of Certified Facilities and Individuals in Orthotics and Prosthetics**, American Board for Certification in Orthotics and Prosthetics, Inc., Washington, D.C., 1971.

The size of the population per prosthetist is large. Table 1 ratios are in thousands of people for each certified prosthetist. Thus, Cleveland has 688,000 people for each certified prosthetist. While the presence of apprentices and uncertified prosthetists, some working in certified facilities, would reduce the ratios, it remains a rough index to service access.

Inspection of Table 1 reveals some differences concomitant with population size among the metropolitan areas. The most populous areas (the first eight listed, New York through Boston) have predominantly middle ratios (five) and low ratios (three), presumably having average or better access to prosthetists, among the 25 areas compared. The eight metropolitan areas which fall in a middle category according to population size (Pittsburgh through Dallas on the list in Table 1) are mixed in ratios, low (four), middle (two) and high (two), generally having average or better access to prosthetists. The nine metropolitan areas with the smallest populations among these 25 (Anaheim through Kansas City) have predominantly high ratios; five of the nine are high ratio cities, two each are low and middle ratio. These ratios may indicate less access to prosthetists.

Unlike any other consecutively listed metropolitan areas in the list, the last five areas all fall at one extreme and all have high population ratios. While this pattern is weak, it may indicate a trend towards higher ratios and less access as city size decreases, perhaps after a threshold level of population is reached.

It is reasonable to expect that even greater variation would be revealed if ratios were computed for smaller cities. This would in part be due to the small numbers of prosthetists but also to the absence of services in many populous areas.

This does not suggest that any specific ratio reflects adequate access, It is most probable that no city has an adequate supply of prosthetists in relation to the numbers of people with deficiencies and the services they need. This is what our interviews suggest.

It must be noted that this method of estimating the relative availability of prosthetic services rests upon the following assumptions. The total number of people in an area is used as an index to the number in that population with prosthetic service needs. Comparisons between cities are based on the assumption that, among our largest metropolitan areas, the proportion of each population which is afflicted is probably about the same. It is also assumed that because there are concentrations of facilities and prosthetists in these areas, the differences between them in the number of people who are served per prosthetist will average out. If it does not average out, then there is chance of misinterpretation of the ratio variation, provided that those cities with high populations per prosthetist are the same cities in which prosthetists are able to serve more people.[7] It seems unlikely that there are sufficient differences in the numbers of patients served per average prosthetist *and* that these differences occur in a pattern to offset the effect of population ratios.

If these assumptions can be accepted as reasonable, then a nationwide look at the variation between ratios is warranted. Table 2 groups cities roughly into the one-third having the lowest ratios, the one-third having the highest ratios, and a middle one-third. Those with the lowest ratios, having the smallest population for each prosthetist, are likely to be cities where prosthetists are more accessible, based on sheer numbers alone. Metropolitan areas with the highest ratios probably have less accessible prosthetic services. It is interesting that no region of the country can be identified, from Table 1, as having either mostly cities with relatively easy access to prosthetists or as having mostly cities with rela-

[7] If the number of people who are served by low volume prosthetists differ from the number served by high volume prosthetists by a factor of three and one-half or more, then we must modify conclusions based on the finding of variations by a factor of three and one-half in the ratios of prosthetists to population. As an example, if a high population ratio city such as Cleveland was known to have high volume prosthetists serving three and one-half times as many patients as a low population ratio city such as Milwaukee, where it was known that low volume prosthetists were serving less than one-third as many patients as were served by the Cleveland prosthetists, then the three and one-half fold difference in prosthetist to population ratios would be offset or equalized and a conclusion of differing availability would be inaccurate.

TABLE 2

GROUPED DATA—CERTIFIED PROSTHETISTS RATIOS TO POPULATION

Low Ratios—Greatest Access—201:1 to 265:1 (thousands)

Milwaukee	Seattle	Baltimore
Minneapolis	San Francisco	St. Louis
New York	Boston	Newark

Middle Ratios—Average Access—278:1 to 371:1 (thousands)

Atlanta	Chicago	Anaheim
Los Angeles	Dallas	Philadelphia
Washington, D.C.	Detroit	

Highest Ratios—Least Access—397:1 to 688:1 (thousands)

Houston	Paterson	Buffalo
Kansas City	Cincinnati	Cleveland
San Diego	Pittsburgh	

SOURCES: Population figures were obtained from the U.S. Bureau of Census, **Number of Inhabitants (1970)**, by state. **1971 Registry of Certified Facilities and Individuals in Orthotics and Prosthetics**, American Board for Certification in Orthotics and Prosthetics, Inc., Washington, D.C., 1971.

tively difficult access. A mixture of both high and low ratio metropolitan areas appears in each general zone.

A listing of cities and ratios for each AOPA region, Table 3, reveals the same mixed results in general. The exception is that, in Region V, two of the three large metropolitan areas have high population ratios, Cleveland (688:1) and Cincinnati (462:1), and the third has only a middling ratio, Detroit (350:1). An opposite pattern occurs in Region VI where two low ratio cities, Milwaukee (201:1) and St. Louis (263:1 occur with a middle range

TABLE 3

POPULATION PER PROSTHETIST RATIOS BY REGIONS OF AOPA

1	Boston	250:1	L	VI	Milwaukee	201:1	L
					Chicago	303:1	
II	New York	236:1	L		St. Louis	263:1	L
	Buffalo	675:1	H				
	Newark	265:1	L	VII	Minneapolis	202:1	L
	Paterson	453:1	H		Kansas City	418:1	H
III	Philadelphia	371:1		VIII	Houston	397:1	H
	Washington, D.C.	286:1			Dallas	311:1	
	Pittsburgh	480:1	H				
	Baltimore	259:1	L	IX	Los Angeles	281:1	
					Anaheim	355:1	
IV	Atlanta	278:1			San Diego	453:1	H
V	Detroit	350:1		X	San Francisco	239:1	L
	Cleveland	688:1	H				
	Cincinnati	462:1	H	XI	Seattle	237:1	L

KEY: H = High ratio cities, having larger populations per prosthetist (397:1 to 688:1)—thousands)

L = Low ratio cities, having smaller populations per prosthetist (201:1 to 265:1—thousands)

SOURCES: Population figures were obtained from the U.S. Bureau of Census, **Number of Inhabitants (1970)**, by state. **1971 Registry of Certified Facilities and Individuals in Orthotics and Prosthetics**, American Board for Certification in Orthotics and Prosthetics, Inc., Washington, D.C., 1971.

city, Chicago (303:1). In the remaining regions where there are two or more metropolitan areas, high population ratio cities appear with offsetting low ratio areas. Middle range areas are well scattered among all regions.

Combining the ranking of ratios for prosthetists and for facilities we can list metropolitan areas in which there may be scarcity of both shops and certified prosthetists. Note that this conclusion is tentative, at best, and subject to modification by detailed knowledge of the quantity and character of services. The potentially difficult access areas are Cleveland, which ranks at the extreme on both prosthetist and facility ratios, Buffalo, Pittsburgh, Houston, and Paterson. Paterson is the only one of these geographically near another area with ratios likely to be offsetting. The cities which are likely to have the readiest access, with low population ratios for both individual prosthetists and facilities, are Seattle, Milwaukee, Boston, San Francisco, Minneapolis, and Newark. Again, Newark may be used by Paterson area clients, reducing its real access.

It appears from this analysis that, even among populous metropolitan areas, we find sufficient variation in the numbers of certified prosthetists per population to expect important differential effects upon the availability of services and, therefore, upon the well-being of patients. It seems likely that the variation in access is even more extreme among smaller metropolitan populations. It is important not only to document this distribution more fully but to learn in more direct and concrete terms about the problems of access to services.

Returning to our basic question about the reality and effects of thinly spread prosthetic facilities away from the city clusters, we must reemphasize the need for research on the human problems of obtaining services. From the analysis of metropolitan areas it seems clear that the problems of obtaining access to prosthetists are not limited to people living in ranch and farm areas. While research on personal problems of access is more complicated and must await the mounting of considerable research resources, it is useful to outline the dimensions of the problem for areas where the number of prosthetists is low.

Half of our states have only three or fewer facilities certified in prosthetics; twenty-four states have only two or less, fourteen have only one, and seven states have no facility certified in prosthetics. If both prosthetic and orthotic facilities are counted, the picture is only slightly better. Six states have no facilities, of either kind, thirteen have one or less, and seventeen states have two or less. Lists of these states are shown in Tables 4 and 5.

Generally, the states with few facilities are relatively less populous, either relating to low density or small size. However, many are likely to have a higher proportion of amputees in the general population, based on the contributions of certain etiologies to the total afflicted. The long-standing leading causes of amputation have been farm machine accidents and gunshot (primarily hunting) accidents. While these causes are dropping in rank among

TABLE 4

CERTIFIED PROSTHETIC FACILITIES IN STATES WITH FEW FACILITIES

(Excludes Shops for Orthotics Only)

No Facilities	One Facility	Two Facilities	Three Facilities
Alaska	Delaware	Alabama	Kentucky
Maine	Hawaii	Arizona	Oklahoma
New Hampshire	Idaho	Arkansas	
North Dakota	Kansas	District of Columbia	
Rhode Island	Nebraska	Mississippi	
South Dakota	Nevada	Montana	
Wyoming	Vermont	New Mexico	
		Oregon	
		Utah	
		West Virginia	
Total = 7 States	Total = 7 States	Total = 10 States	Total = 2 States

NOTE: The number of certified facilities per state indicates whether or not there is any possibility of in-state quality service for a population of whatever size. It is especially important because of the changing sources of payment and referral from or through state agencies.

TABLE 5

CERTIFIED PROSTHETIC AND/OR ORTHOTIC FACILITIES IN STATES WITH FEW FACILITIES

No Facilities	One Facility	Two Facilities
Maine	Nevada	Montana
New Hampshire	Idaho	Arizona
North Dakota	Nebraska	New Mexico
South Dakota	Vermont	West Virginia
Wyoming	Delaware	
Rhode Island	Alaska	
	Hawaii	
Total = 6 States	Total = 7 States	Total = 4 States

reasons for new amputations, they probably are still the causes which contributed the most cases among all existing (prevalent) cases. These causes occur mostly in rural areas and therefore we might expect a higher proportion of amputees in rural, less populous, states. In addition, these same states tend to have older populations and therefore may have more geriatric amputees, relative to total population, than states having more prosthetic facilities.

The lack of facilities in some states is to some degree compensated for by the existence of other facilities nearby. For example, the low number of facilities in Rhode Island, Delaware, and the District of Columbia must be viewed in the perspective that concentration of facilities occur in Boston and Hartford, Philadelphia, and Baltimore. The question of whether the human problems of time, cost and inconvenience deter access for people within these densely populated areas must await specific study.

Many states without suitable prosthetic facilities are not adjoined by other states having a concentration. These become zones of sparse prosthetic resources. In New England, three states of the six have no certified prosthetic facility and a fourth (Vermont) has one, located in the extreme northwest corner of the state. In effect, all of Maine and New Hampshire and two-thirds of Vermont must be served from Boston. Most dramatic, all of both Dakotas, half of Minnesota, half of Montana, most of Nebraska, all of Wyoming, and much of Kansas, all geographically contiguous, are without a certified prosthetic or orthotic facility. It seems doubtful that the scattered shops next to this vast area can offer adequate access to services. This leaves a zone in which there are no certified facilities that is about 1,000 miles wide east to west at the top and 1,000 miles long from north to south. The concentrations of certified facilities nearest to this giant vacant V shape in our northern midwest occur at Chicago, Denver, Oklahoma City and Minneapolis.

Population figures and demographic descriptions such as those used here are not direct measures of prosthetic service accessibility. However, they provide means to estimate the existence, extent, and location of problems in access. It is our conclusion that access to prosthetic services is clearly unequal and deserves national attention. Adding what is known about the effectiveness of shops and individual prosthetists, professional judgments can be made defining the problems and establishing their priorities. Hopefully, resources will be allocated not only for the research needed to describe the human problems of access to prosthetic services but also to alleviate those problems.

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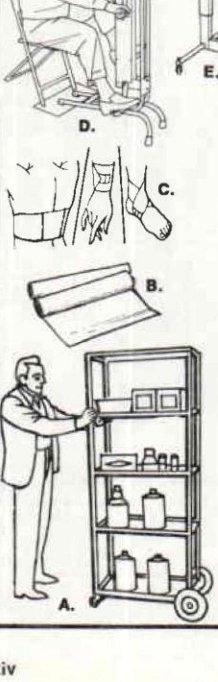
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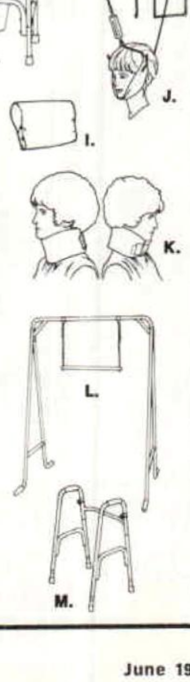
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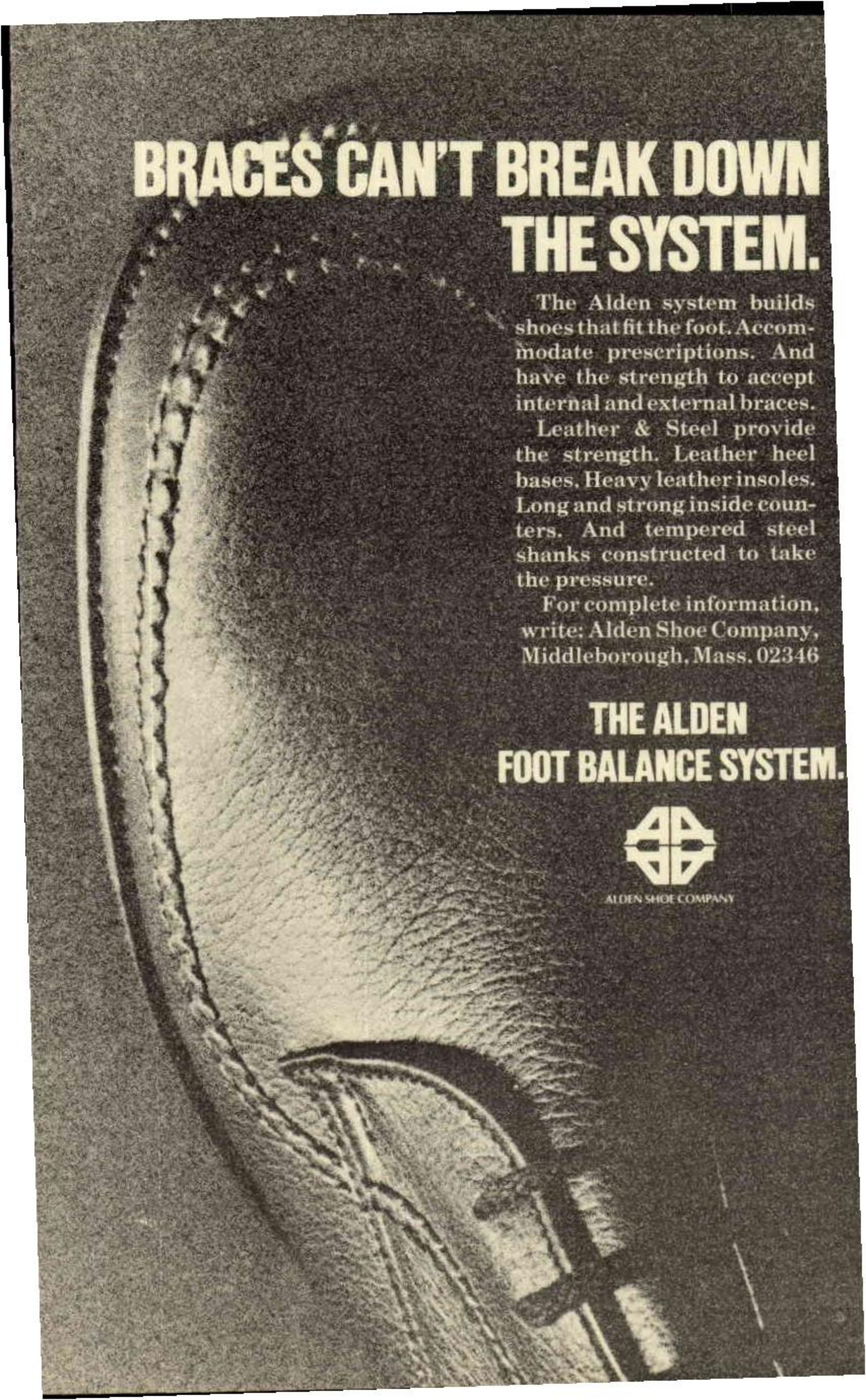
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