December 1970


# orthotics and prosthetics

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# orthotics and prosthetics

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Contents



*Editor*
Audrey J. Calomino

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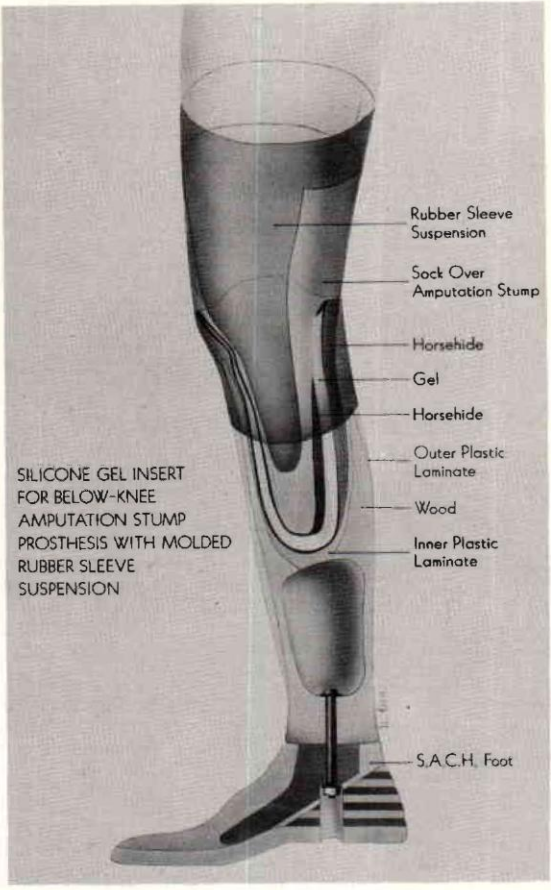


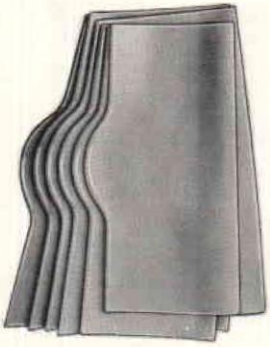

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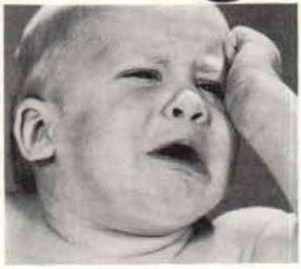

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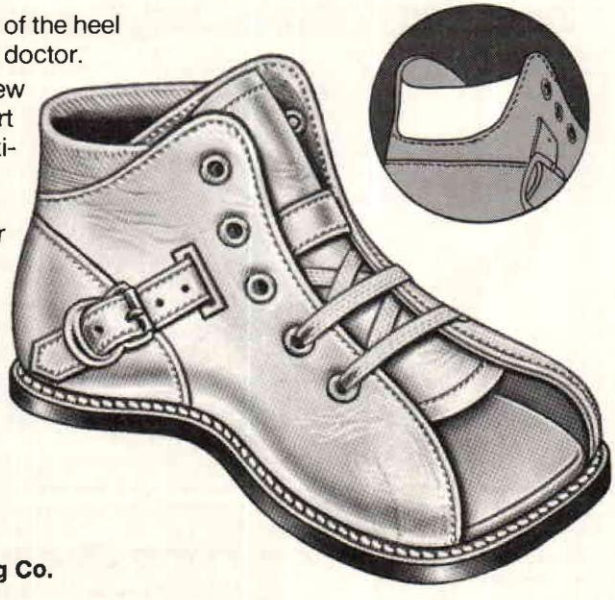

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The following individuals have been awarded Certification status by ABC as a result of their performance in the 1970 Certification Examination held in New York City during the week of July 25.

**Certified Orthotists**

Karl W. Bremer, Jr.
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Michael B. Danforth
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# Report on the Fourth International Congress of INTERBOR

by

Siegfried W. Paul, C.P.O.*

Interbor, currently only an organization of European Orthotic Prosthetic Associations and Guilds, selected Italy for its Fourth International Congress which was held in Turin from May 21-May 23, 1970.

This Assembly with close to 1,000 registrants was the most successful meeting to date. The International climate demonstrated Interbor's goals for close working relationships between Orthotists and Prosthetists of the world. Lectures of the 28 Scientific Papers presented represented sixteen different countries and came from as far as Japan and the U.S.A. The official languages were English, French, German, and Italian. Each seat of the modern auditorium was supplied with ear phones and simultaneous translations permitted flawless following of the lecturers.

*Director, Orthotic and Prosthetic Dept., Newington Children's Hospital, Newington, Connecticut.

I would like to mention a few of the excellent presentations.

Dr. R. M. Davis of the Mechanical Engineering Dept. University College, London discussed the Bio-Mechanical Principles of External Power Systems for the Upper Extremity and reported of current research efforts with sensory feedback systems which show preliminary results. Professor Zarotti from the Prosthetic Center of Budrio, Italy reported on a feedback sytem directly to the stump of the arm amputee.

Mr. Passerini from the Institute Rizzoli of Bologna demonstrated below-elbow prostheses featuring lightweight stainless steel shells and suspension mechanism. Of particular interest was the myoelectric hand used which offered a greater range of motion and most delicate power control. With it he was able to grasp a cigarette by its ends without denting it.

# RECEPTION AND DINNER FOR LECTURERS

**Head Table,** left to right: Mrs. Ginko; Mr. Ginko, President German Association; Mr. Baehler, President Interbor; Mr. Bondente, President of Congress; Prof. Scallas, President of the North Italian Association; Mr. Saltiel, President of the Israelian Association.

**Left to right:** Miss Adelaide, Secretary of the Congress; Mr. Bondente, President of the Congress; Mrs. Betty Paul; Hannes Schmidl, Rehab. Institute Budrio, Italy; Siegfried Paul.

**Left to right:** Mr. Baehler, President of INTERBOR; Miss Adelaide, Congress Secretary; Mrs. Betty Paul; Mr. Bondente, Congress President; Siegfried Paul.

Mr. Habermann O.M., Frankfurt, Germany reported on a new hydraulic foot.

Ralph Uhlig, Director of the Professional School in Frankfurt, Germany spoke on the constructive fabrication of lower-extremity orthoses. The term "apparat" brace is no longer used in Frankfurt and most of Europe.

Dr. Gracanin of Lubriana, Yugoslavia reported on electro-neuromuscular stimulators incorporated in orthoses worn by C.V.A. patients.

Dr. Yamada of Japan showed slides of an external power system for lower extremities. Still experimental, this motor-powered arrangement of flexible shafts is only slowed down by the weight of the power plant (23kg).

Mr. Hannes Schmidl, Budrio, Italy discussed hipdisarticulation, hemipelvectomy, and hemicorporectomy prostheses as they were applied at his center.

Mr. Saltiel from Israel demonstrated Plastic Lower Leg Orthosis.

My own paper which was prepared for this meeting on request featured The Orthotic Management of the Problematic Scoliosis.*

One of the biggest attractions was the exhibit area with 41 companies showing the latest items on the market. It was most evident that the Orthopedic Supply Industry has become part of the International Market exchanging goods at an ever increasing rate. It was a pleasure to notice many U.S. made items exhibited. An item of particular interest was a measuring and fabrication jig for lower Extremity Orthosis developed by Professor Salvatore Scalas who is also an engineer. This system all but eliminates the time

*Mr. Paul's paper appears immediately following this report.

for fittings and still obtains a most accurate fit.

Our Italian friends were superb in the elaborate arranging of the social activities. Whether it was the reception and dinner for the lecturers, the various sight seeing tours, fashion shows for the ladies, the reception by the mayor of Turin in his Palace or the beautiful trip to the Vineyards of Asti, with a tour of Abbazia di Vezzolano where most of the Martini and Rossi products originate. It was all done in beautiful taste. Topping all of this was the gala dinner at the Villa Della Regina, an old castle. Over 1,200 persons came to this social highlight. The castle nestles at a mountainside overlooking Turin. A huge outdoor terrace with fountain was converted into a ballroom by installing a floor level with the brim of the Fountain and placing a canvas ceiling over the entire surface. The two-hour program of top notch entertainment that followed a seven-course dinner would have pleased all of you.

Looking back I must say that this Congress demonstrated the desire of the Orthotic and Prosthetic Associations for closer professional and social ties on an international basis.

This Congress was a very successful step closer to what should be a goal for all of us.

# A New Method for the Manufacture of Splints for the Lower Limb*

Prof. Ing. Salvatore Scalas

P.I. Gastone Passerini

Before starting the description of this new method and the operation of the pertinent equipments, it is advisable to remind that whilst in the manufacture of prostheses for lower and upper limbs the orthopaedic technique has distinguished itself, during these last ten years, in the admirable applied research of new methods and techniques, in comparison little has been made for the splints and, among them, for the ones pertinent to the lower limb.

The practical technique, still used by almost the totality of the manufacturers, is therefore still such that the various manufacturing steps of them have to be considered as not very simple and, in any case, long.

The disabled has to undergo first to a visit by the orthopaedic physician who, in agreement with the technician fixes in a general line the manufacturing and functional specifications of the splint.

The patient then goes to the Orthopaedic Workshop where the measurements and the graphs that are necessary for the first rough preparation of the splint in trial step are taken on him. The systems used to this date for all this are, to tell the truth, to be considered almost empirical and the graphs in a special way, have to be considered of doubtful congruence, also because they are made when the patient is lying in a horizontal surface. In this way it is not easy to notice every necessary specification or measurement, peculiar to the limb in standing position. After this operation the patient leaves therefore the Orthopaedic Workshop and in the technical department the manufacture of the splint takes place, in its trial step, with the frames already connected to one another either by welding or riveting, and with the binding system (belts or pressing devices) of the temporary type.

When this operation has been

*Original report presented at Interbor Meeting, Turin, Italy (Institute Ortopedico Rizzoli, Bologna, Italy). Translated from Italian by Interbor staff.

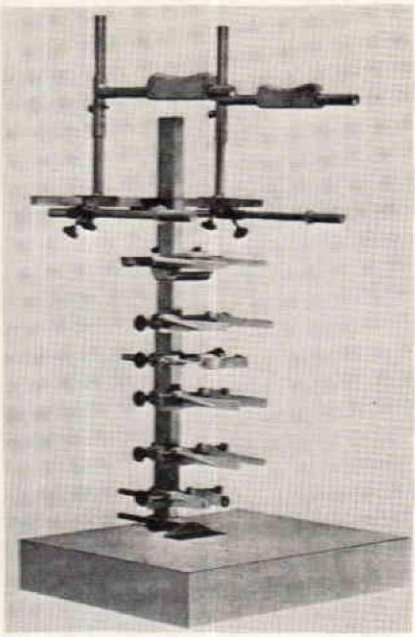

Figure 1

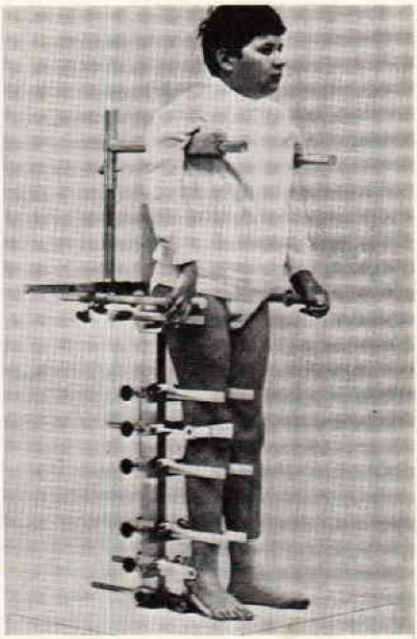

Figure 3

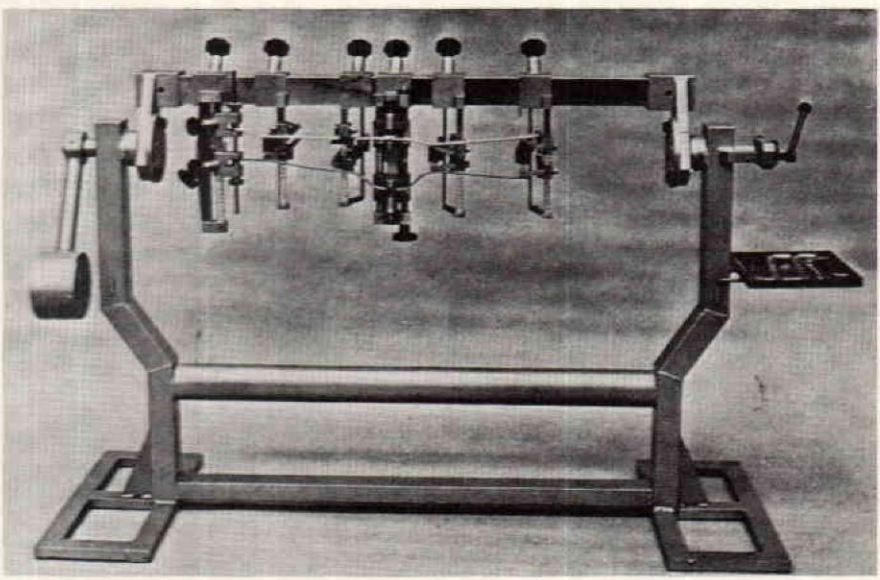

Figure 2

completed, the patient is called again, and the so called trial is made. In this new step, which is the most toilsome and delicate, most of times it is necessary to perform long changement and fittings, which require a remarkable loss of time both for the technician and for the patient.

When people are certain of the static and dynamic congruity of the splint, it is then possible to take care of the finishing operation, and then of the delivery to the disabled.

Of course this method, further to the technical criticisms, also favours very important considerations of economical character. The cost of labour, including the changements and the trial times, is very high and the industrial cost of the finished device is very high with reference to the value of the material and of the components that have been used.

The new method that we have studied and that we now introduce, allows further to a more rational obtaining of the measurements and the manufacture of the splints exactly answering to the actual configuration of the patient, also a remarkable saving of time in the manufacture, with a noticeable influence in the cost and therefore on the sale price.

Further the patient, who sometimes lives in places far from the technical department, is not any more troubled by calls for the trial, with a great saving of time and of travel expenses.

The method allows to obtain more rationally the measurements and the manufacture of the splints

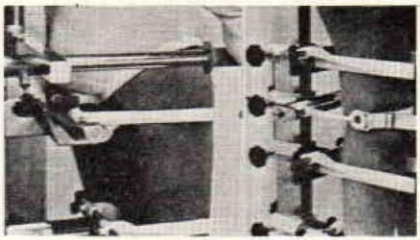

Figure 4 Figure 5

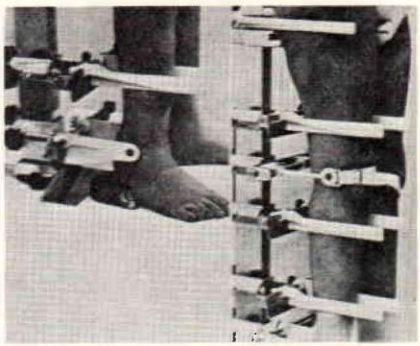

Figure 6 Figure 7

exactly answering to the detected data.

Our unit is composed by two equipments:

1) A measuring bearing device (fig. 1).
2) A revolving bench for the manufacture (fig. 2).

On the *measuring bearing device* the patient is put in his standing position, with the disabled limb resting on the ischium in a suitable bracket, adjustable in height (fig. 3). Two adjustable armpit rests, and two handles to be gripped by the hands, bear the patient who can thus put himself at his ease, with his feet resting on the base surface and with the disabled limb in the position prescribed by the orthopaedic physician.

On a pillar, graduated in millimetres, are fitted the detecting units which permit to determine:

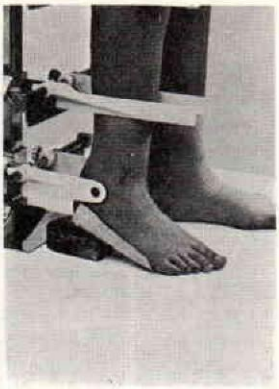

Figure 8

A) the height of the ischiatic rest (fig. 4);

B) the position of the articulation centre of the knee defined in the three orthogonal planes (fig. 5);

C) the position of the articulation centre of the malleolus with reference to the articulation centre of the knee (fig. 6);

D) the width of the splint: above and below the knee, at the thigh and over the malleolus (in correspondence of the connection positions of the cross half rings of the splint frame) as well as the position of said points with reference to the knee articulation (fig. 7);

E) the position of the rest sandal for the foot with reference to the splint (fig. 8).

In this way are determined, according to the known criteria of the orthopaedic technique, all the important anatonical positions for the articulation and for the holding.

For each of said positions, the bearing measuring device gives us two values, each expressed with a number read on a suitable graduated scale, which determine the position in height and in width.

The adjustable touching devices, that are used to detect the sizes of the splint at the height of the four cross half rings, are rested against the limb, in correspondence of the anatomical holding positions (fig.

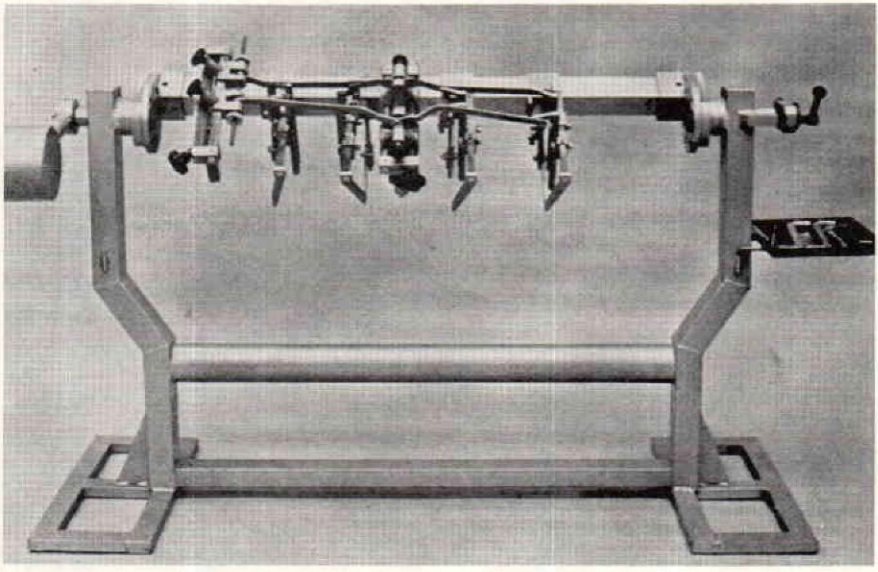

Figure 9

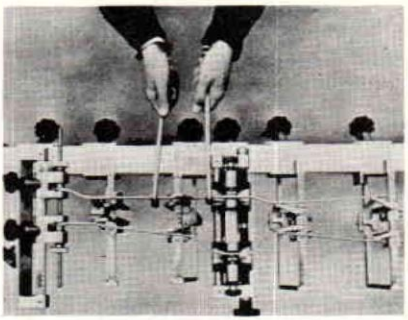

Figure 10

7), so that the limb itself is in the same conditions in which it will be when wearing the splint.

Operating on the touching devices, and pressing them more or less against the holding positions, it is possible to determine, always during the measurement step, the possibilities of lateral correction that can be obtained with the splint on the limb, and that the orthopaedic physician has prescribed.

The measurements obtained in the above described way, are brought on a special measurement form, which is used for the presetting of the *bench for the manufacture* of the splint.

Said bench has bearings with adjustable rest pointers, and with devices suitable to allow the perfect alignment, during the manufacture, of the articulations of the knee and of the malleolus.

By means of suitable graduated scales, it is possible to put the articulation centres and the rest pointers, in the pertinent positions perfectly equal to the ones that the detecting touching devices had in the measuring bearing device (fig. 9).

The rods, of steel profile or of other metal, with which the splint has to be manufactured (fig. 10), are then cut and shaped in such a way to follow the rest pointers, and to have the articulation axes correspond, using for this operation the bench as a jig for the shaping of the rods and for the pre-setting of the already manufactured articulation. Then the operations of preparation and welding of the various components (rods, cross half rings, articulations, possible articulated sandal, etc.) are made.

On this polyvalent jig, the splint is thus manufactured in a perfectly congrous way and, with the exception of rare very difficult cases, the technician can proceed with the finishing operations, without any necessity of trials on the patient.

The described equipment has been in operation in our Workshops for almost one year, and the results obtained on numerous patients have been actually satisfactory, both from the economical point of view, and from the quality point of view.

We therefore point it out especially to the largest Orthopaedic Workshops and Centres, that we know are pressed by the problem to shorten the hospital staying for the patients who only require the supply of orthopaedic equipments.

We realize that the whole of the equipment can appear a little complicated at its first sight, to the artisan technicians, but we can assure that its use is simple and however is such to compel correctly the operator to a rational and technically exact method and manufacturing sequence.

# Graduates of Degree Programs In Prosthetics and Orthotics

J. Warren Perry*
Barbara R. Friz**

## INTRODUCTION

The first graduates of a prosthetics and orthotics degree program in the United States were two students who received their baccalaureate degrees from New York University in 1965. Four years later, in 1969, a total of 25 NYU students had been awarded the bachelor of science degree in *prosthetics and orthotics.*

The first students to be graduated from a *two-year degree* program in *prosthetics and orthotics* received the associate in arts degree from Cerritos College in 1967. In 1969 a total of 29 students had been graduated from that program. At the same time, a total of 30 students had received an associate in arts degree in *prosthetics* after completion of a two-year program at Chicago City College and Northwestern University. The first degrees from this program were awarded in 1968.

By the end of the 1969 school year, then, 84 students had been graduated from a degree program: 25 with a bachelor of science degree in *prosthetics and orthotics,* 29 with an associate in arts degree in *prosthetics and orthotics,* and 30 with an associate in arts degree in *prosthetics.*

In January 1970, these 84 graduates were requested to participate in a survey proposed by the Subcommittee on Educational Projects

*Dean and Professor, Health Sciences Admin., School of Health Related Professions, State University of New York at Buffalo; Chairman, Subcommittee on Special Educational Projects in Prosthetics and Orthotics, Committee on Prosthetic-Orthotic Eduction.

**Executive Secretary, Committee on Prosthetic-Orthotic Education, Division of Medical Sciences, National Research Council, National Academy of Sciences, Washington, D.C.

**TABLE I**

**SURVEY DISTRIBUTION AND RETURNS**

| School | No. of Forms Delivered | No. Returned | % Returned |
|---|---|---|---|
| New York University | 23 | 20 | 86.9 |
| Cerritos College | 27 | 20 | 74.0 |
| Chicago City College | 27 | 25 | 92.9 |
| Total | 77 | 65 | 84.4 |

in Prosthetics and Orthotics, Committee on Prosthetic-Orthotic Education (CPOE).*** The members of the Subcommittee felt that a survey of graduates would not only supplement the data yielded by the Manpower Survey (also sponsored by this Subcommittee), but would provide information related to the professional and economic status of members of this unique group—the first to practice their profession following graduation from a degree program. It was also thought that the insight these graduates acquired in terms of their education and profession could be profitably shared by others.

*Results*

The response to the survey was good, with 84.5 percent of the 77 students returning the completed survey form. (Table I) (Seven forms were not delivered because of inadequate addresses.) Of the 65 respondents, 2 had been graduated in 1965, 1 in 1966, 13 in 1967, 23 in 1968, and 26 in 1969. (Table II)

Fifty-two respondents in civilian status were gainfully employed in the fields of prosthetics and/or orthotics at the time of the survey and were located geographically as follows: 10 in California; 9 in Illinois; 6 in New York; 4 in Pennsylvania; 3 each in Florida and Michigan; 2 each in Maryland, Texas, North Carolina, Ohio, Vermont, and New Jersey; and 1 each in Montana, Louisiana, Indiana, the District of Columbia, and Vancouver, British Columbia. Two were in the military service, one of whom was working in prosthetics. Eight were continuing their education at an advanced level in the fields of prosthetics and orthotics; 2 were unemployed at the time of the survey; and 1 was working as a custodian with plans for entering physical therapy. (Table III)

**TABLE II**

**NUMBER OF RESPONDENTS BY YEAR OF GRADUATION**

| Year of Graduation | Number of Respondents |
|---|---|
| 1965 | 2 |
| 1966 | 1 |
| 1967 | 13 |
| 1968 | 23 |
| 1969 | 26 |

***The Committee on Prosthetic-Orthotic Education is supported by the Prosthetic and Sensory Aids Service, Veterans Administration, and the Rehabilitation Services Administration, Social and Rehabilitation Service, Department of Health, Education, and Welfare.

## TABLE III

## STATUS OF RESPONDENTS AT TIME OF SURVEY

| Status | No. of Respondents |
|---|---|
| Employed in Prosthetics and Orthotics | 52 |
| Continuing Education | 8 |
| Military Service* | 2 |
| Unemployed | 2 |
| Employed Outside of Field | 1 |

*One working in the field of prosthetics

*Place of employment* (Table IV)

Of the 53 graduates working in the fields of prosthetics and/or orthotics, 42 were working in a commercial facility, 7 in a hospital, 2 in a university research program, 1 in a medical school, and 1 in the military service.

The average period of employment for most graduates at the time of the survey was two years or less. (Table V) Because none had been graduated for more than five years, it is obvious that a few left employment temporarily to attend school, or, at least part of the time, attended school during the period of employment.

Graduates were working in situations where the total number of employees (prosthetists, prosthetic technicians, orthotists, and/or orthotic technicians) ranged from 1 (the respondent) to 25, with an average of 7.5 per place of employment. (Table VI) The mode was 4.0 with 9 respondents reporting that number of employees in their facilities. Of the total employees at the 58 places reported (five of the respondents who had left employment temporarily completed this item on former place of employment), the ratio of prosthetists to prosthetic technicians was 1.3 to 1; orthotists to orthotic technicians was 1.3 to 1; orthotists to orthotic technicians was 1.1 to 1. This corroborates the findings of the Manpower Study. A 1 to 3 ratio was reflected in 3 of the largest organizations.

In selecting the place of employment, the graduates listed one or

## TABLE IV

## PLACE OF EMPLOYMENT OF 53 GRADUATES WORKING IN FIELDS OF ORTHOTICS AND PROSTHETICS

| Place of Employment | No. Employed |
|---|---|
| Commercial Facility | 42 |
| Hospital | 7 |
| University Research | 2 |
| Military | 1 |
| Medical School | 1 |

## TABLE V

## YEARS AT PRESENT PLACE OF EMPLOYMENT

| No. of Years | No. of Respondents |
|---|---|
| 1 year or less | 21 |
| 2 years | 17 |
| 3 years | 6 |
| 4 years | 3 |
| 5 years | 1 |
| 10 or more years | 4 |

## TABLE VI

## NUMBER OF EMPLOYEES* IN PLACE OF EMPLOYMENT

| | |
|---|---|
| Range | 1-25 employees |
| Average | 7.5 employees |
| Mode | 4.0 employees |

*Prosthetists, orthotists and technicians

**TABLE VII**

**REASONS FOR SELECTING CURRENT PLACE OF EMPLOYMENT**

| Reason | No. of Respondents |
|---|---|
| Work Opportunity | 40 |
| Salary | 16 |
| Geographic Desirability | 22 |
| Family Business | 10 |
| Educational & Professional Opportunity | 11 |
| Other | 5 |

more reasons for their choice, with "work opportunity" appearing most often. (Table VII) Several checked all categories. Although "geographic desirability" was checked only 22 times, it was found that forty graduates (74%) were working in the same general geographic area in which they lived before attending school.

Most graduates had been working in the same job since graduation. Twenty-one, however, had been employed elsewhere. All except one of the eight NYU graduates who left previous employment did so either because the job lacked an opportunity for professional growth and development or because they were offered a better chance for advancement elsewhere. Salary as a consideration was cited in two instances.

Four of the 15 AA graduates who left previous employment did so to return to school. Other reasons cited by individuals were varied as follows: the working situation allowed no opportunity for applying modern techniques; could not maintain two jobs; drafted; the responsibilities of the job were much greater than his talents; wanted to get away from home; offered the kind of job he wanted in research; and other reasons related to salary and personal considerations. Obviously, in this group, no well-defined pattern emerged as a cause for resigning.

*Salaries*

As might be expected, the salaries of the graduates of the baccalaureate degree program, all of whom were located on the East Coast, were considerably higher than those of the associate in arts degree program. (Table VIII)

The average number of years experience for this group was too few to show any influence on salary level. All those in the highest income brackets, *i.e.,* over $15,000, were in executive or administrative positions, such as president, vice president, or manager of an organization or department.

Twenty-one (62 percent) of the 34 salaries reported for this group were less than $8,000, and 10 (29

**TABLE VIII**

**SALARY RANGE BY EDUCATIONAL LEVEL OF GRADUATES**

| Salary Ranges | B.S. Degree | A.A. Degree |
|---|---|---|
| $5,000-5,999 | | 1 |
| $6,000-7,999 | | 20 |
| $8,000-9,999 | 4 | 10 |
| $10,000-11,999 | 6 | 3 |
| $12,000-14,999 | 5 | |
| More than $15,000 | 4 | |
| Not applicable | | 9 |
| (Student or unemployed) | | 10 |
| No response | 1 | 1 |

**TABLE IX**

**NUMBER OF HOURS IN NORMAL WORK WEEK**

| Hours | B.S. degree | | A.A. degree | |
|---|---|---|---|---|
| | No. | Pct. | No. | Pct. |
| Less than 50 | 9 | 47.4 | 29 | 85.3 |
| 50-60 | 8 | 42.1 | 5 | 14.7 |
| More than 50 | 2 | 10.5 | | |
| Total respondents | 19 | | 34 | |

percent) were in the range of $8,000-10,000. No salaries under $8,000 were reported for NYU graduates; no salaries over $12,000 were reported for AA graduates.

The median salary for those holding the baccalaureate degree is higher than that reported for prosthetists and orthotists in the Manpower Study: $12,000 vs. $9,500. However, the median salary for holders of the AA degree is slightly lower: $9,000 vs. $9,500. The experience factor may be of considerable influence here inasmuch as most graduates had only one or two years in the field.

*Number of hours in normal work week* (Table IX)

Along with impressive titles and higher salaries go increased number of hours worked. Generally, persons in executive or administrative positions work at least 50 hours a week and some considerably in excess of that number. Most graduates with baccaulareate degrees work more hours than those with AA degrees. Fifty-two percent of the former work 50 hours or more each week compared with 14 percent in the latter group.

*Vacation* (Table X)

In completing the question on vacation, 46 persons stated vacation time allocated. Nine of the 46 (19.5 percent) received 1 weeks' vacation, 5 (55 percent) of whom were receiving salaries in the $6,000-7,999 range. Twenty-eight (61 percent) received 2 weeks' vacation. Nine (19%) received 3 or more weeks' vacation. For three

**TABLE X**

**VACATION**

| Salary Range | 1 Week | 2 Weeks | 3 or more weeks | Total |
|---|---|---|---|---|
| Less than $6,000 | 1 | 1 | | 2 |
| $6,000-7,999 | 5 | 9 | 2 | 16 |
| $8,000-9,999 | 3 | 8 | 2 | 13 |
| $10,000-11,999 | | 5 | 2 | 7 |
| $12,000-14,999 | | 3 | 2 | 5 |
| More than $15,000 | | 2 | 1 | 3 |
| Total | 9 | 28 | 9 | 46 |

## TABLE XI

## HOSPITALIZATION AND SICK LEAVE

**Hospitalization**

| Response | No. of Respondents | Pct. of Respondents |
|---|---|---|
| Yes | 43 | 87.7 |
| No | 6 | 12.3 |

**Sick Leave**

| Response | No. of Respondents | Pct. of Respondents |
|---|---|---|
| Yes | 25 | 58.1 |
| No | 12 | 27.9 |
| Not specified | 6 | 14.0 |

employees, vacation time had not been determined or was varied. Four persons failed to complete the question. No relation between number of days vacation and experience nor educational level was detected.

*Hospitalization and Sick Leave* (Table XI)

Forty-three respondents reported that hospitalization was included in fringe benefits. In only 6 instances was it not included.

Sick leave of varying number of days was included in fringe benefits for 25 of the 43 who completed the item. Ten stated that sick leave was awarded as required, 12 reported that no sick leave was included, and in 6 instances the sick leave benefits were not specified. Of the fifteen who were given a specific number of days, the range was 3-24 days with an average of 10 days.

*Distribution of work between prosthetics and orthotics* (Table XII)

Of 51 reporting respondents who were working in the field, 22 work

## TABLE XII

## DISTRIBUTION OF WORK BETWEEN PROSTHETICS AND ORTHOTICS

| Type of Work | No. of Respondents |
|---|---|
| Prosthetics exclusively | 22 |
| Orthotics exclusively | 6 |
| Prosthetics and Orthotics | 23 |
| Prosthetics, including Prosthetics & Orthotics | 45 |
| Orthotics, including Prosthetics & Orthotics | 29 |

in prosthetics exclusively; 6 in orthotics exclusively; 23 work in both fields. The number working in prosthetics, including those working in prosthetics and orthotics, numbered 45.

Fifteen of the NYU graduates who reported were working in prosthetics and orthotics, but the bulk of the work was being done in prosthetics (68 percent of the time in prosthetics, 32 percent in orthotics). Only one of the 15 spent more time in orthotics than in prosthetics (70 percent in orthotics —30 percent in prosthetics). Two NYU graduates worked only in prosthetics; two worked only in orthotics.

Five Cerritos graduates worked in both prosthetics and orthotics (53 percent in prosthetics—47 percent in orthotics). Six worked exclusively in prosthetics; four exclusively in orthotics.

No Chicago graduates were working in orthotics exclusively. Fourteen were working in prosthetics exclusively, and four were working in prosthetics and orthotics (75 percent in prosthetics—25 percent in orthotics).

## TABLE XIII

## DISTRIBUTION OF TIME SPENT IN WORK ACTIVITIES

| Work Activity (Prosthetics and Orthotics) | New York University | Cerritos College | Chicago City College |
|---|---|---|---|
| | Time (%) | Time (%) | Time (%) |
| Fabrication | 20 | 57.4 | 35.3 |
| Fitting | 32.3 | 18.5 | 38.8 |
| Administration | 13.2 | 3.8 | 4.3 |
| Consultation | 6.8 | 5.7 | 8.2 |
| Attending Clinic | 9.7 | 7.3 | 6.1 |
| Instruction | 6.8 | 3.4 | 2.2 |
| Supervision | 8.6 | .1 | 2.1 |
| Other | 2.6 | 3.8 | 3.0 |

*Job Responsibilities* (Table XIII)

New York University graduates reported spending a greater proportion of their time (32.3 percent) in fitting patients than in any one other work activity. An average of 20 percent of their time was spent in fabricating devices. Administrative duties occupied 13.2 percent of their work time, a higher percentage than that of the AA graduates whose administrative duties occupied about 4 percent. NYU graduates spent about a third of their time in such activities as consulting, attending clinic, instructing and supervising.

About two-thirds of the work hours of AA graduates were spent in fabrication and fitting compared to about 50 percent for BS graduates. Graduates of Cerritos City College, where the curriculum includes both prosthetics and orthotics, were fabricating prosthetic and orthotics devices over half of their work hours, whereas the graduates of Chicago City College, where the program is exclusively prosthetics, were spending only about one-third of their work time in fabricating, mostly prosthetic devices. Chicago City College graduates spent twice as much time in fitting patients as did Cerritos graduates.

*Professional relationships*

In response to questions related to participation of the prosthetist as a professional member of a clinic team, the following information was submitted:

*New York University graduates*

Of the 19 employed NYU graduates, 15 did attend clinics and participated as professional members of a team. The four who did not attend had responsibilities that did not warrant attendance, or the clinic concept was poor in that area. One who did attend the clinics, however, noted that prosthetists were given only a surface acceptance by professional members of the allied health professions.

Only two noted any difficulty in communication with physicians and other professional people, one attributing this to physicians being extremely busy and one observing that, in isolated instances, individuals in other fields were not receptive to his point of view.

*Cerritos College graduates*

Of the fifteen Cerritos graduates who were employed in prosthetics and/or orthotics, eight did not attend clinics. Usually, the firm was represented by a more senior or experienced member. Two noted a lack of amputee clinics in the area. One respondent stated that the orthotist is respected for his opinion regarding aspects of proper bracing. Since a number indicated that this is not always true, it is interesting to note that this man had exposure to hospital rounds, followed by question and answer periods, during his clinical training. None of the 15 recognized any difficulty in communication, although one noted much improvement was needed and desired.

*Chicago City College graduates*

Many of the 20 Chicago graduates did not attend clinics, and in most cases attributed this to the need for more experience as required by the supervisor before attending. Two felt strongly that they should attend, and one gave his inability to attend as one reason for leaving the place of employment. Three Chicago AA graduates expressed some difficulty in communicating, and two stated a lack of understanding of clinical pathology and a need for some background in medical subjects. One felt ill-at-ease because of the few clinics he had attended, and one implied that although he had no difficulty in communicating, physical therapists had difficulty in understanding.

*Educational program*

A question in the survey, "In general, did you find that your prosthetic and/or orthotic educational program prepared you adequately for your current responsibilities?" showed 43 graduates answering in the affirmative, 12 in the negative, and 5 were apparently undecided. For those who felt that they were not adequately prepared, 8 expressed an urgent need for more practical experiences; 7 a need for more direct contact with patients and their problems in order to view the patient as part of a rehabilitation program; 5 wanted more courses in management or business administration; and 6 felt more advanced courses in prosthetics and orthotics were needed.

The school courses that were listed as most valuable in terms of postgraduate professional activities were: prosthetics and orthotics, considered so by 26 respondents; and anatomy, rated second by 17. All courses were found valuable by 9 respondents, and biomechanics was listed most valuable by two.

Eleven respondents found the courses in liberal arts the least valuable; 9 listed professional problems as least valuable; 8, biomechanics; 5, drafting and sculpture; 2, clinical application; and 7 AA graduates declared that the first year in the program was wasted.

In responding to the question, "How do your present duties correspond with your expectations?" the NYU graduates, for the most part, said that their present duties did correspond with their expectations. However, there were minor exceptions, such as one expected more clinical work, one more research, one expected to be more clinically

than administratively involved; one said the work was more demanding than he expected. One expressed acute disappointment in his relationship with members of the team and felt that the prosthetist was not given the recognition he should have in terms of his own professional knowledge. He pointed out that physical and occupational therapists, having attended a one- or two-week course, were recognized as authorities in the field of prosthetics and orthotics, more so than he who had received a B.S. degree in this field.

More of the Cerritos and Chicago graduates failed to complete this question than did the NYU graduates, perhaps because they may not have formed definite conclusions about their work. The responses from the graduates of the two schools were approximately the same. Most said their present duties were what they had anticipated; however, a few from both schools said that the present situation was far beyond their expectations, stating that they had much more responsibility than they had expected. Several were disappointed at the level of salaries. One said his duties were "below par," indicating his superiors were reluctant to allow him to improve on methods.

Sixty-one of the 65 respondents (94%) plan to stay in the fields of prosthetics and/or orthotics. Three are undecided—two citing unsatisfactory salaries as a consideration and one unable to find employment in a foreign country where she now lives.

*Professional goals*

Professional goals were quite different as expressed by graduates of the three different schools. The goals of NYU graduates appeared to stem from a motivation directly or indirectly related to professional advancement of their field. Some looked forward to teaching, research or providing services at a high professional level. Others stated that their goal was to raise the level of prosthetics and orthotics at local and national levels, to raise professional standards, or, ultimately, to reach the same professional level as doctors or dentists.

Fifteen of the 21 respondents from Chicago stated that their professional goal was to own a facility. Two spoke of advancing their own professional and educational status; one wanted to become knowledgeable in orthopedics. The graduates of Cerritos College were more interested in certification, and eight expressed this as their short-term goal. Two graduates were interested in the field of education as a long-term goal; two wanted to obtain a higher degree; six wanted to eventually own their own facility; three expressed an interest in education and research; and two were interested in advancement related to their professions.

*Discussion*

In 1969 we were well-pleased with a 49 percent response to the Manpower Survey, inasmuch as responses to previous surveys in the fields of prosthetics and orthotics were far below that level. It is now most encouraging to receive a response of 84.5 percent to the pres-

ent survey. Furthermore, the care and thoroughness with which the forms were completed are manifestations of the respondents' interest and concern, both in the quality of prosthetic and orthotic education and in the professional status of the two specialties. The comments of several graduates reflected an attitude of urgency and deep concern in terms of development and advancement of their own field.

An earnest desire to function and to be recognized as a professional person was uppermost in the minds of many of the graduates. It seems that every emerging health profession is inevitably faced with the situation in which the need and the right to be accepted by other professional groups are initially denied. Although the professional, himself, knows that he is capable of contributing—in this instance, to the rehabilitation of orthopedically disabled patients—he may find that he is not consulted or that his suggestions are ignored or met with skepticism. These kinds of reactions by other professionals may often be expected and may be attributed to a lack of knowledge or understanding on their part, unfortunate past experiences, or simply a natural resistance to the new, or to change.

One would like to suggest a quick and easy way to overcome this difficulty, but most persons who represent an emerging health profession and who are well-established as a member of a professional team have acquired this status by a patient and persistent educational effort, an effort which at times may be discouraging. When a person can consistently and helpfully respond to needs that others cannot respond to, however, it is only a matter of time before the value of his contributions is recognized and he becomes accepted as a member of the team.

It is obvious from the comments by graduates that they are not willing to work in situations where they cannot be creative or innovative, or where new techniques and developments in prosthetics and orthotics are ignored or ruled out by reactionary supervisors. In general, graduates of prosthetics and orthotics degree programs reflect a visionary outlook and are demanding professionalism in their practice. Furthermore, graduates who have had two or more years of schooling in their specialty expect higher pay and will usually not stay at a place that does not offer a chance for economic security.

It is interesting to note that most of the graduates of the baccalaureate degree program did not consider professional goals in terms of their own personal goals, but of those goals related to advancement of their profession, whereas the AA graduates spoke in personally realistic terms and were more concerned with their own advancement. This can probably be attributed to the fact that most of the baccalaureate graduates seem to be placed in situations where they are finding job satisfaction and security and are looking beyond their own immediate needs. This attitude on the part of the practitioners themselves will probably do more to upgrade the professional status of prosthetists and orthotists than any external sup-

port or assistance will ever accomplish.

*Summary*

Survey forms were mailed to 84 graduates of degree programs in prosthetics and orthotics. Seven forms were not delivered. Of the 77 graduates who received the forms, 65 completed and returned them, a 84.5% response.

Fifty-three of the 65 respondents were currently employed in the fields of prosthetics and orthotics. The data related to their work and professional status are analyzed and recorded.

Comments related to the education program and future professional goals are summarized and reported.

*Reference*

Perry, J. W., and B. R. Friz, Manpower Survey, Orthotics and Prosthetics, 23:4:207-225, December 1969.

# Application of Cast Brace for Post Acute Care of Lower Extremity Fractures

Roy Snelson, C.P.O.*, George Irons, C.P.O.**, and Vert Mooney, M.D.***

The fracture cast brace is designed to allow early ambulation on fractures of the proximal tibia and distal femur. By providing total contact support to the thigh and leg while allowing free motion at the knee, functional use of the extremity is made available before fracture healing has matured adequately to withstand the stresses of normal use. The device is designed to answer the temporary but immediate needs of post acute fracture care. With proper equipment it is available for application immediately upon need in any clinical setting such as hospital cast rooms, emergency rooms, or even at the bedside.

Because it is to be an answer to temporary but immediate needs, plaster is the major construction material. An adjustable quadrilateral brim and brace joints with alignment fixture are the other major materials necessary for construction. Familiarity with brace joint alignment is a prerequisite for the application of this device. In addition familiarity and competence in the use of plaster are necessary. An orthotist-prosthetist is the best qualified person to apply the device not only because of his competence in the techniques of brace and prosthesis construction but also because of the availability of specialized equipment through his standard supply sources. The use of the orthotist-prosthetist for the application of this device is very reason-

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able on an economic basis because it provides an opportunity for more rapid release from the hospital and more independent function of the patient during his post acute phase of fracture care. This device presents an excellent example of the use of allied medical personnel to substitute for physician time and reduce overall expense of medical care.

It is important to recognize that the cast brace is to supply support for an incompletely healed fracture during its maturing phase. Therefore, discussion with the physician involved and viewing the X-rays before application of the cast brace are very important. It is sometimes necessary to correct a malalignment of fracture fragments which have occurred during traction or place a varus or valgus stress upon the fracture site to maintain a corrected position. These points should be clarified and thoroughly understood before the brace is applied. Viewing X-rays taken after the application of the cast brace is also very instructive in that it confirms the alignment of fracture fragments and positioning of joints at the knee. It may be necessary to correct further fracture alignment by wedging of the brace. This of course is one of the great advantages of using plaster as the major fabrication material.

Following application of the cast brace, the patient should be instructed not to bear weight or use the limb for 24 hours in order to allow adequate hardening of the plaster. Many times physical therapy training is necessary to allow the patient to become functional in the use of the cast brace and crutches. The patient should be instructed to range the knee, do quadriceps setting exercises, and to extend the knee fully during stance phase of gait. At first accomplishing these will be difficult but this condition will rapidly improve as the patient gains greater control of his limb.

The cast brace should be worn until the fracture is united—usually 6 to 8 weeks. If the brace becomes loose or has been incorrectly applied indicated by increasing pain and/or angulation of the fracture site, it must be changed. It has been necessary to change the cast brace or realign the joints in about 5 per cent of the cases treated.

This brace is designed only for the treatment of post acute fractures; therefore, it is appropriate for application after the fracture has stabilized in traction or suspension. In comminuted fractures of the distal femur treated by this device, the time of application should be 4 to 8 weeks after fracture, depending on the stability of the fracture in traction. In fractured tibial plateaus, the most appropriate time for application is approximately 10 days after surgery for elevation of the tibial plateau, or when the knee is comfortable enough to tolerate gentle ranging while in suspension or traction. In fractured femurs, if the device is put on earlier than that time wherein the fracture has achieved some stability (will not shorten when traction is removed), there will be some tendency for the fracture to shorten while it is confined in the brace.

The concept of the brace is to provide total-contact support to the

thigh—not particularly to achieve ischial weight bearing. It is believed that if the thigh can be encased in a rigid capsule under slight compressive pressure stability, skeletal unloading will be achieved by way of the hydraulic effect of the encapsulated fluid-filled leg. Experimental studies have demonstrated that the amount of skeletal unloading is extremely variable and dependent on many factors. The degree of skeletal unloading was not related to rate of bone union.[1] Based on our experience and studies, the only truly critical factors about the brace are that it be total-contact about the thigh and be applied as proximal to the root of the leg as possible. Good plaster techniques and intelligence in joint alignment are the necessary skills required.

**Instruction for Cast Brace Application**

1. Mark the knee for placement of the brace joint hinges (Figure 1). A point of the adductor tubercle (or the level of the midportion of the patella, whichever is easier to define) and about ¾" posterior to the midline of the leg has been found, an appropriate compromise location for the brace joint axis. When this point is determined, it should be defined by marking the patient's skin before any application is begun. This mark serves as a reference point throughout the rest of the procedure.

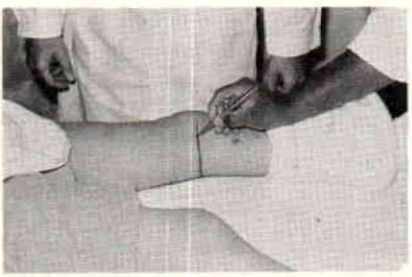

Figure 1
Marking the knee for placement of brace joint hinges.

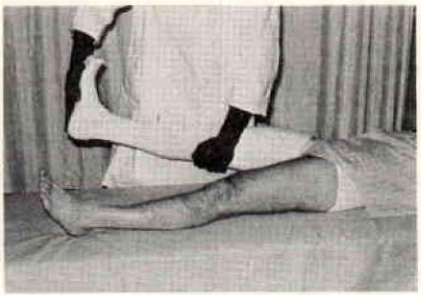

Figure 2
Leg held from lateral side with ankle in neutral.

2. The below-knee portion of the leg is generally plastered first. With the leg held in a comfortable position, taking care to avoid wrinkles. The leg should be held from the lateral side with the ankle in neutral and the foot in valgus (Figure 2). If the leg is painful to move and it is difficult to role on Spandex cast sock, a six-inch bias cut Stockinette can be rolled on instead. Place foam pads approximately 2½ inches in diameter and ½ inch thick over the boney prominences of the medial and lateral malleolus and the head of the fibula. Foam pads also should be used over any pressure sores or open wounds. Potential effusion at the knee can be avoided by the use of an elastic knee cage or the cast sock. No other padding is used in cast brace application. In order to avoid pressure concentration, do not use 4" x 4" dressings over pin sites, open wounds, or pressure sores. Furacin gauze pads may be placed over open, draining

Figure 3
Application of elastic plaster.

wounds with foam on the outside of the sock.

3. With the foot held in a neutral position, 4-inch elastic plaster is wrapped over the Spandex sock for contouring and to provide a total-contact cast. Start the elastic plaster wrap at the toes and work proximal to the level of the femoral condyles, avoiding compression of the foam relief pads (Figure 3). With the foot still in a neutral position, 4-inch plaster of Paris bandage is rolled on for strength.

4. The proximal trim should include the medial and lateral condyles at the level of the adductor tubercle, to the mid-patella anteriorly. The posterior trim should provide full knee flexion. At this point, mark and trim the cast. The toe of the cast should be marked through the mid-metatarsal heads. (Figure 4)

Figure 4
Trim lines.

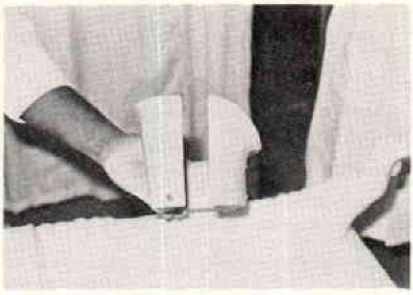

Figure 5
Cast brace brim.

5. Select the proper size brim to fit the ischial circumference measurement (Figure 5). The medial wall should be placed parallel to the longitudinal axis of the leg. It is important that the brim be applied as proximal as possible. To insure that the brim is held proximal until plaster is applied, it may be necessary for the orthotist-prosthetist to hold the brim in place until plaster is applied. Hose clamps or adhesive straps also may be used to attain compression.

6. Place the brim proximally so the posterior seat is at the ischial level. The medial wall should be perpendicular to the examining table. With the brim in position, moderate pressure should be applied to compress the soft tissue. Elastic plaster is used, starting at the brim. Reinforce the elastic plaster with 4-inch plaster of Paris (Figure 6).

7. Distal trim of the thigh cast should be approximately 1-inch above the lower cast medially and laterally (Figure 7). Trim the posterior high enough to allow full

Figure 6
Application of plaster.

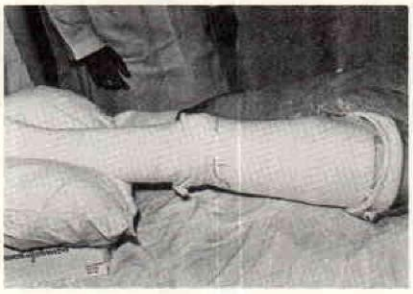

Figure 7
Thigh cast trim lines.

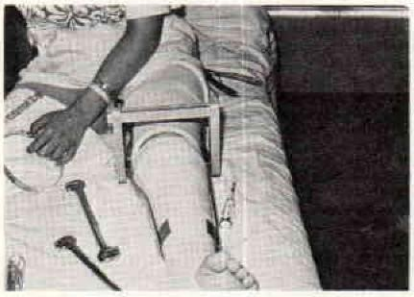

Figure 8
Placement of knee hinges.

knee flexion. After completion of the upper and lower casts, the leg should be placed in a position of good alignment in preparation for bending of the brace joint. The leg may be placed in the appropriate degree of varus or valgus at this time.

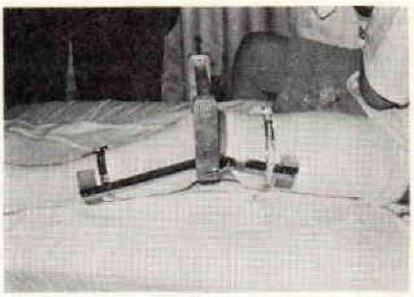

Figure 9
Checking positioning of knee hinges.

8. Place the uprights in the knee fixture. The brace joints should be positioned at the level of the marked knee center on the midline of the leg. The side bars are bent to achieve appropriate alignment. The knee joint axis should be parallel to the table (Figure 8). When the knee hinges are positioned, the medial wall of the brim should be perpendicular to the table and the foot should be in good alignment.

9. The knee joints are temporarily held in place by long hose clamps. Placement of the hinges can be checked by passively taking the patient's knee through range of motion (Figure 9).

10. Check for knee flexion contracture. If a flexion contracture is present, the hinges will have to be placed in flexion to accommodate the contracture. Secure the uprights with plaster bandages, looping them around the bars several times, then around the entire cast (Figure 10). Remove the hose clamps and finish securing the lower and upper uprights. After removal of the knee fixture, check for adequate knee flexion.

11. A molo-pedic shoe should be placed on the foot for ambulation.

Figure 10
Plastering knee hinges in place.

Instruct the patient to allow 24 hours drying time before attempting ambulation (Figure 11).

## SUMMARY

A rationale for use and specific instruction for application of a cast brace is designed to meet the temporary but immediate needs of post acute fractures of the distal femur and proximal tibia. It is expected to be applied by orthotic-prosthetic personnel with competence in the use of plaster and brace joints.

The ultimate success of this device depends upon providing the patient an opportunity to functionally use his extremity before the skeletal system is sufficiently healed to tolerate unprotected stresses. The device must be used in cooperation with a physician who accepts and understands the benefits of early function. Close cooperation and communication among the patient, physician, and orthotist-prosthetist are necessary to avoid misunderstanding and failures. Once comfortable communication is established among the three members of the team, all participants should be gratified by the use of this device.

Figure 11
Patient standing.

## REFERENCES

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# The Cosmetic Below-Knee Brace

William T. Murray, B.A., M.S.*
and Jack E. Greenfield**

Cosmesis is one of the factors influencing patient tolerance of an orthotic appliance. Conventional below-knee braces are conspicuous and, of necessity, heavy. A little over a year ago a plastic below-knee brace was developed by Jack Greenfield, C.O. of the Orthotic Department, Rancho Los Amigos Hospital, Downey, California, in an attempt to improve cosmesis and decrease the weight of standard devices. Plastics of many types were tried, including laminated prosthetic resin, ortholene, and polyethylene. Polypropylene proved to be the only plastic suitable for the molding of a rigid orthosis which would hold up under the stresses of ambulation.

Other workers have reported on lightweight cosmetic below-knee braces. The work of Simons, Jebson, and Wildman[1,2] on a laminated prosthetic resin type brace has been the most notable. Engen[3] also has worked on a laminated resin and woven polypropylene type brace.

The cosmetic brace described herein consists of a posterior molded plastic shell of ⅛th inch thick polypropylene plastic (Fig. 1). It is held on the patient by an anterior velcro strap at the proximal end

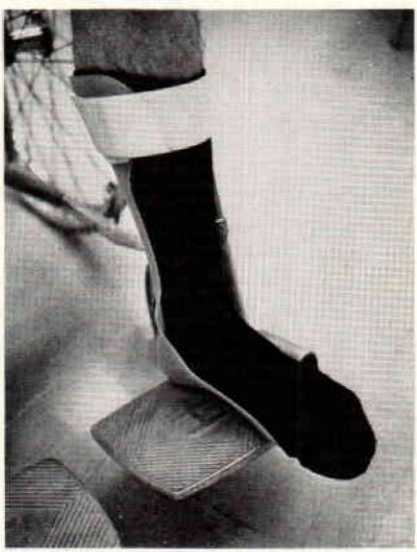

Figure 1

*Orthotic Intern, Rancho Los Amigos Hospital, Downey, California
**Certified Orthotist, Rancho Los Amigos Hospital, Downey, California

Figure 2

and by the patient's shoe at the distal end. Since its development, over 75 patients have been successfully fitted with this brace.

Most patients wear the brace in contact with the skin; however, stockings may be worn underneath. When males wear their normal stocking over the orthosis, the result is excellent cosmesis. Shoe modifications are generally not necessary, although a size wider than usual may be required. Orthopedic shoes are also not necessary, although laces or a strap with buckle over the instep are needed.

### Fabrication

A plaster negative is made of the patient's leg in the following manner: A piece of three-inch tubular stockinette containing a piece of one-inch webbing is pulled over the patient's foot and lower leg; the webbing is positioned over the full length of the anterior crest of the tibia and extends to the distal portion of the foot. The stockinette is then marked over each malleoli and any other bony prominences are marked.

With the patient in a sitting position, the foot and lower leg are wrapped, distal to proximal, with four-inch plaster of Paris bandage. Two rolls are usually sufficient. Elastic plaster of Paris bandage is suggested for the foot as this seems to result in better molding of the longitudinal arch and heel.

The casted foot is positioned on a standing board like that used in casting for the Berkeley shell (Fig. 2). The patient is asked to place his hands on the knee of the leg being casted and press forward. The desired degree of dorsiflexion is controlled by placement of the foot and standing board. Any varus or valgus is corrected by pressure on the appropriate malleolus until the cast has hardened.

Horizontal lines are marked across the anterior portion of the hardened cast. The cast then is cut over the crest of the tibia and dorsum of the foot and removed. Immediately upon removal, the cast is closed and held with tape, using the horizontal lines to correctly position the cut edges.

When completely hardened, the cast is prepared for filling with plaster of Paris and the placing of a mandril. The resulting plaster positive is smoothed with a surform file, care being taken not to remove any plaster from the area of the malleoli or other bony prominences marked on the cast. If indicated, the arch may be modified to prevent valgus. In fact, any modification that can be made on the inside of a shoe can be made on the cast.

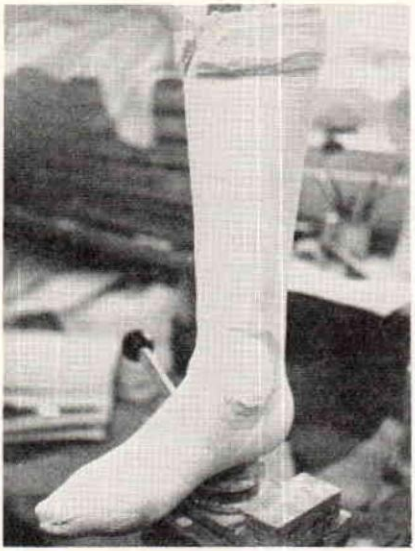

Figure 3

When smooth, the area over each malleolus is built up with a piece of ¼ inch felt, 1½ inches in diameter, with skived edges. These pieces are glued into position. Another piece of ¼ inch felt, one inch wide and long enough to cover the posterior portion of the calf, is glued to the apex of the bulge of the calf to give a rolled effect to the proximal end of the finished brace (Fig. 3). A piece of cotton stockinette is pulled over the cast and tied at each end. The cast is now ready for use in molding the polypropylene.

Figure 4

Figure 5

To prepare the polypropylene for molding, it is heated in an oven at 400° for eight to ten minutes. When warm enough to mold, it turns clear. Because polypropylene is very tacky when heated, a special frame is needed to hold the sheets while in the oven (Fig. 4). Two layers of cloth are stretched and stapled over this wooden frame. Before the plastic is put on the cloth, the cloth is sprinkled with talcum power so the plastic will not adhere to it. Talcum powder also should be used on the gloves worn to handle the moldable plastic.

When it becomes moldable, the plastic is lifted off the cloth by its corners, placed on the cast, and fused together along the anterior surface (Fig. 5 and 6). Care must be taken not to touch the surface of the plastic until it cools because in a tacky state it marks easily and these marks cannot be buffed off. After the surface cools, the plastic is sprinkled with talcum powder and molded into the contours of the cast.

When the plastic is cool, it is cut from the cast with a cast saw. The edges are finished by sanding to the desired shape and by smoothing with a hard felt wheel run at 1000 rpm or less. Higher speeds will burn the edges of the plastic.

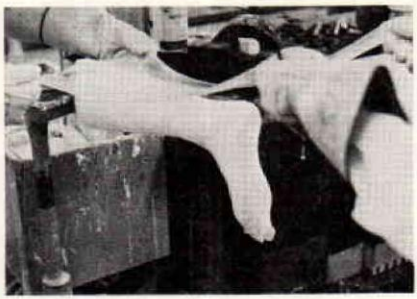

Figure 6

Pressure over each malleolus and the navicular should be checked durng fitting. In most cases any excess pressure can be relieved by heating with a heat gun and stretching the troublesome area.

### Indications

1. Drop foot—flaccid or with mild spasticity.

### Contraindications

1. Plantar flexion contracture—the foot must come to 90°.
2. Minimal sensory involvement—slight involvement is allowable as contact of the brace with the skin seems to aid proprioception.
3. Spasticity—mild spasticity can be controlled.
4. Knee instability—up to 5° of hyperextension at the knee has been controlled by casting the patient in slight dorsiflexion.

A cosmetic below-knee brace having excellent cosmetic value is presented. Details of fabrication are included to facilitate duplication by other orthotists. Compared to conventional orthoses, the plastic brace is more cosmetic and lighter in weight. Costs are comparable to standard below-knee braces.

### References


[1] Simmons, Bernard C.; Jebsen, Robert H.; and Wildman, Louis E.: Plastic Short Leg Brace Fabrication. *Orthop. and Pros. Appl. J.*, 21: 215-218, September, 1967.

[2] Simons, Bernard C.; Jebsen, Robert H.; and Corcoran, Paul J.: Experimental Plastic Short Leg Brace. *Arch. Phys. Med.*, 49: 108-109, February, 1968.

[3] Engen, Thorkild J.: Panel on Lower Extremity Orthotics, Subcommittee on Design and Development, Committee on Prosthetics Research and Development, National Academy of Sciences, held March 9-12, 1970, at Rancho Los Amigos Hospital, Downey, California.

## *CORRECTION*

Please note the following additions and corrections to the article entitled "Brace to Body Dynamics" by John Glancy, C.O. The article was published in Volume 24 No. 3 of *Orthotics and Prosthetics* dated September, 1970, pp 21-29.

p. 23: Number 3 in column 2 states that the ankle joints should be set in 22° of external rotation. This statement applies only to the example given; 22° of external rotation is not a fixed setting and does not apply to all patients.

p. 24: Number 4. The brace attachment should be set at 12° of toe-in on the shoe, not 22°.

p. 26-27: The sections marked *a, b, c,* and *d* refer to the illustration in Fig. 5 and correspond to the positions marked 1, 2, 3, and 4. For example, the action described in part *a* is shown in Fig. 5 as position 1. Part *b* refers to position 2, part *c* to position 3, and part *d* to position 4.

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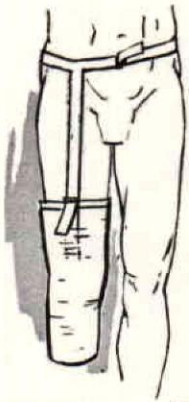

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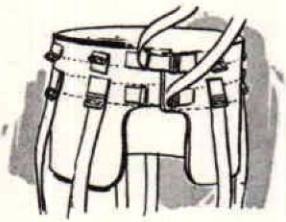

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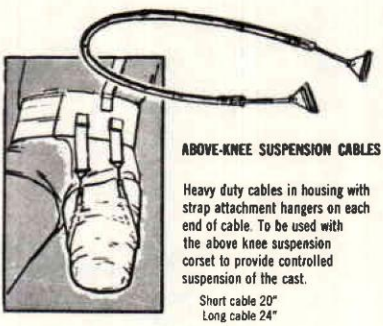

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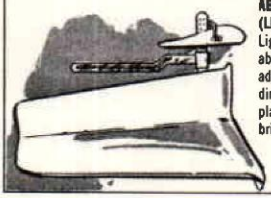

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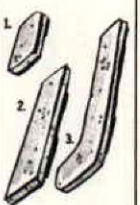


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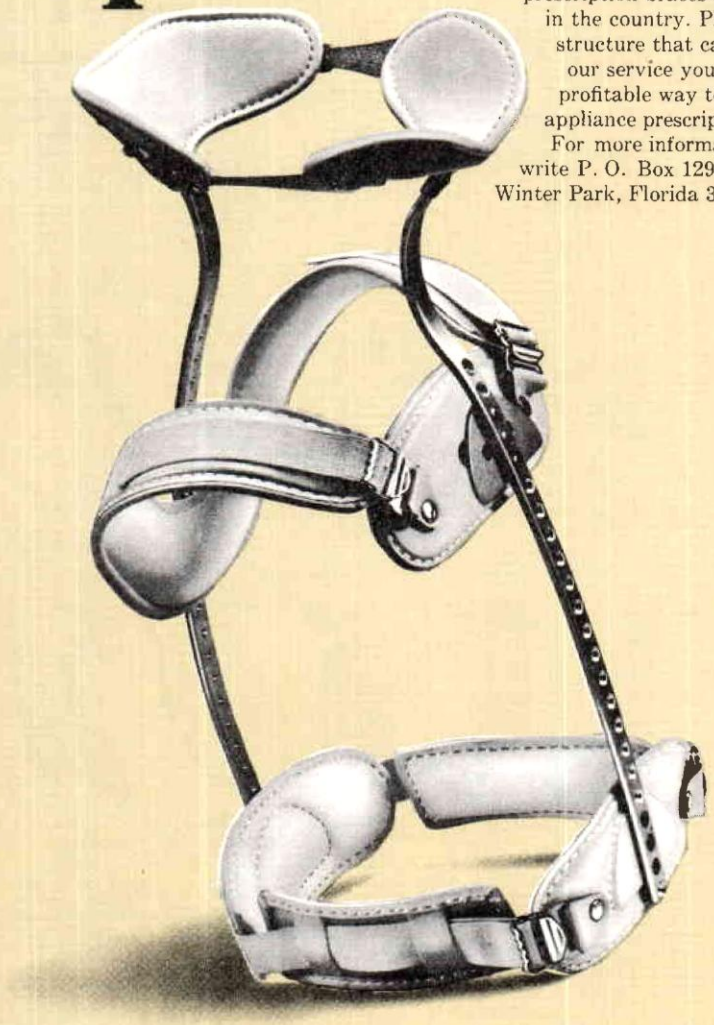

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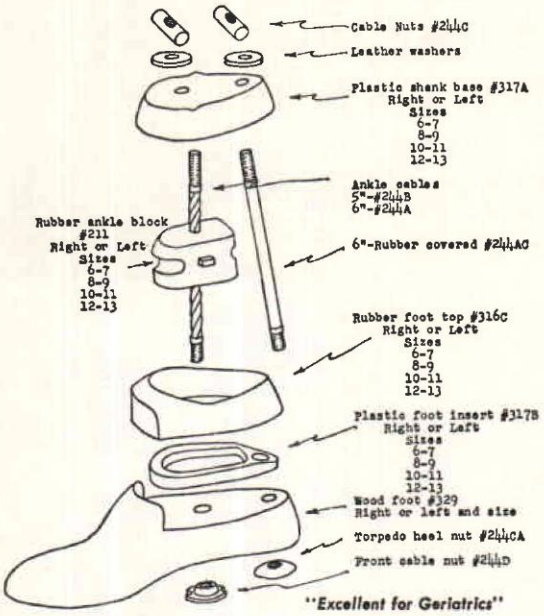


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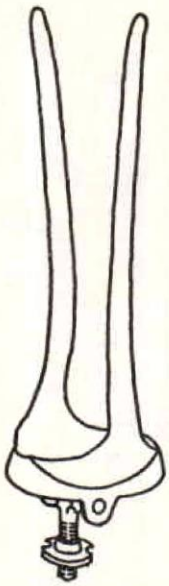

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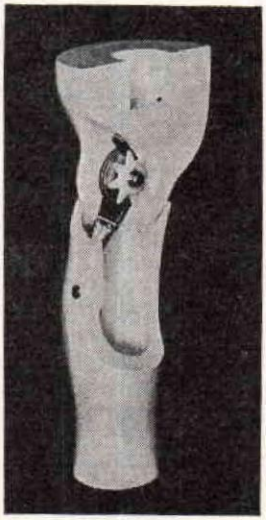

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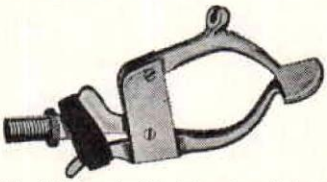

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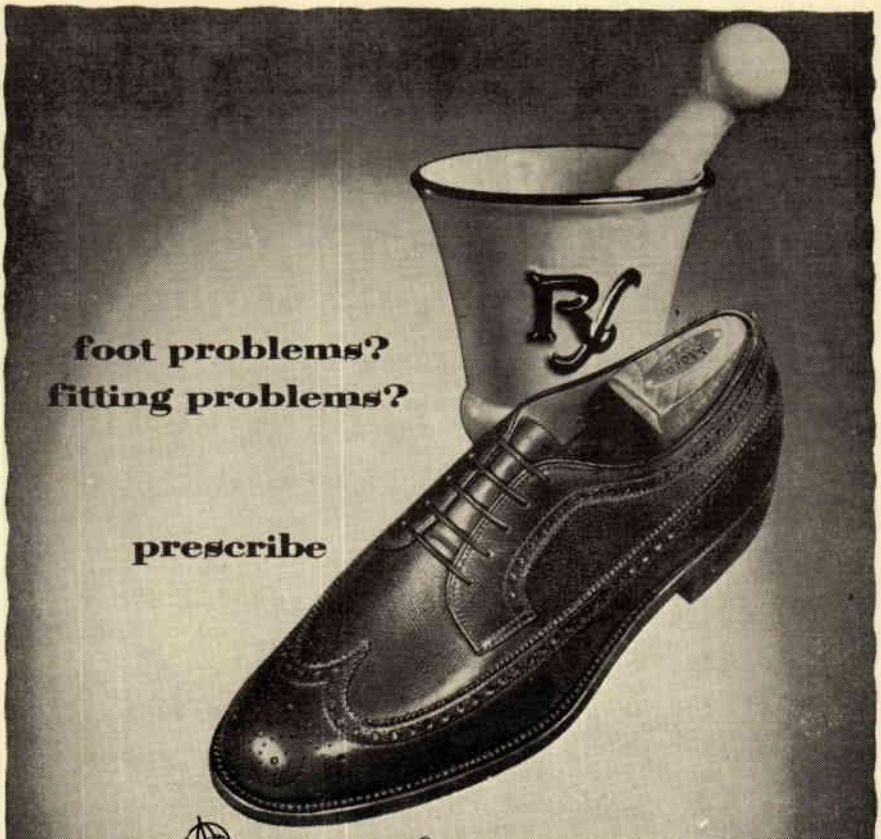


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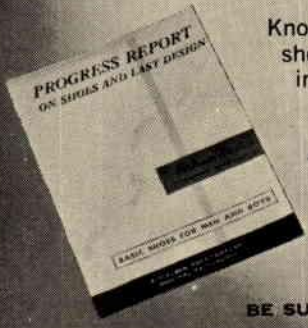


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