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December 1969

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Contents

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Audrey J. Calomino

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December 1969

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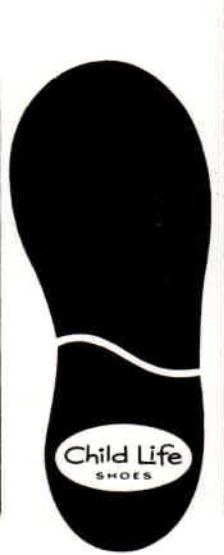

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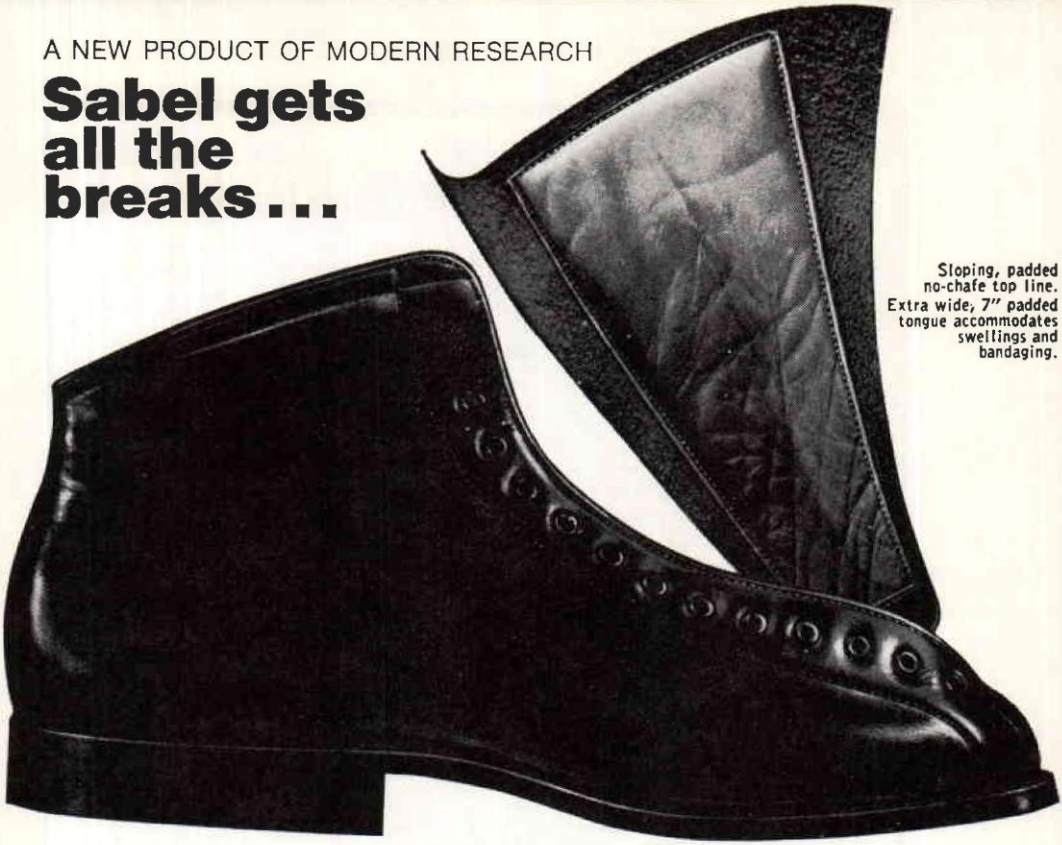

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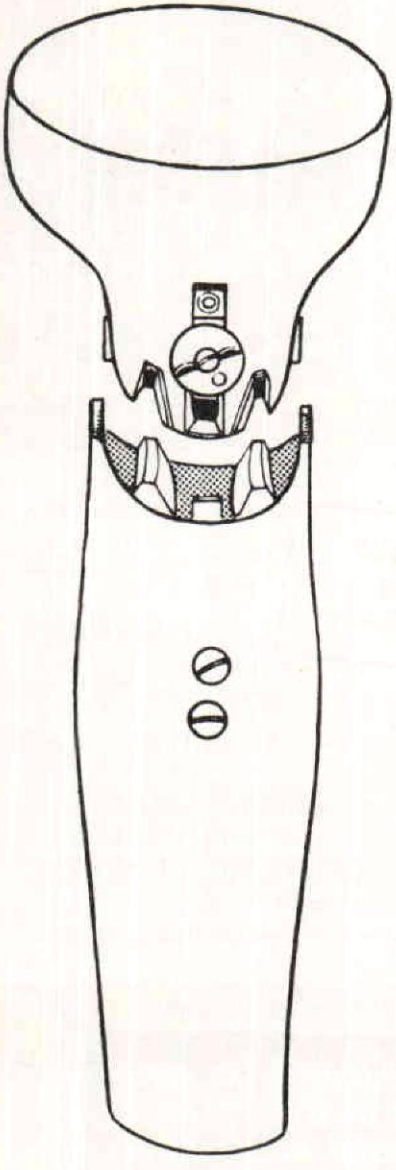

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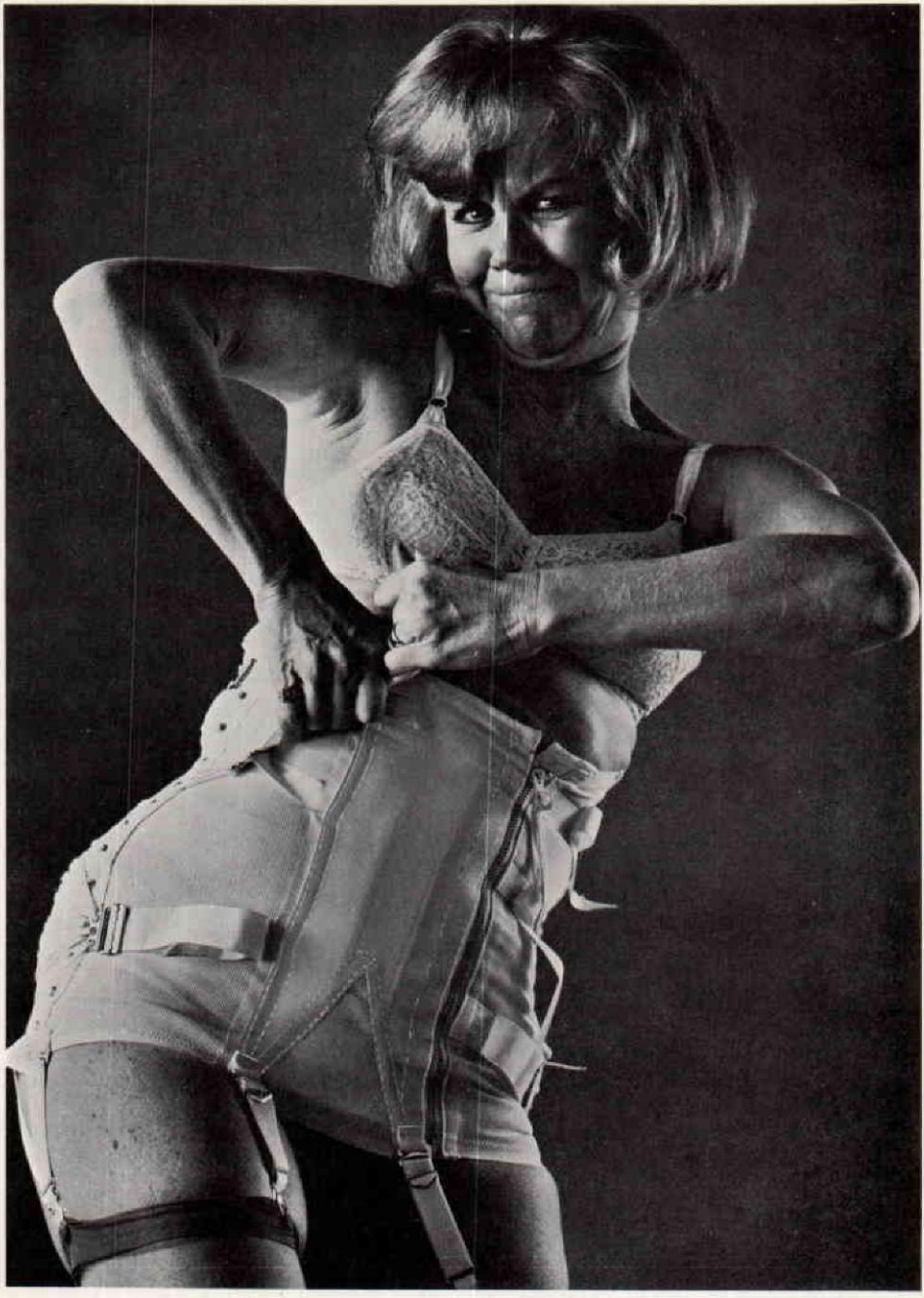

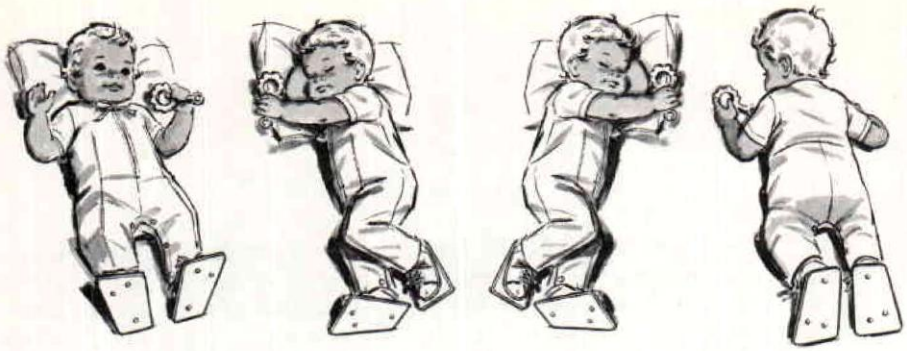

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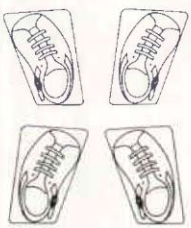

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A New Technique for the Application for Immediate Post-Surgical and Temporary Below-Knee Prostheses

by

John Snowden, C.P.

This technique was developed to eliminate strap loosening or breaking at the attachment points on the plaster cast and to provide the prosthetist with greater alignment adjustability. The application involves two major changes in technique. First, the plaster is applied in a more structurally sound manner and second, the use of a new pylon device designed to provide for greater strength, less weight and to increase alignment adjustability. (Fig. 1)

Procedure: After initial roles of elastic bandage are applied, the stainless steel straps are cut to size and contoured to fit the cast. A spare quick-disconnect ring is applied to the threads of the attachment ring to protect them from plaster.

Dry one inch hardcoat plaster bandage is then threaded from above down through the holes in the attachment ring beneath the straps where they cross and back up through the holes in the ring (Fig. 2). The bandage should be sufficient length to reach at least eight inches proximal to the distal end of the amputation stump. Allow the plaster strips to drape over the attachment ring in the opposite direction from the straps.

A cross is then fashioned of four inch hardcoat plaster splints or folded bandage and is placed on the top or cast side of the attachment ring with each arm of the cross running at least three inches up each strap (Fig. 3).

Holding the straps vertical, dip the attachment ring, plaster strips

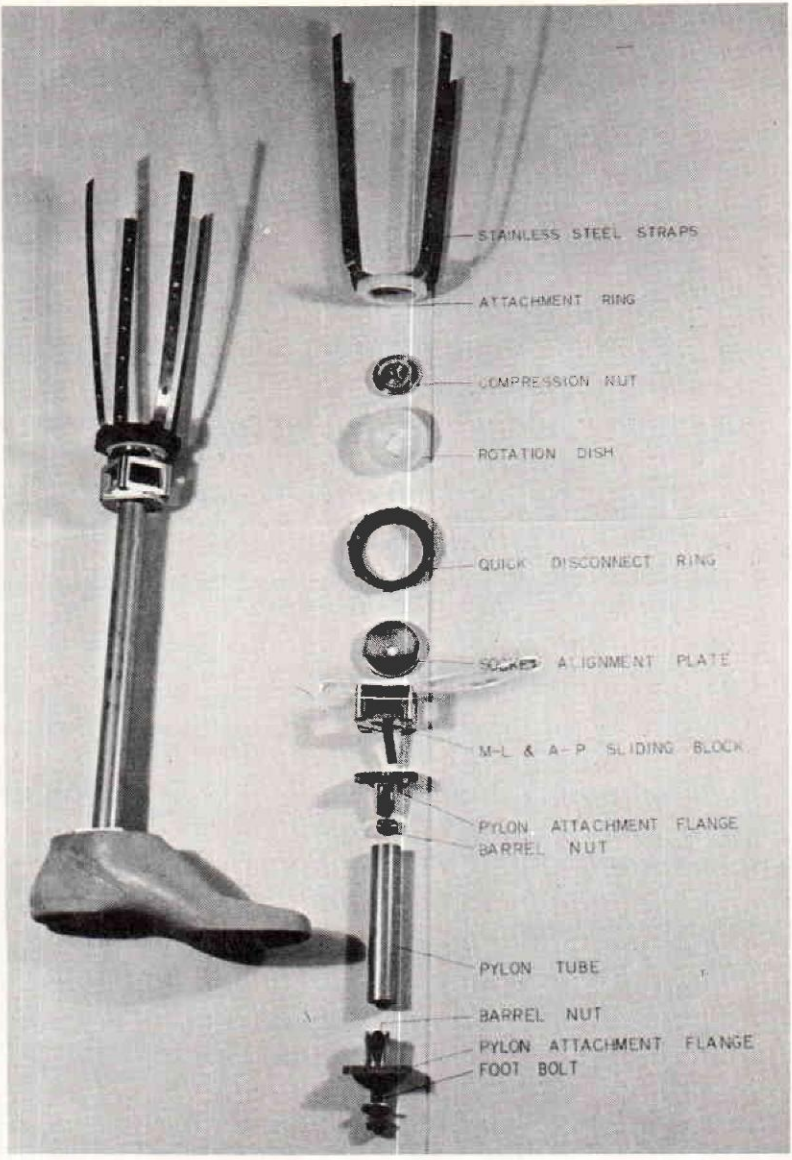

FIGURE 1—Immediate post operative below-knee pylon.*

and plaster cross in water and apply it to the cast. The arms of the cross are then smoothed into the gaps between the cast and the attachment ring and straps. The strips are then pulled up proximally as far as they will reach and massaged into the cast. Fig. 4

The rolls of four inch hardcoat plaster bandage are then applied in the usual manner to provide lateral stability for the straps and to incorporate a suspension strap.

The quick-disconnect ring is removed and the pylon device with SACH foot is attached. Loosen

the upper bolt on the sliding block. Flexion, extension, adduction, adduction and medial/lateral adjustment can then be made and the bolt tightened. Loosen the lower bolt on the sliding block and anterior/posterior adjustment and rotation of the foot can be made. Determine the proper length of the tube and loosen the foot bolt. Remove foot bolt and pylon attachment flange from the pylon tube. Cut and ream tube, replace foot and flange and after determining proper toe-out, tighten foot bolt.

The procedure as stated above will suffice for the majority of amputation lengths, however if a long B/K amputation is the case, the pylon tube and both attachment flanges can be removed and either select the proper height sliding block and rebolt it to the foot or simply remove the sliding block and bolt the socket alignment plate directly to the foot, depending upon the height adjustment.

In summary, this technique has alleviated strap breakage and loosening and provided us with greater alignment adjustability. Moreover, we are able to adjust the height from three-quarters of an inch between the plaster cast and the foot to whatever length needed to accommodate the short amputation stump.

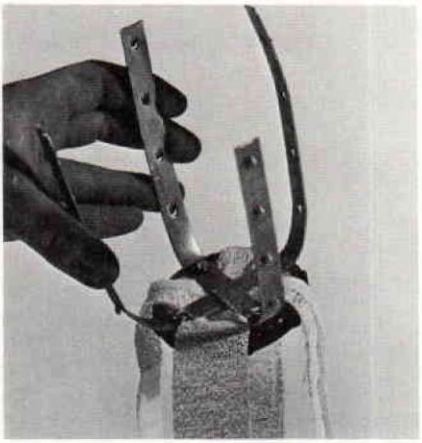

FIGURE 2.

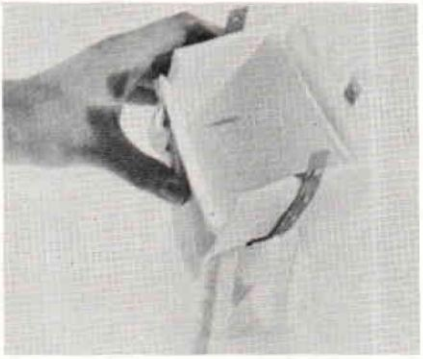

FIGURE 3.

FIGURE 4.

Research in Prosthetics In New Brunswick

Barbara O'Shea, O.T.Reg.*

During the past few years, research in prosthetics has paid substantial dividends. Conventional prostheses have been improved both functionally and cosmetically. However, the most significant results have been in the area of externally powered prostheses. It wasn't until after the thalidomide tragedy that a concerted effort was put forth in Canada to develop methods of supplying external power for prostheses, which would be of benefit to the severely handicapped amputee. At present across Canada, there are four research centres, set up by the Federal Government, working primarily on the development and improvement of prosthetic devices. These are located in Winnipeg, Toronto, Montreal and Fredericton. My discussion will be confined to the research being done at the University of New Brunswick in Fredericton.

The Bio-Engineering Institute was established at the University of New Brunswick in 1965 for the purpose of facilitating interdisciplinary research on a broad range of topics of which the unifying theme is the interaction of man with modern technology. It had its origin in the activities of the Technical Assistance and Research Group for Physical Rehabilitation. This was an informal organization which had been conducting research in myo-electric control since 1962. (1)

The program at the Bio-Engineering Institute is divided into three separate projects. These are:

1. The investigation and development of myo-electric control systems.

2. Clarification of the roles of specific muscles in remedial and conditioning exercises and in sport skills.

3. The investigation of requirements for a satisfactory fit of lower extremity prostheses, and development of apparatus which will rapidly and automatically measure the stump, thus standardizing fitting techniques.

As an occupational therapist my chief concern is in the first project, that is myo-electric control systems.

From physiology courses in un-

* Research Associate, Bio-Engineering Institute, University of New Brunswick, Fredericton.

This paper was presented at the Conference of the Canadian Association of Occupational Therapists in Halifax, 1968.

Reprinted from the *Canadian Journal of Occupational Therapy*, Volume 35, No. 3, pp. 92-97.

dergraduate days, you will recall that an electric potential is developed whenever a muscle is contracted. Although the current produced is very small, it can be amplified and used to activate relays which switch a motor on or off. A myo-electric control system, therefore, is one which uses the electric potential produced by voluntary contraction of a muscle to activate an output unit. The control system consists of a set of three electrodes, the control unit, and a battery to operate the unit. A second battery is required to supply power to the output unit. The type of output unit controlled is immaterial as far as the myo-electric system is concerned. It can be a prosthetic component such as an elbow or a hook, a dynamic splint, or perhaps a 'robot' used to perform tasks by a severely handicapped quadriplegic. The term myo-electric refers only to the system used to control the output unit.

For the sake of convenience, I will confine my references to amputees, as it is this group we have used to evaluate our controls.

The myo-electric system developed at the University of New Brunswick is a three-state system (2). That is it uses one muscle to provide on-off control of two functions. A slight contraction of the muscle activates one function, while a stronger contraction of the same muscle activates the second function. As an example you can consider a prosthetic elbow unit. With the three-state system, a weak contraction of the controlling muscle will produce elbow extension while a stronger contraction of the same muscle will produce elbow flexion. Thus, the number of control sites required is less than with the systems that require separate controlling muscles for each function. This can prove to be of vital importance to the high level amputee where control sites are limited.

Because the signal obtained from the muscle is greatly amplified, only a light muscle contraction is required to activate the device. It does not necessarily involve any physical motion of a body part. Consequently, a muscle which cannot produce any useful movement due to disease or injury may have sufficient electric output to serve as a control site for a myo-electric system. Also, as is the case with most high level amputees, it is easier to harness the electric output of a muscle than the corresponding physical movement it would produce.

One exciting development relating to the availability of potential control sites in the severely handicapped individual is the work being done in the control of single motor units. Dr. J. V. Basmajian at Queen's University (3) was the first to report the ability to produce voluntary contraction of a single motor unit. In his experiments, using normal subjects, he has shown that from one wire electrode in a muscle as many as three different motor units can be controlled voluntarily. These findings have since been verified in many laboratories including our own. However, this technique requires the use of an electrode in direct contact with the muscle.

The clinical application of this technique has been delayed due to the difficulties encountered in designing an electrode that can remain

in a muscle at least semi-permanently. One approach to solving this problem is the development of a wireless transmitter which can be implanted permanently in the stump. This would transmit signals from the muscle to a control unit on the surface. The Bio-Engineering Institute will cooperate with the Manitoba Rehabilitation Hospital in the development of equipment and techniques for implanting a wireless myo-electric transmitter. This work will be carried out in Winnipeg this year under the direction of Professor Scott of the Bio-Engineering Institute and Dr. Tucker, an orthopedic surgeon at Manitoba Rehabilitation Hospital.

In this project, a transmitter will be implanted in the medullary canal of the humerus with two screws through the humerus. These screws will rest on the under surface of the muscle and act as electrodes to pick up the electric signal. Further reports on this project will be forthcoming at its termination within the next year.

Now let us consider the clinical application of myo-electric controls which, of course, is the area of primary interest to the occupational therapist. To date the U.N.B. myo-electric control system has been fitted to eight patients, all of whom are upper extremity amputees (1). It has been used to control electric components which were developed at the Prosthetic Research and Training Unit at the Ontario Crippled Children's Centre under the direction of Mr. Colin McLaurin. These are the two-fingered electric hook, the electric elbow, and the electric wrist rotator. In one case it was used to control a cable puller designed at Rancho Los Amigos Hospital in California. This was used to operate a standard Dorrance number 3 hand. The levels of amputation fitted were four below elbow, two above elbow, one complete phocomelia, and one forequarter amputation. All had unilateral involvement. Although we used below elbow amputees for evaluation purposes, it is generally agreed that mechanical control, that is, harnessing body motions to provide the power required to activate the prosthetic components, will remain the system of choice for the minimally involved amputee.

In the fitting and the training of patients using myo-electric control, it can be assumed that the occupational therapist will be most directly involved since most benefits will be derived by patients with upper extremity disabilities.

The occupational therapy program can be considered in four stages; these are:

1. Assessment of patients to determine their needs and recommending to clinics appropriate patients to be fitted with myo-electrically controlled prostheses.
2. Selection and training of muscles as control sites.
3. Functional prosthetic training after fitting has been completed.
4. Evaluation of the control system.

As I have already mentioned, myo-electric control and indeed external power is not suitable for all patients. Each individual must be carefully assessed and all his needs considered. The types of patients who can benefit most are the severe-

ly handicapped high level amputees. That is, those who do not have sufficient power and excursion to operate conventional appliances.

Once a patient has been considered for external power, the next decision must be on the type of control to provide. If a mechanical on-off switch can be used it is preferable because of its simplicity. However, it is usually not possible in a high level involvement to find switch locations to operate the number of functions that will be provided. In these cases myo-electric control should be considered either as the control for all functions or in combination with switches or mechanical controls.

In the selection of control sites there are some criteria that each control muscle must meet. First, it must be a superficial muscle whose primary function has been lost. Therefore, it is free to control a new function without interfering with normal activity. It is for this reason that in unilateral amputees muscles on the side of the loss are used in preference to control sites on the remaining arm. Second, the muscles chosen should not be accessory muscles for other functions such as turning the head, trunk movements, etc., as this will cause undesired activity in the controls. Contrary to the original idea, of only utilizing as control sites, the muscles normally associated with the function, it has now become evident that any muscle which can produce a useable signal is a potential control site. The function it controls is irrelevant.

Once suitable muscles have been chosen to control the unit, the patient must be trained to contract and relax these independently and at will. This is usually done with the aid of a "myo-electric trainer". This is a device which will indicate on a meter and by lights, the electrical activity in the muscle. Three surface electrodes are placed over the muscle. Two electrodes are used to pick up the signal and the third is a ground. These are connected to the trainer which provides the feedback during training. When the muscle is relaxed a green light is showing; with a weak contraction an amber light comes on and for a stronger contraction a red light is activated. With this feedback the patient can then, fairly quickly, learn to voluntarily contract and relax the muscles. Control is considered satisfactory when the patient can reach and hold all of the three levels of muscle tension on command, that is, complete relaxation, a weak contraction or a stronger contraction. The most difficult task is to go from a state of complete relaxation to a strong contraction without activating the function controlled with the weak contraction. A slight time delay is built into the control unit to facilitate this control.

Once good islolation of the controlling muscles has been achieved, the functional prosthetic training can begin. The methods used for this are similar to the established practices for any type of prosthetic training. Emphasis is placed on functional activities relating to everyday living, job skills and recreational or leisure time activities. Training concentrated on the functional use of the prosthesis, as opposed to drills, provides a more realistic picture of the demands that will be

made on the components and will bring to light any problems that might occur.

Evaluation of the control system is the fourth aspect of the occupational therapy program. As this is not directly related to patient care, and is often time consuming, there is a tendency to neglect it. However, the therapist who is participating in the clinical evaluation of new equipment must realize that he is also a member of the research team, and, as such, has a contribution to make.

It is the therapist who is in daily contact with patients, knows their needs and knows how they react. This is information to which the engineers, who are responsible for design and development, do not have direct access but rely on the treatment personnel to provide.

In relation to myo-electric controls specifically, there are many questions yet to be answered. What is the ideal size and shape for the packaging of components? How sensitive must the units be to provide the optimum function? What is the maximum number of functions which a person can be expected to control myo-electrically? Which function has priority? Due to his close association with patients, the therapist can assist in supplying the answers to these questions.

First impressions often play a major role in final acceptance of something new. For this reason the packaging of the components can be a critical factor. Size, shape, weight, colour, placement of wires, etc., are factors to be considered when planning the final form of the control unit. To a great extent these aspects are not predetermined by the components used but can be tailored to suit the patients' needs. The therapist, therefore, can be of valuable assistance in providing information on these factors to the designers. One interesting case can be noted in which the patient was a teenage girl. She wore the package, which was covered in black plastic, on a belt around her waist. This did not present a problem except when worn under light coloured clothing. With the covering material changed to white it would be more acceptable from her point of view. Often small considerations such as these can make a difference in the patient's acceptance and use of a device.

The sensitivity of the units can also be varied to suit the patients' requirements. For example, the unit can be made very sensitive so that a signal of about 20 or 30 microvolts from the muscle will activate the control. However, if the unit is this sensitive, or in engineering terms, if the gain is this high, it will also be more sensitive to electrical activity in the environment such as 60 cycle (Hz.) electricity or signals from neighboring muscles. Therefore, there is a greater tendency for these extraneous signals to operate the control unit inadvertently. On the other hand, if the gain is too low, the strength of contraction required is greater and may be tiring for the patient who is using it all day. The optimum gain must be determined in order to achieve the best functional use of the prosthesis.

Another variable in the control system is the time constant. That is, the time delay between the contraction of the muscle and the initiation

of the control sequence, or, in reverse, the delay between relaxation of the muscle and the cessation of activity in the output unit. This can be varied electronically to suit the requirements of the component being controlled. For instance, a device such as the electric hook which moves quite quickly, requires a fairly short time constant. Otherwise, it is difficult to accurately regulate the degree of opening because of the delay between relaxation and the end of the movement. In contrast, however, a slower moving component such as the electric elbow, is easier to operate if the time constant is a little longer.

Both of these variables, although essentially technical problems, can best be determined during functional training with the prosthesis. The therapist responsible for training and evaluation, therefore, must have a reasonable knowledge of the operation of the system and in addition must be able to communicate with the engineers in terms that are meaningful to both. Thus, it is important to provide the opportunity for treatment personnel to become familiar with the principles of myo-electric control and its applications.

The Bio-Engineering Institute has proposed an evaluation study of the functional applications of myo-electric control with particular reference to vocational rehabilitation. If the grant to cover this project is received, patients with potential for vocational rehabilitation, who have high level upper extremity involvement and would benefit from external power, will be selected from centres across Canada. The fitting, training and evaluation would all be carried out at the centre presently treating the patient.

A course would be given at the Bio-Engineering Institute for the staff member responsible for the treatment, which in most cases is the occupational therapist. This course would deal with principles of myo-electric control and its applications, selection of control sites, patient training, care and maintenance of equipment and evaluation procedures.

In addition to providing the foundation for our evaluation, this course would also give therapists in clinical settings an opportunity to become familiar with new developments in this area.

Although progress in any new field is slow, the developments during the past few years in providing external power for prosthetic and orthotic components have been encouraging. Use of myo-electric signals to control devices has proven to be functional. Already designers are working on more advanced and sophisticated control, as well as improving the reliability and packaging of present units. With continued research, the future in prosthetics looks optimistic.

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Review of Visual Aids for Prosthetics and Orthotics

Committee on Prosthetic-Orthotic Education

Division of Medical Sciences
National Academy of Sciences—National Research Council
2101 Constitution Avenue, N.W.
Washington, D. C. 20418
July, 1969

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

FOREWORD

This annotated listing of prosthetic and orthotic visual aids was started in 1964 as a project of an ad hoc committee of the Subcommittee on Paramedical Education, Committee on Prosthetic-Orthotic Education. Since the functions of this Subcommittee were absorbed by the Subcommittee on Educational Materials in 1967, the latter group has taken over responsibility for the reviews. Meetings to review visual aids are held when several films or other aids can be made available. Attending each meeting and assisting in evaluation are highly qualified persons representing various specialties in the health fields.

Most of the visual aids in this listing were reviewed by the original ad hoc committee: Colonel Ruth A. Robinson (U.S. Army, Retired), Chairman, Subcommittee on Paramedical Education; Florence Knowles, Social and Rehabilitation Service, and Mary Poole, Department of Social Work, University of Pennsylvania, consecutive chairmen of the ad hoc committee; Joan Edelstein, Post-Graduate Medical School, New York University; Nancy Ellis, Occupational Therapy, Columbia University; Lena Plaisted, Boston University School of Nursing; Jamie Lisle, Department of Physical Therapy, Medical College of Virginia; and Muriel Zimmerman, Institute of Rehabilitation Medicine, New York University Medical Center.

Members of the Subcommittee on Educational Materials who reviewed films include: Geneva Johnson, Graduate Physical Therapy Curriculum, Case

Western Reserve University, Chairman; H. Blair Hanger, Prosthetic Education, Northwestern University; W. Frank Harmon, C.O., Atlanta Brace Shop; Phyllis Porter, College of Nursing, University of Bridgeport; Clark Sabine, School of Occupational Therapy, Virgina Commonwealth University; and Augusto Sarmiento, M.D., Department of Surgery, Division of Orthopaedics, University of Miami School of Medicine.

Others assisting with reviews were: Joseph M. Cestaro, C.P., J. E. Hanger, Inc.; Hazel M. Elliot, Department of Occupational Therapy, Medical College of Virginia; Hans Lehneis, Institute of Rehabilitation Medicine, New York University Medical Center; Alan Smith, M.D., Veterans Administration Hospital, Brooklyn, New York; and Helen Vaughn, Bureau of Maternal and Child Health, D. C. General Hospital, Washington, D. C. From the National Research Council were Elizabeth Davies, Professional Assistant, and Barbara R. Friz, Executive Secretary, Committee on Prosthetic-Orthotic Education.

Prosthetics (General)

Bilateral Hip Disarticulation: Casting, Fabrication and Training, Prosthetic-Orthotic Center, Northwestern University, 1967, 27 min., color, sound, 16 mm.

Summary: Presents a young man with transverse myelitis who underwent bilateral hip disarticulation for the purpose of increasing mobility. The picture shows a suspension-casting technique and a step-by-step progression in fabricating and fitting the plastic socket. Limbs are attached to the socket by mechanical hip joints. Demonstrates training activities, such as balance exercises; ambulation, using parallel bars; negotiation of stairs, curbs and inclines; and falling and recovery. Pylons are replaced with articulated prostheses incorporating manual knee locks. The patient is seen at the conclusion of the rehabilitation program walking along the street using crutches.

Evaluation: This is a technically excellent film in which the prosthetics techniques and the training procedures are clearly portrayed. A minor exception concerns positioning for the hip joint, where further clarification is needed. It should be noted that the remarkable results obtained by this patient can be attributed largely to the fact that he is highly motivated and possesses superior neuromuscular coordination and strength. The film, which presupposes some knowledge of the subject, would be particularly useful for prosthetists and physical therapists who might be working with this type of patient.

Distributor: Prosthetic and Sensory Aids Service, Veterans Administration, 252 Seventh Ave., New York, N.Y. 10001.

Rental Fee: None.

Not available for purchase.

Checkout Procedure for Unilateral Below Elbow Prosthesis, Institute of Rehabilitation Medicine, 1968, 3-4 minutes per cartridge, color, silent, super 8 mm., requires Technicolor Super 8 projector.

Summary: Six cartridges depict various aspects of the checkout procedure as follows: Part I—Fit; Part II—Function, range of motion; Part III—Function, cable system; Part IV—Function, control system efficiency; Part V—Function, wrist unit; and Part VI—Craftsmanship. An occupational therapist, working with the below-elbow amputee, demonstrates the various procedures. Checkout forms accompany the cartridge films.

Evaluation: These films are excellent teaching devices. Procedures are clearly presented and the separate cartridges can be used as required by either instructor or student. A special projector is required, however. Only basic routine procedures, as practiced at the Institute of Rehabilitation Medicine, are included. In a few instances, reasons for failure are controversial. Recommended for 1) occupational therapists, 2) physical therapists, 3) physicians, and 4) prosthetists.

Distributor: Institute of Rehabilitation Medicine Publications, 400 East 34th St., New York, N. Y. 10016.

Rental Fee: None.

Purchase Cost: $11.00 per cartridge. If desired, film can be ordered in 16 mm. continuous reel, cost unknown.

Controls Training for the Bilateral Amputee, San Jose State College, 1968, 22 min., color, sound, 16 mm.

Summary: The expositor of the film, a bilateral above-elbow, below-elbow amputee, demonstrates donning and removing his prostheses, identifies the prosthetic components, demonstrates and explains the function of each component. Describes early training procedures and demonstrates these with the assistance of an occupational therapist.

Evaluation: The difficult task of narrating, demonstrating and explaining is accomplished remarkably well by the expositor who is thoroughly knowledgeable in all aspects of his subject. The film presupposes considerable knowledge of prosthetics on the part of the viewer. As a teaching film it would have been enhanced by a slower pace, better organization and perhaps a professional narrator. Repeated showing of the film would be of value to an amputee in helping him understand the operation of various mechanisms of the device. For the same reason, therapists involved in training should see and study this presentation.

Distributor: Hosmer, Inc., P. O. Box 37, Campbell, California 95008.

Rental Fee: None.

Purchase Source: Film Service Laboratories, Inc., 6327 Santa Monica Blvd., Hollywood, California 90038.

Purchase Cost: $101.66.

A Day in the Life of the Amputee, Hosmer-Dorrance, 1955, 26 min., color, silent, 16 mm.

Summary: Presents a bilateral upper-extremity amputee as he performs a number of activities related to self-care, work, and recreation. These include fishing, bowling, gardening, dressing, eating, playing pool, driving a car, and lighting a cigarette.

Evaluation: A technically well-executed film of a man who has acquired unusual skill in the use of the prostheses. It is recommended for upper-extremity amputees and for professional groups who wish to become familiar with the potential accomplishments of this type of amputee. Essentially, its purpose appears to be to encourage upper-extremity amputees to use prostheses with maximal skill.

Distributor: Hosmer, Inc., P. O. Box 37, Campbell, California 95008.

Rental Fee: None.

Purchase Cost: Approximately $150.00.

Dairy of a Sergeant, U. S. War Department, 1945, 22 min., black and white, sound, 16 mm.

Summary: The story of a soldier (Harold Russell) who, having lost both arms during World War II, wages a determined and successful fight to achieve success in the use of artificial limbs and to establish himself as a useful member of society.

Evaluation: An excellent film for its era. It has lost much of its value, however, through the passage of time and today is primarily of historical interest. It deals with the emotional trauma involved in loss of arms and portrays the courage required by an amputee to achieve his rehabilitation goals. For these reasons, the film may still serve a purpose when used to motivate discouraged upper-extremity amputees or when shown to groups concerned with the emotional impact caused by crippling disease or injury.

Distributor: Central Office Film Library, Veterans Administration, Vermont Ave. and H St., N.W., Washington, D. C. 20420.

Rental Fee: None.

Dynamic Exercises for Lower-Extremity Amputees, U. S. Veterans Administration, 1959, 10 min., color, sound, 16 mm.

Summary: Reviews normal gait and the relationships of body segments during walking. Following the physician's examination of the above-knee stump, the amputee patient demonstrates a series of dynamic exercises to develop balance, coordination, and strength. These exercises are part of a physical therapy program that prepares the amputee to meet daily functional demands. Several amputee gaits are demonstrated.

Evaluation: This is a large order for a ten-minute film, particularly since it goes beyond the scope of the title. The exercises *per se* are excellent, but the rate at which they are pre-

sented limits the use of the film as a teaching device. A patient-to-patient type of teaching contributes to some worthwhile scenes. The film is considered useful for those who are previously oriented in the techniques of dynamic exercises and who are experienced in working with amputees.

Distributor: Central Office Film Library, Veterans Administration, Vermont Ave. and H St., N.W., Washington, D. C. 20420.

Rental Fee: None.

Gait Analysis, Northwestern University Medical School, 1961, 27 min., color, sound, 16 mm.

Summary: Demonstrates the most common gait defects that may be seen in an above-knee amputee, including circumduction, abduction, vaulting, medial and lateral whips, instability of the knee, long prosthetic step, and others. The defects are shown on a subject wearing an adjustable above-knee prosthesis and are described in detail, then discussed as to possible causes, considering the amputee, the stump and the prosthesis. Demonstrates a normal gait so that comparison between normal and abnormal gait can be made. The narration is conducted by a physician, a prosthetist, and a physical therapist, all faculty members of the Prosthetic-Orthotic Education Program at Northwestern University Medical School. Pocket-sized brochures summarizing the material presented are provided for distribution to viewers.

To be used in conjunction with the film are 16 loop films, each of which depicts one gait deviation. These loops are 7 ft. in length and can be rerun an indefinite number of times, on standard projectors.

Evaluation: This is a valuable teaching film. Ample time is allowed for the viewer to observe each gait deviation, making it possible for him to correlate the movie sequence with the material presented in the booklet that accompanies the film. The loop films reinforce the teaching. Recommended for all medical groups concerned with the management of the lower-extremity amputee, including physicians, physical and occupational therapists, nurses, and prosthetists, at both the student and graduate levels. The amputee patient would also benefit.

Distributor: American Academy of Orthopaedic Surgeons, 430 N. Michigan Ave., Chicago, Ill. 60611.

Rental Fee: $5.00.

Purchase Source: Prosthetic-Orthotic Center, Northwestern University, 401 East Ohio, Chicago, Ill. 60611.

Purchase Cost: Film: $150.00; set of 16 loop films: $35.00.

Good-Bye to Captain Hook, University of Michigan, 1966, 20 min., color, sound, 16 mm.

Summary: Presents an overview of the medical management of the upper-extremity amputee, including selection of amputa-

tion level, principles of surgery (illustrated diagrammatically), occupational and physical therapy, selected basic steps in fabrication, prescription of prosthesis, types of terminal devices, training activities and prevocational testing. Some of the newer prosthetic fittings (for example, Munster) are not included.

Evaluation: Technically and professionally, this is an excellent film, accurate and informative in its presentation. Coverage of a large amount of material precludes the detailed exposition necessary for a teaching film. It serves well, however, as an overall orientation, particularly for the general medical practitioner to whom it is directed. For allied groups, it would be useful as background material. Since it presupposes some knowledge of the subject, it would not be suitable for nonprofessional groups.

Distributor: Audio-Visual Education Center, University of Michigan, 416 Fourth Street, Ann Arbor, Michigan 48103.

Rental Fee: $7.00.

Purchase Cost: $175.00.

Immediate Postsurgical Fitting, U. S. Naval Hospital, Oakland, Calif., 1965, 25 min., color, sound, 16 mm.

Summary: A concisely written synopsis of the history, definition, and advantages of immediate postsurgical fitting is projected on the screen by way of introduction. The film discusses indications for the use of this method of amputee management, presents preamputation work-up procedures, mentions briefly some principles of surgical techniques, and devotes considerable time to the application of a plaster-of-Paris socket which incorporates an unusual method of suspension. Demonstrates adjustment of the temporary prosthesis and shows several patients walking at varying intervals following amputation and immediate prosthetic fitting.

Evaluation: A technically excellent film that presents the subject matter in a well-organized and professional manner. The film might have been more convincing had the cast not been applied to a two-week old stump. Application of the socket did not include an explanation of weight-bearing areas, thereby somewhat limiting its instructional value. The film would be of particular interest to physicians and prosthetists and would serve to acquaint therapists, nurses, and others in selected procedures of immediate postsurgical fitting.

Distributor: Navy Prosthetic Research Laboratory, Naval Hospital, Oakland, Calif. 94627.

Rental Fee: None.

Purchase Source: Multichrome Laboratories, 760 Gough Street, San Francisco, Calif. 94102.

Purchase Cost: Approximately $145.00.

Immediate Postoperative Fitting of the Below-Knee Amputee, University of Miami, 1965, 15 min.,

color, sound, 16 mm.

Summary: A large portion of the film is devoted to a graphic description of surgical techniques used in below-knee amputation. Principles important in achieving a satisfactory stump and prosthesis for immediate postoperative fitting are stressed. Level of amputation, proper alignment of the prosthesis, and criteria for weight-bearing are briefly discussed. Advantages of immediate fitting are pointed out and several below-knee amputees are shown walking with temporary patellar-tendon-bearing or Syme prostheses.

Evaluation: The primary purpose of the film appears to be to stress the important principles underlying amputation surgery and the immediate application of the cast. This purpose is achieved through excellent photography and lucid explanation. The film lacks continuity and the narration is uneven. The case presentations are too brief to be very meaningful. Although rehabilitation procedures are not included, the film provides worthwhile background material for therapists and nurses. It would serve surgeons and prosthetists more advantageously.

Distributor: American Academy of Orthopaedic Surgeons, 430 N. Michigan Ave., Chicago, Ill., 60611.

Rental Fee: $5.00.

Purchase Source: Write to Dr. A. Sarmiento, University of Miami School of Medicine, P. O. Box 875, Biscayne Annex, Miami, Fla. 33152.

Purchase Cost: $100.00-$150.00.

Immediate Postsurgical Fitting of the Upper Extremity, University of Miami, 1968, 20 min., color, sound, 16 mm.

Summary: Shows surgical techniques used in wrist disarticulation of a snake bite victim who suffered complete loss of hand function. Demonstrates application of temporary plaster socket prosthesis immediately following surgery. Thermoplastic material replaces temporary prosthesis in about two and one-half weeks. Patient uses the prosthesis seventeen hours after surgery, and a year later demonstrates skillful use of the hook for writing and other activities of daily living.

Evaluation: The material is well organized and presented in a clear, concise manner. An excellent film, of value primarily for the surgeon and prosthetist, but of interest as background information for physical therapists, occupational therapists and nurses.

Distributor: American Academy of Orthopaedic Surgeons, 430 N. Michigan Ave., Chicago, Ill. 60611.

Rental Fee: $5.00.

Purchase Source: Write to Dr. A. Sarmiento, University of Miami School of Medicine, P. O. Box 875, Biscayne Annex, Miami, Fla. 33152.

Purchase Cost: $100.00-$150.00.

Immediate Postsurgical Prosthesis, Veterans Administration Hospi-

tal, Seattle, Wash., 1966, 35 min., color, sound, 16 mm.

Summary: Dr. Ernest M. Burgess, principal investigator, Seattle Prosthetics Research Study, presents the historical background leading to the present research program and explains the concept, rationale, and advantages of immediate postsurgical fitting. A patient with a nonhealing defect is followed from the preamputation period to 31 days postamputation, at which time he demonstrates his dancing ability while wearing a permanent prosthesis. The film presents details of the surgical techniques, including tension myodesis, and shows application of the plaster-of-Paris socket and temporary prosthesis immediately following surgery. The film outlines the rehabilitation program and introduces other types of amputees who have had immediate prosthetic fitting.

Evaluation: The surigical procedure from the initial incision to the closing of the wound is clearly and graphically portrayed. Inclusion of the anatomical structures involved adds to the value. Details of prosthetic fitting and postsurgical care are sketchy, but adequate to illustrate principles. The photography is excellent. The film is directed primarily toward introducing and encouraging the use of immediate postsurgical fitting. It is a completely optimistic report. Criteria are not discussed. Of special interest to the physician, prosthetist, nurse, and physical therapist, and certainly of value in graduate prosthetics programs.

Distributor: Central Office Film Library, Veterans Administration, Vermont Avenue and H Street, N.W., Washington, D. C. 20420.

Rental Fee: None.

Purchase Source: National Audiovisual Center, National Archives and Records Services, Washington, D. C. 20409.

Purchase Cost: $143.50.

Meet Jerry Leavy, San Jose State College, 1968, 40 min., color, sound, 16 mm.

Summary: Jerry Leavy, a bilateral above-elbow, below-elbow amputee narrates the film as he performs many activities of daily living. (He is the same person who appeared in the film, "A Day in the Life of the Amputee," 1955.) Showering, shaving, and other early morning activities are accomplished before donning the protheses immediately prior to dressing. For the rest of the normal day, he wears the prostheses and uses them with unusual dexterity and skill. Portrayal of Mr. Leavy's activities as President of the Hosmer Corporation and at the controls of his plane constitute the final part of the film.

Evaluation: This film demonstrates the high degree of skill that can be achieved by a prostheses wearer who possesses the necessary motivation, perseverance and coor-

dination. An upper-extremity amputee would profit from observing the demonstrated tricks and short-cuts in performance of activities and would probably appreciate the informal personal approach. The amputee should have the opportunity of viewing the film several times because it moves along rapidly and it would be difficult to pick up all the points in one showing. Besides the amputee and his family, the film would be of special value for occupational and physical therapists. Of interest to anyone working with upper-extremity amputees.

Distributor: Hosmer, Inc., P. O. Box 37, Campbell, California 95008.

Rental Fee: None.

Purchase Source: Film Service Laboratories, Inc., 6327 Santa Monica Blvd., Hollywood, Calif. 90038.

Purchase Cost: $201.50.

New Geriatric Prostheses Adaptable to Bilateral Amputees, Waterbury, Conn., 1964, 10 min., color, silent, 16 mm.

Summary: Describes an above-knee prosthesis designed for use by the geriatric patient and points out the advantages of certain modifications over the more conventional "temporary" prosthesis. Demonstrates the use of the prostheses as fitted to a bilateral amputee, a 64-year-old woman.

Evaluation: This film would be of interest to those who are dealing with the problems of prescribing, designing, or fabricating prostheses for the geriatric patient. The graphic description of the prosthesis is well presented.

Distributor: Dr. Sung J. Liao, Director, Department of Physical Medicine and Rehabilitation, Waterbury Hospital, Waterbury, Conn.

Rental Fee: None.

Not available for purchase.

New Legs, National Council for Care of Cripples, South Africa, 1960, 18 min., color, sound, 16 mm.

Summary: Presents the case history of a young railway platelayer who suffered an accident that ultimately resulted in a bilateral hip disarticulation. He is fitted with a pair of prostheses that incorporate double-action hip joints. Following a training program, he is shown walking with prostheses and crutches and participating in many physical activities with and without the prostheses.

Evaluation: The purpose of this film is to encourage people living in South Africa to support rehabilitation through the purchase of Easter Seal stamps. Perhaps this accounts for the optimistic tone of this technically excellent picture. The amputee is unusually cheerful, physically agile, and well motivated, and his well-planned rehabilitation program is highly successful. This film might be of interest to the patient and family. For professional groups it is of interest only to show the achievement of one amputee with a bilateral hip dis-

articulation.

Distributor: Film Library, International Society for Rehabilitation of the Disabled, 219 East 44th St., New York, N.Y. 10017.

Rental Fee: $10.00.

Purchase Source: National Council for the Care of Cripples in South Africa, P. O. Box 10173, Johannesburg, South Africa.

Purchase Cost: Unknown.

Normal Human Locomotion, University of California at Los Angeles, 1965, 3 hr., black and white, sound, 16 mm.

Summary: This seven-reel film reproduces a classroom lecture as presented by Cameron B. Hall, M.D., in the UCLA courses in lower-extremity prosthetics. In his presentation, Dr. Hall graphically describes the normal pattern of human locomotion and explains it in terms of pertinent basic principles, including determinants of gait and mechanical forces. The film is printed at a contrast level that permits it to be shown in a partially lighted room, thereby allowing viewers to write on the illustrated lesson sheets provided with the film.

Evaluation: The film is of special value. It encompasses a difficult subject on the basis of research from voluminous literature, and it is organized in a clear, concise, and understandable manner.

No attempt is made to achieve a technically perfect film; it comes "as is" from the classroom. Dr. Hall's teaching methods, which include skillful execution of illustrations, a keen sense of timing, and—most important— a sequential, organized presentation of materials, combine to make this film an excellent teaching device for both students and instructors.

The film is highly recommended for any professional person engaged in gait training or concerned with any aspect of human locomotion. Its use in undergraduate programs will vary according to the teaching talents of the faculty members and the curriculum content. If the length precludes showing it in one session, it can be shown in two or three sessions. It is recommended that instructors review the film in order to strengthen their own teaching methods and to determine in what way it can supplement or reinforce instruction in their own particular situation.

Distributor: American Academy of Orthopaedic Surgeons, 430 N. Michigan Ave., Chicago, Ill. 60611.

Rental Fee: $15.00. (The film may be retained by the borrower for a maximum of two weeks. Requests for the film should indicate the number of lessons sheets desired.)

One Step at a Time, Rehabilitation Institute of Montreal, 1963, 15 min., black and white, sound, 16 mm.

Summary: Portrays a unilateral above-knee amputee who is first seen walking with crutches but without an artifical limb.

After considerable introspection, this young male decides to be prosthetically fitted. As the story unfolds, it depicts his reaction to the various steps in the rehabilitation program. The three key people responsible for the program—the physician, the physical therapist, and the prosthetist—are presented and their roles briefly explained. The prosthetist plays the major role in this film.

Evaluation: The close-ups, the music, and the general tone of this picture are designed to show the emotional impact on the amputee of the various situations that evolve during the rehabilitation process. The movie is photographically artistic and technically good. Its use to professional people is limited, however, because of the superficial manner in which the material is handled. It appears to be directed toward the layman and especially toward the unfitted amputee.

Distributor: International Film Bureau, Inc., 332 S. Michigan Ave., Chicago, Ill. 60604.

Rental Fee: $6.00.

Purchase Cost: $85.00.

Phantom Pain, Public Health Service, 32 min., black and white, sound, 16 mm.

Summary: The psychiatrist comments briefly before and after an interview with a 39-year-old below-knee amputee suffering from severe phantom pain. The patient is on screen most of the time, vividly relating his experiences, feelings, and symptoms. He is interrupted only by an occasional question from the physician. No attempt is made to probe the reasons for the phantom pain or to suggest any definitive treatment plan.

Evaluation: The patient's remarks and behavior in describing the history and character of his pain provide a good stimulus for discussion among professional persons interested in the emotional aspects of this condition. The picture is not consistently clear and the fact that the sound is not synchronized with the visual part is somewhat distracting. Psychiatrists, residents, and medical students might find the film useful, especially for seminar-type discussions. Allied groups concerned with this and other problems of pain would be interested in seeing the film.

Distributor: National Medical Audiovisual Center Annex, Station K, Atlanta, Georgia 30324.

Rental Fee: None.

Purchase Source: National Audiovisual Center, National Archives and Records Services, Washington, D. C. 20409.

Purchase Cost: $55.25.

Physical Therapy Management of a Bilateral Lower-Extremity Amputee, U.S. Army, (PMF 5382), 1964, 32 min., color, sound, 16 mm.

Summary: Illustrates the progression of physical therapy procedures in the management of the amputee, following the program from the day prepros-

thetic stump exercises are initiated until the time skillful use of the prostheses is achieved and the amputee—a military officer—is returned to duty as an instructor. The various procedures include bandaging of the above-knee and below-knee stump, joint measurement, stump exercises, stump hygiene, care of the suction socket, body-strengthening and balancing exercises, gait training and analysis, and advanced functional activities. Also, briefly presented, are the principles involved in fitting two types of prostheses, the suction socket and the patellar-tendon-bearing socket.

Evaluation: The film is technically superior and professionally sound. Of particular interest and worthy of mention are the well-presented progression of exercises, the clear graphic descriptions, the inclusion of training with the patellar-tendon-bearing prosthesis, and the portrayal of the exacting self-discipline required by the patient. Although the rehabilitation team is acknowledged, the film is presented entirely from the physical therapist's point of view. Because of the extensive amount of material in this film, its primary value lies in an orientation to a good physical therapy program rather than its use in teaching skills. It is recommended for viewing by physical therapists and students, and also by any of the allied medical professions who have an interest in the management of the amputee. New amputees would also appreciate this preview of the treatment program.

Distributor: Requests for film should be directed to Audio-Visual Support Center of the Army Area in which the requesting individual or institution is located, as follows: First U.S. Army, Fort George G. Meade, Maryland 20755 (includes Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont, Delaware, Kentucky, Maryland, Ohio, Pennsylvania, Virginia, and West Virginia); Third U.S. Army, Atlanta, Georgia 30330 (includes Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Tennessee); Fourth U.S. Army, Fort Sam Houston, Texas 78234 (includes Arkansas, Louisiana, New Mexico, Oklahoma, and Texas); Fifth U.S. Army, Fort Sheridan, Chicago, Illinois 60037 (includes Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Wisconsin, and Wyoming); Sixth U.S. Army, Presidio of San Francisco, California 94129 (includes Arizona, California, Idaho, Montana, Nevada, Oregon, Utah, and Washington). Requests originating in Metropolitan Washington, D. C. should be directed to Audio-Visual Support Center, Armed Forces Institute of Pathology, Washington, D. C. 20305.

Rental Fee :None.

Not available for purchase.

Problems of Amputee Joint Alignment, Charles Bechtol, M.D., 1951, 12 min., black and white, silent, 16 mm.

Summary: Shows a limited number of gait deviations related to faulty knee-joint alignment in above-knee amputees.

Evaluation: Although the year of production precludes use of the adjustable leg to establish alignment, the film may still be useful to prosthetists and student prosthetists in understanding faults in old-type prostheses. It should be used in a classroom environment because it lacks the narration needed for clarification. Freeze frames help in analyzing the deviations.

Distributor: American Academy of Orthopaedic Surgeons, 430 N. Michigan Avenue, Chicago, Ill. 60611.

Rental Fee: $5.00.

Rehabilitation Approach to the Hemicorporectomized Patient, New York University Medical Center, 1965, 20 min., color, sound, 16 mm.

Summary: Presents a 49-year-old man amputated between L4 and L5 for pelvic cancer. Traces the chronological progress of the amputee, emphasizing preprosthetic management, fitting and transfer and ambulation activities. Makes reference to social, psychological, and vocational adjustment and to continuous medical and prosthetic follow-up.

Evaluation: This is an excellent film, professionally and technically. Although such a patient is rare, his rehabilitation illustrates principles of fitting and training applicable to amputees with high levels of amputation and to severely involved paraplegics. The results of cooperative team effort are well presented. Physicians, nurses, prosthetists, and physical therapists will find the film of interest as will hemicorporectomized patients.

Distributor: National Medical Audiovisual Center Annex, Station K, Atlanta, Georgia 30324.

Rental Fee: None.

Purchase Source: Color Service Company, Inc., 115 West 45th St., New York, N.Y. 10036.

Purchase Cost: Approximately $56.00.

Rehabilitation of the Quadruple Amputee, Baylor University — Texas Institute for Research and Rehabilitation, 1967, 15 min., color, sound, 16 mm.

Summary: Presents a young man who became a quadruple amputee as the result of electrical burns. The below-elbow and below-knee stumps are shown before and after surgical revision. Patient is shown donning the prostheses, walking, negotiating stairs, and performing several other activities of daily living.

Evaluation: The film shows some activities that this type of quadruple amputee is able to perform in a clinical situation. The approach is very general in that only results are shown,

without reference to methods of training, time required for training, and professional participation. Vocational achievements would have been of interest, inasmuch as the patient returned to work on a farm. The technical quality of the film is good. The film might be useful to acquaint a patient, a family, or an interested group with the potential rehabilitation of this type of patient.

Distributor: Orthotics Department, Texas Institute for Research and Rehabilitation, 1333 Moursund Ave., Houston, Tex. 77025.

Rental Fee: None.

Purchase Cost: $85.00.

Some Biomechancial Methods for Evaluating Activities, VA Prosthetics Center, 1956, 18 min., color, magnetic sound (requires special projector), 16 mm.

Summary: Shows some of the biomechanical methods used in the laboratory to measure the effectiveness with which both normal and handicapped people can perform various activities. Various photographic, mechanical, and electrical techniques are demonstrated.

Evaluation: This interesting film deals with research methodology and is, therefore, of interest primarily to individuals engaged or interested in research.

Distributor: Research and Development Division, Prosthetic and Sensory Aids Service, Veterans Administration, 252 Seventh Ave., New York, N.Y. 10001.

Rental Fee: None.

Speaking of Nurses—Nursing Care of the Amputee, Rancho Los Amigos Hospital, 1968, 28 min., sound, black and white, need Ampex one-inch video tape recorder.

Summary: Presents the role of the liaison nurse in the care of a patient who receives a below-knee amputation and is fitted immediately following surgery. Shows patient's presurgical orientation, with the nurse, the surgeon and the prosthetist participating. Depicts procedures in treatment, including surgery and subsequent steps in rehabilitation. Stresses patient-nurse relationships, self-help, and the concepts of prevention, maintenance, restoration, and continuity of patient care.

Evaluation: Although the patient who was selected to be in this film is an amputee, the primary purpose of the film appears to be the presentation of a concept of nursing care, a purpose which is well served. The film does provide a good orientation to the care and management of a particular kind of amputee. The video tape will limit distribution. The film may be of value to nurses and to patients, particularly in situations where this type of program exists or is being developed.

Distributor: Acme Film Laboratories, Hollywood, California.

Rental Fee: $40.00.

Purchase Cost: $100.00.

Suction Socket Artificial Limb, U.S. Veterans Administration, 1951,

24 min., color, sound, 16 mm.

Summary: Describes the suction prosthesis in terms of the anatomical principles involved in its fabrication and fitting. Presents the indications and contraindications for its prescription, emphasizing the importance of the emotional maturity of the patient. Demonstrates briefly gait abnormalities and training. Also illustrates check-out procedures.

Evaluation: Although made in 1951, this excellent film is valuable in its presentation of a type of above-knee prosthesis that is widely used. This film is of greatest value to physicians, prosthetists, and physical therapists, both staff and students. As background information, it could be useful for anyone concerned with the management of the above-knee amputee.

Distributor: Research and Development Division, Prosthetic and Sensory Aids Service, Veterans Administration, 252 Seventh Ave., New York, N.Y. 10001.

Rental Fee: None.

Surgery and Immediate Prosthetic Rehabilitation of the Peripheral Vascular Disease Amputee, University of Miami, 1967, 16 min., color, sound, 16 mm.

Summary: Describes amputation surgery, immediate prosthetic fitting, and rehabilitation of a 62-year-old man who underwent a below-knee amputation for severe arteriosclerosis. Points stressed in surgical procedure include transection of the tibia and fibula at the same level, unattached section muscle groups, and the use of interrupted sutures, rather than drains. A plaster-of-Paris socket that leaves the knee unrestricted is attached to an adjustable pylon with foot. Weight-bearing is on a graduated basis. Also briefly presented is a 79-year-old diabetic fitted with the expandable PTB-Syme's prosthesis.

Evaluation: The film outlines clearly the steps and procedures followed in this approach to immediate postsurgical fitting. The subject matter is well organized and effectively handled. The technical quality of the film is excellent in all respects. It is of interest primarily to physicians and prosthetists. Although gait training is not included, physical therapists would be interested in the film for background information, as would other professional personnel working with patients who have undergone this procedure.

Distributor: American Academy of Orthopaedic Surgeons, 430 N. Michigan Ave., Chicago, Ill. 60611.

Rental Fee: $5.00.

Purchase Source: Write to Dr. A. Sarmiento, University of Miami School of Medicine, Biscayne Annex, P. O. Box 875, Miami, Fla. 33152.

Purchase Cost: $100.00-$150.00.

Surgical Approach to Syme's Amputation, University of Miami, 1965, 13 min., color, sound, 16 mm.

Summary: The patient is a 22-year-old woman with spina bifida who required amputation of a foot because of infection. Illustrates surgical procedures, which include transection of bone to allow surfaces to be parallel to floor, removal of bone flares for improved cosmesis, and closure of wound with interrupted wire sutures. A SACH foot is attached to the plaster pylon and the patient becomes fully weight-bearing after the stitches are removed and the second cast is applied. The permanent appliance, which is usually delivered two months following amputation, has an inner wall of expandable plastic which eliminates the need for the side window and supracondylar cuff. Also shows a 79-year-old man satisfactorily wearing this type of prosthesis two years after amputation.

Evaluation: This is a well-organized, technically excellent film, presenting a modification of the Syme's amputation and prosthetic fitting. The prosthesis is described, but fabrication is not detailed. Some of the surgical procedures are shown without much explanation, so presumably they would be completely understood only by surgeons, to whom the picture is actually directed. Other professional groups would find the material valuable for orientation to this approach to the Syme's amputation.

Distributor: American Academy of Orthopaedic Surgeons, 430 N. Michigan Ave., Chicago, Ill. 60611.

Rental Fee: $5.00.

Purchase Source: Write to Dr. A. Sarmiento, University of Miami Medical School, P. O. Box 875, Biscayne Annex, Miami, Fla. 33152.

Purchase Cost: $100.00-$150.00.

Techniques of Biceps Cineplasty, U. S. Army, 1954, 25 min., color, sound, 16 mm.

Summary: Presents a graphic description of surgical techniques used in construction of the tunnel. Shows training procedures, including manual and mechanical resistive exercises, and bimanual activities of daily living.

Evaluation: Although this film was produced in 1954, it is still useful in its vivid presentation of the details of surgery. It is directed primarily to the surgeon, but would be of interest to other professional people working with this type of patient. It would have been more useful for the latter group had the training instructions been more expansive.

Distributor: U. S. Army Audio-Visual Support Centers. (See distributors for film, "Physical Therapy Management of a Bilateral Lower-Extremity Amputee."

Rental Fee: None.

Not available for purchase.

Total Rehabilitation of a Bilateral High Upper-Extremity Amputee, U. S. Veterans Administration, 1959, 30 min., color, sound, 16 mm.

Summary: Stresses the roles of all

members of the rehabilitation team in the management of this amputee. Illustrates the team approach in establishment of the program—examination and supervision by the physician; preprosthetic preparation of the stump and an exercise program by the physical therapist; prosthetic training by the occupational therapist; and vocational guidance by the counselor. Most of the time this film is devoted to occupational therapy, and the amputee is shown in several learning situations involving functional activities.

Evaluation: The scenes that show how the patient encounters difficulty in performing normally simple chores and how the patient and the therapist work together to find an efficient method of performance are well presented. Although the film does not attempt to present a step-by-step prosthetic training program, the omission of any reference to solving toilet problems, a real concern with this type of amputee, is unfortunate. The team approach is somewhat overemphasized in the film, particularly insofar as the meetings are concerned. This film has teaching value for occupational therapy students and for occupational therapists who have limited experience in working with patients with upper-extremity amputations. It may also be useful as an orientation for any allied health group whose members are concerned with the management of the high upper-extremity amputee.

Distributor: Central Office Film Library, Veterans Administration, Vermont Ave. and H St., N.W., Washington, D. C. 20420.

Rental Fee: None.

A Triple Amputee Steps Out, U. S. Veterans Administration, 1964, 25 min., color, sound, 16 mm.

Summary: Shows the rehabilitation of a male adult with an above-knee amputation, a below-knee amputation, and a unilateral above-elbow amputation. The patient also suffers from heart and kidney complications that add to the difficulty of rehabilitation. Preprosthetic exercises and balancing activities are followed by ambulation with stubbies, and, finally, with permanent prostheses and crutches.

Evaluation: The level of rehabilitation for this severely involved patient appears unrealistic; and, although he finally ambulates, the gait is labored and unsteady. Use of the upper-extremity prosthesis, which would seem a more useful activity for this patient, is not discussed. This film has little place in paramedical teaching and would be of interest only to note the accomplishments of this unusual and highly motivated amputee.

Distributor: Central Office Film Library, Veterans Administration, Vermont Ave. and H St., N.W., Washington, D. C. 20420.

Rental Fee: None.

Upper-Extremity Prosthetics, U. S. Veterans Administration, 1952, 23 min., color, sound, 16 mm.

Summary: Presents two veterans, both of whom are upper-extremity amputees. One wears his prosthesis successfully; the other keeps his device in his desk. The film explains the dynamics leading to this difference. The successful patient is portrayed as the recipient of services offered in a well-planned amputee management program. The absence of such a program, together with other deterrent factors, is presented as the cause for the second patient's rejection of his original prosthesis. A program designed to overcome his reluctance to wear the prosthesis is outlined.

Evaluation: This film succeeds in achieving its objectives, as it clearly demonstrates the importance of good technical and psychological management of the amputee patient. It is not recommended as a teaching film, because it is lacking in its portrayal of the ideal training program. It is recommended as a general type film for allied health groups and for patients who might be resistant to the intensive effort needed to obtain maximal use of the prosthesis.

Distributor: Central Office Film Library, Veterans Administration, Vermont Ave. and H St., N.W., Washington, D. C. 20420.

Rental Fee: None.

Purchase Source: National Audio-visual Center, National Archives and Records Services, Washington, D. C. 20409.

Purchase Cost: $78.25.

Upper-Extremity Prosthetic Principles, U. S. Veterans Administration, 1955, 29 min., color, sound, 16 mm.

Summary: Demonstrates several interesting activities that were part of a research program aimed at improving upper-extremity prosthetic devices. Of special interest are the demonstration of normal movements of the human hand in a variety of grasping and gripping activities, an analysis of lost movements at various levels of upper-extremity amputation, and the types of upper-extremity prostheses appropriate for specific levels of amputation.

Evaluation: This film is of interest to those who would like to be better informed about the development of prosthetic devices. It could be used to illustrate components of prostheses when they are not available, although it should be remembered that only those prosthetic devices in use prior to 1955 are included.

Distributor: Central Office Film Library, Veterans Administration, Vermont Ave and H St., N.W., Washington, D. C. 20420.

Rental Fee: None.

Purchase Source: National Audio-visual Center, National Archives and Records Services, Washington, D. C. 20409.

Purchase Cost: $97.75.

Upper-Extremity Prosthetics—Harnessing and Control Systems, Northwestern University, 1966, 23 min., color, sound, 16 mm.

Summary: Presents the mechanics of the single-control system for a below-elbow amputee and the dual-control system for an above-elbow amputee. Body control motions and sequence of operation for each are demonstrated. Clarification of concepts is achieved by use of patients, the actual prostheses, and two-dimensional models of the prostheses. Does not include shoulder disarticulation or triple-control system as title might imply.

Evaluation: The sequential, properly paced presentation of well-selected items and procedures and the judicious repetition of pertinent points result in an extremely well-organized film and an effective teaching device. The technical quality is excellent and the narration is clear and specific. The film presupposes a fair amount of knowledge of prosthetics. It would be extremely valuable for use in a graduate program or for review by physical therapists, occupational therapists, nurses, and any other groups concerned with the prescription or fabrication of upper-extremity prostheses, and for those who instruct amputees in use of upper-extremity prostheses. A brochure summarizing the material in the film has been prepared for distribution to viewers.

Distributor: American Academy of Orthopaedic Surgeons, 430 N. Michigan Ave., Chicago, Ill., 60611.

Rental Fee: $5.00.

Purchase Source: Prosthetic-Orthotic Center, Northwestern University, 401 East Ohio St., Chicago, Ill. 60611.

Purchase Cost: $150.00.

The Urban Maes Amputation for Peripheral Vascular Disease, U. S. Veterans Administration, 1956, 14 min., color, sound, 16 mm.

Summary: Demonstrates the Urban Maes operative technique of below-knee amputation in a patient with disease of compromised circulations. Shows the healed stump and joint range of motion some weeks later. Also presented are several other patients whose treatment management is similar. Several views of stumps are shown, and the patients are seen ambulating on a temporary pylon as well as on the permanent prosthesis.

Evaluation: Primarily of value to physicians. Because of its relative simplicity, however, the film would be a good selection to illustrate a well-defined surgical procedure to individuals who have not observed actual surgery.

Distributor: Central Office Film Library, Veterans Administration, Vermont Ave. and H St., N.W., Washington, D. C. 20420.

Rental Fee: None.

Child Prosthetics

Child Prosthetics Project: A Report, University of California at Los Angeles, 1958, 22 min., color, sound, 16 mm.

Summary: Explains the role of each member of a large prosthetics team, which includes the family physician, pediatrician, orthopaedic surgeon, social worker, psychologist, engineer, prosthetist, physical therapist, occupational therapist, and project administrator. Portrays proceedings of a prosthetics conference, during which the patient and parent are presented. The contributions of the social worker, the psychologist, and the engineer are emphasized. At the conclusion of the film, it is explained that one of the principal purposes of the team is to collect research data with a view toward improving training and prosthetic devices and procedures.

Evaluation: At the time the film was made, it undoubtedly served the purposes of showing the UCLA program as well as presenting the concepts of the prosthetics team and the early fitting of the child amputee. Although it might be of some value in demonstrating a research approach, its outdated quality relegates it, for the most part, to the category of "historical interest."

Distributor: Paul L. Brand and Son, 2153 K St., N.W., Washington, D. C. 20001.

Rental Fee: $6.50.

Purchase Cost: $110.00.

Child Upper-Extremity Amputees, University of Michigan Medical Center, 1964, 19 min., color, sound, 16 mm.

Summary: Presents ten child amputees and portrays their accomplishments in use of an upper-extremity prosthesis at specified ages, covering a span of several years in some instances. The x-rays of the involved extremities are shown, and a pictorial description of the amputation or limb deficiency is given. In cases of congential amputees, diagnoses are given in terms of roentgenographical appearance. The type of prosthesis prescribed for each child and the changes necessitated by his growth and development are shown.

Evaluation: A well-presented, informative film that graphically portrays the accomplishments that may be expected of the child amputee who has the advantage of an early treatment program. It points out clearly the disadvantage to the child when prosthetic fitting is delayed. An orientation film of a specialized nature, it should be of interest to any professional person involved in the care of the child amputee. Parents of child amputees could also benefit by seeing this film. It is recommended for public health nurses who are in a position to refer the young amputee to the

amputee clinic.

Distributor: Audio-Visual Education Center, University of Michigan, 416 Fourth St., Ann Arbor, Mich. 48103.

Rental Fee: $1.50.

Purchase Cost: $165.00.

The Child with an Acquired Amputation, Prosthetic-Orthotic Education, Northwestern University, 1967, 29 min., color, sound, 16 mm.

Summary: Summarizes current practices in the care of the child with an acquired amputation. Stresses behavioral and physiologic differences between children and adults. Presents statistics related to etiology and sites of amputation, outlines principles of surgery, and discusses prescription of prosthesis and principles of training as related to age of child. Emphasizes team approach and involvement of family.

Evaluation: This film provides an excellent vehicle for the philosophy underlying the medical management of these children. The subject is thoroughly covered, well organized and well documented. Continuity is maintained and the final summary constitutes an effective teaching device. The superb photography, animated illustrations, and musical background contribute to the technical excellence and appreciation of the film. The narration is not particularly well paced, and the statistics could be presented more effectively. The film is directed primarily to a physician (orthopaedic-pediatric) audience; however, it would also provide excellent orientation to the program for any professional person involved in the treatment of these children. Selected members of a family might profit by seeing it.

Distributor: American Academy of Orthopaedic Surgeons, 430 N. Michigan Ave., Chicago, Ill. 60611.

Rental Fee: $5.00.

Purchase Source: Prosthetic-Orthotic-Center, Northwestern University, 401 East Ohio St., Chicago, Ill. 60611.

Purchase Cost: $150.00.

Congenital Absence of the Lumbar Spine and Sacrum, Area Child Amputee Center, State of Michigan, 1968, 22 min., color, sound, 16 mm.

Summary: This relatively rare but long-known disease is well described by use of clinical signs, x-ray, gross and microscopic tissue specimens, pylograms and arteriograms. Five male patients were treated at this center, and the film is mostly concerned with the steps in rehabilitation of these patients. Advantages of bilateral subtrochanteric amputation are discussed, and patients are shown ambulating with and without hip disarticulation prostheses and crutches. A variety of physical activities is demonstrated.

Evaluation: The material is extremely well organized and clearly presented. Photography is excellent. A good teaching device for professional per-

sons working with these and other congenitally limb-deficient children. Could conceivably be of value for viewing by a child's family.

Distributor: State of Michigan Department of Public Health, The Area Child Amputee Program, 920 Cherry St., S.E., Grand Rapids, Michigan 49506.

Rental Fee: None.

Purchase Cost: $136.10.

Early Development of Ambulation —Unilateral Below-Knee Amputee, University of California at Los Angeles, 1965, 18 min., black and white, sound, 16 mm.

Summary: Depicts the progress of the child amputee from the time he attempts to stand until he walks independently with the prosthesis, which has become an integral part of his body image. Shown are the changing patterns of rhythm, the gradual narrowing of the base of support, and the increasing stability as motor-kinesthetic development takes place and the child participates in increasingly complex skills and play activities.

Evaluation: Presents well the concept of early fitting, as the child is shown wearing and using the prosthesis as effectively as a normal leg. The film should be shown in conjunction with "Infant to School-Age Child—Unilateral Below-Elbow Amputee."

Distributor: Academic Communications Facility, University of California, Royce Hall, Room 2, 405 Hilgard Ave., Los Angeles, Calif. 90024.

Rental Fee: $7.50 for 3 days.

Purchase Cost: $50.00.

Also available for loan from the crippled children's services in all 50 states and in the District of Columbia, the Virgin Islands, Puerto Rico, and Guam through funds supplied by the Children's Bureau, Department of Health, Education and Welfare.

Infant to School-Age Child—Unilateral Below-Elbow Amputee, University of California at Los Angeles, 1964, 10 min., black and white, sound, 16 mm.

Summary: Presents the various stages in the motor-kinesthetic development of the child and relates them to the specific times at which the child amputee is ready for initial prosthetic fitting as well as for increasingly complex devices. As skills and physical activities develop in response to demands of daily living, devices are provided that are appropriate to the level of function. The cooperation of the parents in the teaching process is stressed.

Evaluation: The concept of fitting the child amputee with the appropriate device at a specific time in his motor-kinesthetic development is well presented. The film has value, not only in demonstrating the progress of the child amputee, but also in teaching the basic principles of growth and development in the young child. Although the film is specialized in nature, it is recommended for undergrad-

uate students in allied health fields to present the principles of growth and development. It is highly recommended for professional groups working with child amputees. It should be shown in conjunction with the film "Early Development of Ambulation — Unilateral Below-Knee Amputee."

Distributor: Academic Communications Facility, University of California, Royce Hall, Room 2, 405 Hilgard Ave., Los Angeles, Calif. 90024.

Rental Fee: $7.50.

Purchase Cost: $40.00.

Also available for loan from the crippled children's services in all 50 states and in the District of Columbia, the Virgin Islands, Puerto Rico, and Guam through funds supplied by the Children's Bureau, Department of Health, Education and Welfare.

Juan Irigoyen Yepez, Institute of Rehabilitation Medicine, 1968, 30 min., sound, black and white, 16 mm.

Summary: This is the story of a bright young Bolivian child with severe congenital anomalies of all extremities who is brought to this country to receive intensive rehabilitation. His physical, social, and emotional problems are discussed by various members of the rehabilitation team, and his progress is demonstrated by dialogue and pictures depicting his activities at various ages. He returns to his own country as an independent young man, capable and prepared to contribute to society.

Evaluation: The film's chief value lies in its demonstration of the benefits which may be derived by the severely handicapped person as the result of a well-planned, continuous rehabilitation program. The professional presentation is excellent. Technical quality, although satisfactory, is variable because the film is a composite of still and motion pictures taken over many years. The film is recommended for anyone interested in rehabilitation of the severely disabled, and is of particular value for social workers, vocational counselors, and the general public.

Distributor: National Medical Audiovisual Center, Atlanta, Georgia 30333.

Rental Fee: None.

Not available for purchase.

Juvenile Amputee with Congenital Skeletal Limb Deficiencies, Tulane University School of Medicine, 1964, 20 min., color, sound, 16 mm.

Summary: Presents ten patients treated at a child amputee clinic. As each case is presented, the limb deficiency is described on the screen in the terminology of roentgenographic classifications. The deficiency is further described by x-ray plates and by pictures of the child before surgical procedures. Scenes filmed at a later date show the patient wearing and using a prosthesis fitted to the surgically revised limb. The history of the child is outlined rather fully

and, in some instances, the history is pictorially depicted at intervals over a number of years.

Evaluation: This film would be helpful in reinforcing use of the classification of limb deficiencies as developed by O'Rahilly and Frantz. The results obtained in fitting severely involved children are impressive. The information presented is too extensive for the time allotted, making it difficut to stay with the narrator and detracting from the technical quality of the film. The film is recommended for professional groups interested in orientation to this particular type of patient and program. It could also benefit parents of the congenital child amputee.

Distributor: American Academy of Orthopaedic Surgeons, 430 Michigan Ave., Chicago, Ill. 60611.

Rental Fee: $5.00.

Kevin is Four, Ohio State University, 1965, 26 min., color, sound, 16 mm.

Summary: Presents a congenital amputee with left below-elbow and right below-elbow-knee limb deficiencies. Demonstrates fabrication and enumerates prostheses which eliminate the undesirable features of the old out-grown prostheses. Prosthetist is shown with child in a series of close-up shots. Also describes a waterproof leg used for swimming, and worn to bed by this child. Shows Kevin engaged in a wide variety of play and work activities.

Evaluation: This film effectively demonstrates the active life which may be led by the child amputee and shows clearly the value of a suitable well-fitting prosthetic device. The photography is good and includes some very appealing shots of Kevin. Narration is not always distinct and it is sometimes difficult to distinguish between speakers. The film would be excellent for showing to parents, teachers, and organizations such as the PTA, as well as other groups interested in the habilitation potential of the child amputee. It is not a teaching film for professional people.

Distributor: Ohio State University Motion Picture Division, 1885 Neil Ave., Columbus, Ohio 43210.

Rental Fee: $12.50.

Purchase Cost: $240.00.

Proximal Femoral Focal Deficiency, Michigan Department of Public Health (Authors: G. T. Aitken and C. H. Frantz), 1966, 30 min., color, sound, 16 mm.

Summary: Differentiates between congenital coxa vara and proximal femoral focal deficiency by identifying characteristic x-ray and clinical features of each. Presents four radiographic types of proximal femoral focal deficiencies and illustrates each with a specific patient for whom surgical indications, prosthetic fitting, and gait pattern are shown. One bilateral case is included. Stresses need to retain feet in patients with bilateral proximal femoral

focal deficiencies. Serial x-rays are shown and the patients are followed for several years.

Evaluation: This is a skillfully produced, effective teaching film. The material is well organized, narration is realistically paced, and the main points are conclusively summarized. X-ray plates, diagrams, and cineradiography contribute to the clarity of the presentation. The film is of value primarily to the orthopaedic surgeon, the resident, and the medical student for purposes of differential diagnosis and orientation to some aspects of medical management. No mention is made of the need for prolonged gait training. For other professional groups the film provides a background of information for better understanding in working with this type of patient.

Distributor: State of Michigan, Department of Public Health, Area Child Amputee Program, 920 Cherry St., S.E., Grand Rapids, Mich. 49506.

Rental Fee: None.

Purchase Cost: Negotiable upon request.

Upper-Extremity Prosthetic Checkout Procedures—Below Elbow, Michigan Crippled Children Commission, 1961, 23 min., color, sound, 16 mm.

Summary: Defines and states the purpose of checkout and identifies the equipment needed. Demonstrates checkout procedure on a 4-year-old boy with short below-elbow amputation by showing how each item on the checkout form is tested or measured.

Evaluation: The film is technically good, except for cutting procedures. Although modern fitting makes the prosthesis shown outdated, the film is well planned and would be of value to anyone learning the checkout procedures, presumably the occupational therapist in most instances. For maximum benefit the viewer should have some knowledge of amputee training and standards of performance. Film viewing will be much more meaningful if checkout forms are on hand and can be followed item by item.

Distributor: State of Michigan, Department of Public Health, Area Child Amputee Program, 920 Cherry St., S.E., Grand Rapids, Mich. 49506.

Rental Fee: None.

Purchase Cost: Negotiable upon request.

Orthotics

An Application of Research in Orthotics, Texas Institute for Rehabilitation and Research, 1965, 22 min., color, sound, 16 mm.

Summary: Presents a wide variety of upper-extremity orthoses developed during a three-year research program. Important among these is a wrist-extension device designed to provide the hand with the function of pinch. Discusses and demonstrates the device in terms of an artificial muscle powered by compressed carbon dioxide, the actuation of valves by voluntary control movements, and the orthosis itself. Also illustrates equipment that enables the patient to perform shoulder and arm movements. Stresses the value of the team concept, the importance of fitting the device to the patient, and the necessity of training to achieve the most effective use of the device.

Evaluation: This is an excellent orientation film because it presents effectively the basis of orthotic design and development as well as the importance of fitting and training in the use of orthoses. It demonstrates well how design application, engineering technology, and technical innovation can combine to produce an efficient device and how the team concept enhances the prospect of satisfactory patient rehabilitation. The technical quality of the film is excellent except for the rapidity of the narration. The film would be of interest to anyone concerned with orthotic fitting and training of the patient with severe upper-extremity disability. It might be considered as a recruitment film for orthotists and would be informative for rehabilitation counselors.

Distributor: Orthotics Department, Texas Institute for Rehabilitation and Research, 1333 Moursund Ave., Houston, Texas 77025.

Rental Fee: None.

Not available for purchase.

Assistive Devices for the Physically Handicapped, National Foundation for Infantile Paralysis, 1957, 12 min., sound, color, 16 mm.

Summary: Illustrates many assistive devices and their use by postpoliomyelitis patients. The devices include mouth sticks, overhead slings, feeders of various types, automatic page turners, hydraulic lifts, and several others.

Evaluation: This very comprehensive film is useful to show the kinds of devices used to increase the functional capacity of the postpoliomyelitis patient with severe residual paralysis. Credit is due those whose ingenuity resulted in the improvised equipment demonstrated here. While the film is photographically excellent its content in terms of emphasis on certain devices, such as the mouth stick, is questionable.

The film, made prior to the poliomyelitis vaccines, is necessarily outdated in some aspects, but the devices shown would still be of interest to personnel working with the severely disabled.

Distributor: Film Library, International Society for Rehabilitation of the Disabled, 219 East 44th St., New York, N. Y. 10017.

Rental Fee: $5.00.

Purchase Source: National Foundation, 800 Second Ave., New York, N. Y. 10017.

Purchase Cost: Unknown.

Balanced Forearm Orthosis in Muscular Dystrophy, Highland View Hospital, 1967, 14 min., color, sound, 16 mm.

Summary: Two patients with Duchenne's muscular dystrophy demonstrate how the balanced forearm orthosis (BFO) increases their independence. Film explains some principles underlying the function of the BFO and shows assembly of the device and method of making adjustments to aid or prevent specific motions. One patient demonstrates his ability to use the electric typewriter.

Evaluation: The material is clearly and simply presented and the demonstrations of increased function are effective. The technical quality is good. The presentation presupposes some knowledge of orthotic function, although terminology is often expressed in layman's terms. It would be of particular value to orthotists and occupational therapists interested in the use of this device.

Distributor: Dr. Charles Long, II, Highland View Hospital, 3901 Ireland Dr., Cleveland, Ohio 44122.

Rental Fee: $5.00.

Purchase Source: Holland Wegman Labs., Inc., 4019 Prospect Ave., Cleveland, Ohio 44103. (Please refer to Can #7-8-H-1269.)

Purchase Cost: $48.62.

The Heather Hand, U. S. Veterans Administration, 1960, 10 min., color, silent, 16 mm.

Summary: Describes a lightweight, wrist-extension, hydraulic orthosis. Shows the patient putting it on himself and performing several activities.

Evaluation: Although this film illustrates the device very well and graphically demonstrates its function, it is of practically no value for paramedical groups because it is not accompanied by any explanation, either written or auditory.

Distributor: Research and Development Division, Prosthetic and Sensory Aids Service, Veterans Administration, 252 Seventh Ave., New York, N. Y. 10001.

Rental Fee: None.

The IRM Electric Arm Orthosis, Institute of Rehabilitation Medicine, New York University, 1966-67, 8 min., color, sound, 16 mm.

Summary: Explains mechanism of motorized device and demonstrates use of the IRM electric arm orthosis for quadriplegic patient with C4-5 cervical lesion. Demonstrates prehension of the hand, pronation

and supination of the forearm, elbow flexion and extension, and shoulder flexion, extension, abduction, and adduction.

Evaluation: The film introduces a new device. The technical quality is adequate for this purpose. Activation of motion should have been explained early in the film and needs clarification. The film was designed primarily for research orthotists and engineers, but is informative to anyone interested in developments in this area.

Distributor: Institute of Rehabilitation Medicine, New York University Medical Center, 550 First Ave., New York, N. Y. 10016.

Rental Fee: None.

Purchase Cost: $30.00.

Kinetics and Orthotics for Function, Institute of Physical Medicine and Rehabilitation, New York University Medical Center, 1963, 25 min., black and white, sound, 16 mm.

Summary: Presents the basic principles in the selection and the use of orthotic devices to achieve as normal function as possible in the presence of upper-extremity weaknesses. The basic normal motions of the upper extremity in the performance of several everyday activities are carefully depicted. The subject, a quadriplegic patient, is introduced as he is undergoing a manual muscle test. The test, which reveals severe weakness in the musculature of the upper extremities, also serves as a basis for determining the degree and nature of the mechanical assistance required to supplement the existing strength. Periodic evaluations are made; and, as strength increases, the appliances are adjusted or replaced. Finally, the amount of assistance is reduced to the minimum required by the patient, who is shown performing a number of activities. Before discharge from the hospital, the patient is equipped with a flexor-hinge hand and is planning to return to his former occupation.

Evaluation: An excellent analytical presentation of the prescription and use of orthotic devices for severely involved upper-extremity patients. Outstanding in this picture is its adherence to the practice of sound teaching principles. As each new step is presented, the principle underlying the selection of orthotic devices is applied and illustrated. The analysis of normal motion serves as a basic approach to the problem. The film gives a feeling for the long time involved and is realistically hopeful in terms of patient accomplishment. This film is highly recommended for those who work with patients wearing orthoses; for occupational therapists it is of value in teaching specific techniques of training.

Distributor: Film Library, New York University Medical Center, 342 East 26th St., New York, N.Y. 10016.

Rental Fee: $6.50.

Purchase Source: Mr. Paul Clark, Special Products, Institute of Physical Medicine and Rehabilitation, New York University, 400 East 34th St., New York N.Y. 10016.

Purchase Cost: Unknown.

Nonoperative Treatment of Scoliosis with Milwaukee Brace, Part I, Marquette University and Pope Foundation, 1963, 38 min., color, sound, 16 mm.

Summary: Shows briefly the physical examination for scoliosis in an adolescent girl; discusses principles and techniques in construction of the brace, fitting, application of pressure pads, and general treatment management of the young scoliotic patient. Most of the film is devoted to demonstration of the progressive steps in fabrication of the Milwaukee brace.

Evaluation: This is a technically superior film. The material is well organized and the step-by-step fabrication of the brace is exceptionally well demonstrated. Although the psychological problem is recognized, it is treated rather lightly in consideration of its seriousness. Results achieved by wearing the brace might appear to be overly optimistic. The orthotist has most to gain from this picture, but for anyone working with the adolescent scoliotic patient who wears the Milwaukee brace, it would be of value. One worthwhile feature is the explanation of how to determine whether the brace is too short or only appears to be so. The film could be shown to selected patients and family.

Distributor: American Academy of Orthopaedic Surgeons, 430 N. Michigan Ave., Chicago, Ill. 60611, or Ideal Pictures, 4431 W. North Ave., Milwaukee, Wisc. 53208.

Rental Fee: $5.00.

Purchase Source: Write to Dr. W. P. Blount, 2140 W. Wisconsin Ave., Milwaukee, Wisc. 53233.

Purchase Cost: $150.00.

The Nonoperative Treatment of Scoliosis and Round Back by the Milwaukee Brace, Part II, 1968, Marquette University, 30 minutes, color, sound, 16 mm.

Summary: Presents several patients to demonstrate principles of treatment by use of the Milwaukee brace. Shows the effects of proper and improper fitting of brace components. Discusses all aspects of treatment, including fitting, principles underlying component adjustment, methods of adjustment, voluntary correction of posture, rest, therapeutic exercise, and other physical activities.

Evaluation: An excellent overall presentation of the nonsurgical treatment of scoliosis and round back. The fact that the patients are followed for long periods of time contributes to the authenticity of the statements. Continuity and organization of the film could have been improved, but, generally speaking, the material is well handled, particularly in view of its extensive coverage. Professionally, this is an excellent

film and would be valuable for physicians, nurses, orthotists, therapists, families of patients and anyone interested in the treatment of scoliosis and round back.

Distributor: American Academy of Orthopaedic Surgeons, 430 N. Michigan Ave., Chicago, Ill. 60611, or Ideal Pictures, 4431 W. North Ave., Milwaukee, Wisc. 53208.

Rental Fee: $5.00.

Purchase Source: Write to Dr. W. P. Blount, 2140 W. Wisconsin Ave., Milwaukee, Wisc. 53233.

Purchase Cost: $150.00.

The RIC Plastic Tenodesis Splint, Rehabilitation Institute of Chicago, Department of Occupational Therapy, 1967, 24 min., color, sound, 16 mm.

Summary: Shows how patient with minimal wrist function can use this device effectively. Describes components of the splint which possesses no mechanical joints. Discusses criteria for useful wearing. Demonstrates application and removal of splint, steps in training, and use in a number of activities, such as shaving, writing, and cutting meat. The last portion of the film demonstrates the steps in fabrication and fitting. The advantages of the splint are listed.

Evaluation: This is an outstanding instructional film, exemplifying the highest technical and professional qualities in production. Photography and narration are exceptionally good. Subject matter is well organized and presented clearly and concisely. Physicians, orthotists, occupational therapists, physical therapists, and nurses will be interested in the film, particularly the first half; the second half is specifically directed to the orthotist.

Distributor: Rehabilitation Institute of Chicago, 401 East Ohio St., Chicago, Ill. 60611.

Rental Fee: $10.00.

Purchase Cost: $175.00.

Self-Help Devices for Patients with Arthritis, Institute for Physical Medicine and Rehabilitation, 1960, 16 min., color, sound, 16 mm.

Summary: In a foreword, Dr. Howard Rusk describes the need and place for self-help devices for persons with arthritis. A physician then demonstrates and explains a variety of self-help devices as used by several severely involved patients in performance of activities of daily living. Kitchen design for handicapped persons is discussed. Sources of devices and information are given.

Evaluation: This is a technically excellent film which could serve to orient health professions and organizations to the potential value of devices in helping the handicapped achieve independence. The explanations would have been more meaningful if the film had portrayed other members of the health team involved in rehabilitation of these patients. Of special interest to the general practitioner, nursing per-

sonnel, public health nurses, and vocational counselors.

Distributor: Campus Films Distributor Co., 20 East 46th St., New York, N.Y. 10017.

Rental Fee: $15.00.

Purchase Cost: $152.00.

Spinal Cord Injury, Rancho Los Amigos Hospital, 1961, 25 min., color, sound, 16 mm.

Summary: Depicts eight levels of spinal cord injury and demonstrates the degree of independence that the average patient can attain after injury. Independence is accomplished through a program of maximum strengthening of the remaining active muscles, combined with appropriate assistive devices such as short leg braces, long leg braces, overhead slings, artificial muscles, special splints, crutches, hydraulic lifts, etc., and training.

Evaluation: This well-organized film discusses clearly and precisely each level of injury in terms of specific pertinent information, such as key muscle groups involved, functional loss, and orthotic devices. It points out that the prognosis of the patient is not constant with the level of injury, but is based on demonstrable muscle function. Limitations are carefully noted, and goals are realistic. The film is highly recommended for any professional person working with the paraplegic or quadriplegic patient and for inclusion in the undergraduate curriculum for therapists and nurses. Patient and family would benefit from seeing this film, provided they have accepted a realistic attitude toward rehabilitation.

Distributor: American Academy of Orthopaedic Surgeons, 430 N. Michigan Ave., Chicago, Ill. 60611.

Rental Fee: $5.00.

Swivel-bar Transfer for the Quadriplegic Patient, Rancho Los Amigos Hospital, 1968, 12 min., color, sound, 16 mm., or Super 8 mm. cartridges for either Fairchild or Technicolor sound projection.

Summary: A physical therapist and a patient with a high cervical cord quadriplegia demonstrate technique for patient transfer from wheel chair to bed. (Patient must have at least one biceps muscle with fair-plus strength.) Describes equipment needed and method of attaching it to bed.

Evaluation: Step-by-step sequence in performance of transfer, repetition, and well-paced narration contribute to the teaching value of this excellent film. Of value in training all levels of health personnel involved in transfer activities of this type of patient. Of interest to public health nurses.

Distributor: Attending Staff Association, Rancho Los Amigos Hospital, 12826 Hawthorn Street, Downey, California 90242.

Purchase Cost: 8 mm. single-concept cartridge—$60.00; 16 mm.—$87.00. Film is available one time for preview.

Use of the Flexorhinge Hand, Rancho Los Amigos Hospital, 1963, 25 min., color, sound, 16 mm.

Summary: Describes wrist-driven and externally powered flexorhinge hands, orthotic devices for patients with inadequate prehension. Also presented are surgical interventions to obtain prehension. Shows several patients who demonstrate inadequate pinch in severely involved hands. The loss of hand function in each is evaluated, the appropriate flexorhinge hand for each is described, and the patients are shown performing a variety of activities using the device. Supplementary bracing and adaptive equipment are also described.

Evaluation: A well-organized, clearly presented film that could be used advantageously as an effective teaching aid in basic educational programs for physical and occupational therapists and nurses. Especially valuable for anyone working with patients having upper-extremity disability. Because it is not overly technical, it might be considered for showing to parents and to selected patients.

Distributor: Medical Education Service, Rancho Los Amigos Hospital, 7601 East Imperial Highway, Downey, California 90242.

Rental Fee: None.

Purchase Cost: $250.00.

Slides

Nomenclature for Congenital Skeletal Limb Deficiencies, 1967. Approximately 35 cardboard-mounted, 35 mm., 2″ x 2″ slides, black and white.

These are slides of the figures used to illustrate the article, "Nomenclature for Congenital Limb Deficiencies, a Revision of the Frantz and O'Rahilly Classification," *Artificial Limbs,* 10:1, Spring 1966.

Distributor: Committee on Prosthetics Research and Development, Division of Engineering, National Research Council, 2101 Constitution Avenue, Washington, D. C. 20418.

Rental Fee: None.

Not available for purchase. May be borrowed for purpose of duplication.

Upper and Lower Limb Deficiencies, Congenital Amputees, compiled by Henry K. Taylor, M.D., Institute of Rehabilitation Medicine, 1968. One hundred and twenty-three cardboard-mounted, 35 mm., 2″ x 2″ slides.

These slides are made from x-rays of ninety-two cases of limb deficiencies in congenital amputees and are grouped according to patients with a specified number of limb deficiencies. They are accompanied by a booklet which includes definitions of terminology and captions for each slide

indicating the Frantz-O'Rahilly classification of the anomaly.

The slides are arbitrarily divided into Series No. 10-4 capsule A and 10-4 capsule B.

Distributor: Micro-X-ray Recorder, Inc., 3755 West Lawrence, Chicago, Illinois 60625.

Purchase Cost: $22.00 for each series.

Project Slides, Second Series, 1968, Prosthetic and Sensory Aids Service, Veterans Administration, and Committee on Prosthetic-Orthotic Education. One hundred 35 mm., 2" x 2" slides, color.

Slides illustrate above-knee, below-knee, above-elbow, below-elbow, and hip-disarticulation prostheses; prosthetic feet, hands, hooks, hinges; immediate post-surgical prosthetics; lower extremity braces.

Distributor: Committee on Prosthetic-Orthotic Education, Division of Medical Sciences, National Research Council, 2101 Constitution Avenue, Washington, D. C. 20418.

Rental Fee: None.

Not available for purchase.

Audiotapes

The following audiotapes were produced by the New York University Medical Center. The audiotapes require the use of a 4-track, 3¾ ips tape recorder.

Congenital Anomalies of the Extremities, Chester A. Swinyard, M.D., 86 min., magnetic sound.

Summary: Reviews the problems of a child born without one or more extremity or parts of extremities. Discusses the prosthesis, schooling and adaptation to living by these patients.

Rehabilitation of the Lower Extremity Amputee, Donald A. Covalt, M.D., 116 min., magnetic sound.

Summary: Discusses early management, fitting the prosthesis, and use training in the rehabilitation of the lower extremity amputee.

Upper Extremity Prosthesis, 1966, Sidney Fishman, Ph.D., 114 min., magnetic sound.

Summary: Explores the rehabilitation of the upper extremity amputee. Shows the sites of amputation preferred, the fitting, training, checkout and psychological factors involved in upper extremity prostheses.

Manpower Survey

J. Warren Perry, Ph.D.*
Barbara R. Friz, M.S.**

INTRODUCTION

For several years, reports from various parts of the country have indicated the existence of a manpower shortage in the fields of prosthetics and orthotics. These reports have stemmed primarily from facility owners and physicians endeavoring to provide quality prosthetic and orthotic services for their patients. This paper reports the results of a survey which was conducted for the purpose of shedding some light on the nature and magnitude of this problem and, in turn, contributing to efforts directed toward its solution.

* 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 Prosthetices and Orthotics, CPOE.

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

The survey was proposed and conducted by the Subcommittee on Special Educational Projects in Prosthetics and Orthotics, Committee on Prosthetic-Orthotic Education, whose membership includes representation from the American Orthotic and Prosthetic Association; The American Board for Certification, AOPA; the University Council on Prosthetic-Orthotic Education; the Rehabilitation Services Administration, Social Rehabilitation Service; and the Prosthetic and Sensory Aids Service of the Veterans Administration. The Subcommittee was established in June 1967 to supplement the work of other interested agencies and organizations in developing definitive training and long-term educational programs in the fields of prosthetics and orthotics.

At the first meeting of the Subcommittee the members agreed that, before a program of purposeful activities could be launched, it

would be necessary to examine various aspects of the manpower situation in prosthetics and orthotics, to include scope and intensity of shortages, profiles of personnel currently working in these fields, salary ranges, and demand for graduates of existing educational programs in prosthetics and orthotics. A manpower survey was therefore proposed.

METHODS

Thirty prosthetists and orthotists participated in a pilot study conducted for the primary purpose of evaluating the effectiveness of an initial survey form as a data collection tool. The pilot study experience led to an extensive revision of the form and the incorporation of explanatory material to serve as a basis for more accurately completing a section on employment of graduates. This material consisted of carefully formulated descriptive profiles of graduates of the various educational and training programs in prosthetics and orthotics.

For the purpose of this study, five personnel categories were defined and appeared in the survey form as follows:

1. A *Prosthetist-Orthotist* is skilled in all facets of fabrication, fitting and alignment of prosthetic and orthotic devices; deals with patient; usually certified in both prosthetics and orthotics or qualified to apply for certification in both.

2. A *Prosthetist* is skilled in all facets of fabrication, fitting and alignment of prosthetic devices; deals with patient; usually certified or qualified to apply for certification.

3. A *Prosthetic Technician* performs benchwork only; does not fit or align prosthetic devices; serves as support person for the prosthetist.

4. An *Orthotist* is skilled in all facets of fabrication, fitting and alignment of orthotic devices; deals with patient; usually certified or qualified to apply for certification.

5. An *Orthotic Technician* performs benchwork only; does not fit or align orthotic devices; serves as support person for orthotist.

The revised survey forms were distributed in early July, 1968, and again to non-respondees about a month later. The last completed forms were returned to the CPOE office January 31, 1969. Data were analyzed according to personnel categories and, geographically, according to the eleven regions designated by the American Orthotic and Prosthetic Association. (Appendix A)

PARTICIPANTS AND SUBJECTS

Representatives of 203 facilities, institutions and military installations completed the survey forms. A total of 1,374 persons, representing seven categories related to prosthetics and orthotics, were entered in the study. (Tables I and II)

Data related to corsetieres and shoe specialists will be considered in a separate study. This report is concerned with the remaining five categories of personnel, totaling 1,163, as shown in Table III. It is interesting to note that, excluding the prosthetist-orthotists, the number reported for the various categories are relatively close.

The incidence of females reported is low—one prosthetist, seven prosthetic technicians, three orthotists, and six orthotic technicians.

Among the three groups who qualify for certification, the prosthetist-orthotists show the highest percentage of certifees (74.8%) and the orthotists the lowest (51.9%). (Table IV)

RESULTS

Personnel Needs*

All categories reflect current and future shortages of manpower (Table V and Figure 1). According to the findings in this study, and based on the reported number of currently employed, the groups reflecting the greatest manpower shortage at this time are the orthotic technicians (28.6%) and prosthetic technicians (27%).

In one year from the time of the survey, the estimates identify the same two groups as requiring the highest percentage increase of personnel, with prosthetic technicians requiring a 53.7% increase and orthotic technicians a 50.7% increase.

In five years it is estimated that the need for prosthetic technicians will be more than double (113.3%) the number currently employed, and that the need for orthotic technicians will be almost double (97.7%). Estimates for personnel requirements for the other three groups also indicate the need for substantial personnel increases in five years.

The estimated personnel needs for all groups average 23% now, 45.7% in one year, and 87.6% in five years.

Personnel Needs by Regions

The pattern of personnel requirements for different categories in the eleven AOPA regions is, for the most part, diffuse and ill-defined. (Tables VI-X) After breaking down the total number of personnel into categories and then into regions, the remaining sample is reduced to a relatively small number. Within the limits of this sample, however, the most urgent regional demands for personnel appear as follows:

Prosthetist-Orthotist (Table VI)

Regions V, VI, and VII reflect the greatest over-all demand for personnel in this category, although Region IV reports a somewhat greater current shortage than Region VII.

Prosthetists (Table VII)

Current personnel requirements for prosthetists appear to be most acute in Regions XI and IV, in that order. In five years, Region IV projects the highest percentage needed increase, followed by Regions V, XI and IX.

Prosthetic Technicians (Table VIII)

Regions I and VIII reflect the greatest current shortage in this category. Region IV reflects the greatest future demand, followed by Regions VIII and V.

Orthotists (Table IX)

Region II reports a significantly greater current shortage than any other region. Regions I and V follow, but at a considerably lower

* Use of the terms "now," "current," etc., in this discussion denotes time of survey rather than time of this report.

level. Region II also reports the largest future demand for orthotists, followed by Regions I and VI.

Orthotic Technicians (Table X)

Regions V, VII and II report the greatest current shortages. Regions XI and V reflect the greatest demand for this category in the five-year projection.

RATIOS

It is interesting to note the approximate 1:1 ratios in this study. This is characteristic of the ratio of prosthetist to orthotists currently employed and is further reflected in the projected personnel requirements for these two groups. (The ratio of prosthetist-orthotists to prosthetists is approximately 1:2 at the time of the survey and remains the same for estimated future needs. Similarly, the ratio of prosthetist-orthotists to orthotists is consistently 1:2.)

Of greater significance and interest at this time is the ratio of prosthetists to prosthetic technicians and orthotists to orthotic technicians (Tables XI and XII). Here again, an approximate 1:1 ratio is characteristic of the numbers currently employed. Estimates for future needs show some weighting toward the technicians' side, but do not approach the 1:3 or 4 ratio that is sometimes quoted as desirable.

Upon further examination, it appears that these ratios are reversed in some geographical locations, especially in the western regions. In Region X the prosthetist: prosthetic-technician ratio shows a marked weighting toward the prosthetist' side. This is not found in the orthotist: orthotic technician analysis in this region. The reason for the reversal perhaps may be attributed to the inclusion in this area of a large research laboratory where prosthetic technicians are not employed.

YEARS IN THE FIELD

Slightly over half (53.8%) of the prosthetist-orthotists reported in this study have 10-29 years' experience in their field. The group with 0-9 years' experience is only two-thirds as large as the group with 10-19 years' experience, and less than half as large as the group with 20-29 years' experience. (Figure 2)

Sixty-five percent of the prosthetists and 68% of the orthotists in this study have 10-29 years' experience. In both groups, the number of personnel with 10-19 years' experience approximates the number with 20-29 years' experience. These last two groups are approximately one-third larger than the group with 0-9 years' experience.

Conversely, the number of prosthetic technicians and orthotic technicians with 0-9 years' experience constitutes well over half the total number of technicians in their respective groups. (Figure 3) A sharp drop appears in the groups having more than 0-4 years' experience. (It is possible that further investigation would reveal this drop coming even earlier.) The number of years in the field for orthotic technicians showed the same type of distribution as that for prosthetic technicians.

EDUCATIONAL LEVEL

The educational levels of various groups are shown in Table XII. Ex-

cluded in this computation are those persons whose "highest level" was indicated as "intern," "certificate," and "other." Since these often referred to courses which were taken in foreign countries, or were not clearly identifiable, it was decided to include only those levels that indicated completion of recognized school levels and degree courses.

RECOMMENDATIONS FOR EDUCATION

The recommended levels of education are reflected in Table XIV and are much higher than current levels.

SALARIES BY EDUCATIONAL LEVEL

In attempting to correlate salaries with educational level, it is difficult to see a consistent pattern, except that in certain areas a higher educational level appears to conform with higher salaries. For example, in four of the five groups of personnel, there was a higher incidence of above-high-school-level personnel with higher salaries than the median salary for their specific group. This is shown in Table XV.

PROFILE

Table XVI is a composite of the various groups showing median age, median salary, years in field and average education.

DEMAND FOR GRADUATES OF DEGREE COURSES

The final section of the survey form represented an effort to find out how many graduates of the various prosthetic-orthotic educational programs would be employed and the level of salary they might expect.

The number of graduates whom facility owners proposed to employ was unrealistic in that it exceeded the number required as stated in Section I of the survey form. Some respondees explained that they did not have a choice of one graduate over perhaps two or three others, and therefore entered all possibilities. As a consequence, the figures have been distorted in terms of actual need.

The proposed salaries show an extremely wide range, but for the most part, reflect a gradual increase commensurate with an ascending level of education. (Table XVII)

DISCUSSION

The magnitude of the manpower shortage in the fields of prosthetics and orthotics, although undoubtedly more acute in some localities, is, generally speaking, comparable to that in other health fields. The situation has spurred intensive efforts on the part of the various health fields to recruit young qualified individuals to their particular field. Perhaps the manpower needs as projected in this study will underscore the necessity of much greater recruiting efforts on the part of those in the fields of prosthetics and orthotics.

Results of data analysis pose several questions. For example, what implications may be drawn from the projected prosthetist-prosthetic technician ratio of approximately 1:1? And the same ratio for orthotist-orthotic technicians? This

finding is in contradiction to the well-circulated belief that there should be three or four technicians for every professional person. Does this imply that the industry feels a greater urgency for more professional people than for technicians? Does it point to a comparatively lesser need for technical personnel, perhaps because of an anticipated increase in the use of prefabricated components? Or is it an expression of status quo, inasmuch as the 1:1 ratio is characteristic of the current ratio of prosthetists to prosthetic technicians and orthotists to orthotic technicians?

What is the reason for the short time that technicians remain in the field as reflected in the relatively small size of those groups with more than four years' experience? How much of this may be attributed to upward movement of personnel to the professional level? How will the trend toward higher standards of education affect this group? Is it realistic to try to keep these technicians for a longer period of time? If so, how might this be accomplished?

These are the kinds of questions which, if answered, might provide a clearer perspective in trying to develop long-range plans for educational and clinical programs in the prosthetic-orthotic field.

SUMMARY

Two hundred and one survey forms were completed on 1,374 personnel in the fields of prosthetics and orthotics. Reported here are data related to 1,163 persons currently employed in five categories: prosthetics-orthotics, prosthetics, orthotics, prosthetic technicians and orthotic technicians. Current manpower shortages and estimated future manpower needs are also reported.

* * *

Members who have served on the Subcommittee on Special Educational Projects in Prosthetics and Orthotics, CPOE, are:

Dr. J. Warren Perry, Chairman
Dr. Jack D. Armold
Mr. William M. Bernstock
Dr. Sidney Fishman
Mr. McCarthy Hanger
Dr. Alfred E. Kritter
Mr. George H. Lambert
Mrs. Florence Knowles
Mr. Alvin Muilenburg
Dr. Herbert E. Pedersen, ex officio
Mr. Herbert Warburton

TABLE I
PROSTHETIST-ORTHOTIST MANPOWER SURVEY

Survey forms sent out	410	
Survey forms returned	201	(49.0%)
Personnel entered in study	1,374	

TABLE II
PERSONNEL ENTERED IN STUDY BY CATEGORY

	NUMBER	% OF TOTAL (1374)
Prosthetist-Orthotists	119	8.7
Prosthetists	271	19.7
Prosthetic Technicians	258	18.8
Orthotists	266	19.4
Orthotic Technicians	249	18.1
Corsetieres	149	10.8
Shoe Specialists	62	4.5
TOTAL	1,374	

TABLE III
PERSONNEL ENTERED IN STUDY
(Excluding Corsetieres and Shoe Specialists)

	NUMBER	% OF TOTAL (1,163)
Prosthetist- Orthotists	119	10.2
Prosthetists	271	23.3
Prosthetic Technicians	258	22.2
Orthotists	266	22.9
Orthotic Technicians	249	21.4
TOTAL	1,163	

TABLE IV
NUMBER OF CERTIFEES ENTERED IN STUDY

	TOTAL NUMBER IN STUDY	CERTIFEES	
		NUMBER	PERCENT
Prosthetist-Orthotists	119	89	74.8
Prosthetists	271	171	63.1
Orthotists	266	138	51.9

TABLE V
ESTIMATED PERSONNEL NEEDS

	CATEGORIES					
	Pros. Orth.	Pros.	Pros. Tech.	Orth.	Orth. Tech.	TOTAL
CURRENTLY EMPLOYED	125	262	270	271	266	1,194
NEEDED NOW	154	310	343	320	342	1,469
Increase in Number	29	48	73	49	76	275
*Percentage increase	23.2	18.3	27.0	18.1	28.6	23.0
NEEDED IN ONE YEAR	186	354	415	384	401	1,740
Increase in number	61	92	145	113	135	546
Percentage increase	48.8	35.1	53.7	41.7	50.7	45.7
NEEDED IN FIVE YEARS	236	460	576	442	526	2,240
Increase in number	111	198	306	171	260	1,046
Percentage increase	88.8	75.6	113.3	63.0	97.7	87.6

*Percentage increases based on number currently employed in category.

TABLE VI
ESTIMATED PERSONNEL NEEDS BY REGION
PROSTHETIST-ORTHOTISTS

	REGIONS I	II	III	IV	V	VI	VII	VIII	IX	X	XI	TOTAL
CURRENTLY EMPLOYED	6	14	15	17	3	13	8	9	12	16	12	125
ESTIMATED PERSONNEL NEEDS												
Needed now	6	18	17	23	6	19	10	11	14	17	13	154
Increase in No.	0	4	2	6	3	6	2	2	2	1	1	29
*Percentage Inc.		28.6	13.3	35.3	100.0	46.1	25.0	22.2	16.7	6.2	8.3	23.2
Needed in 1 year	7	20	20	27	8	24	13	13	18	20	16	186
Increase in No.	1	6	5	10	5	11	5	4	6	4	4	61
Percentage Inc.	16.7	42.8	33.3	58.8	166.6	84.6	62.5	44.4	50.0	25.0	33.3	48.8
Needed in 5 years	8	26	24	32	12	32	18	16	22	25	21	236
Increase in No.	2	12	9	15	9	19	10	7	10	9	9	111
Percentage Inc.	33.3	85.7	60.0	88.2	300.0	146.1	125.0	77.7	83.3	56.2	75.0	88.8

*Percentage increase based on number of currently employed.

TABLE VII
ESTIMATED PERSONNEL NEEDS BY REGION
PROSTHETISTS

	REGIONS I	II	III	IV	V	VI	VII	VIII	IX	X	XI	TOTAL
CURRENTLY EMPLOYED	15	30	45	30	23	36	22	23	11	22	5	262
ESTIMATED PERSONNEL NEEDS												
Needed now	16	35	48	42	28	41	27	27	14	24	8	310
Increase in No.	1	5	3	12	5	5	5	4	3	2	3	48
*Percentage Inc.	6.7	16.7	6.7	40.0	21.7	13.9	22.7	17.4	27.3	9.1	60.0	18.3
Needed in 1 year	17	40	52	49	33	46	32	35	18	24	8	354
Increase in No.	2	10	7	19	10	10	10	12	7	2	3	92
Percentage Inc.	13.3	33.3	15.5	63.3	43.5	27.8	45.4	52.2	63.6	9.1	60.0	35.1
Needed in 5 years	22	48	60	77	54	55	39	44	24	26	11	460
Increase in No.	7	18	15	47	31	19	17	21	13	4	6	198
Percentage Inc.	46.7	60.0	33.3	156.7	134.8	52.8	77.3	91.3	118.2	18.2	120.0	75.6

*Percentage increase based on number of currently employed.

TABLE VIII
ESTIMATED PERSONNEL NEEDS BY REGION
PROSTHETIC TECHNICIANS

	REGIONS											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	TOTAL
CURRENTLY EMPLOYED	13	30	51	42	29	41	26	17	8	4	9	270
ESTIMATED PERSONNEL NEEDS												
Needed now	19	38	62	56	36	50	33	24	10	4	11	343
Increase in No.	6	8	11	14	7	9	7	7	2	0	2	73
*Percentage Inc.	46.1	26.7	21.6	33.3	24.1	21.9	26.9	41.2	25.0	–	22.2	27.0
Needed in 1 year	22	47	71	76	43	56	39	30	12	5	14	415
Increase in No.	9	17	20	34	14	15	13	13	4	1	5	145
Percentage Inc.	69.2	56.7	39.2	80.9	48.3	36.6	50.0	76.5	50.0	25.0	55.5	53.7
Needed in 5 years	28	63	88	119	66	76	52	43	17	6	18	576
Increase in No.	15	33	37	77	37	35	26	26	9	2	9	306
Percentage Inc.	115.4	110.0	72.5	183.3	127.6	85.4	100.0	152.9	112.5	50.0	100.0	113.3

*Percentage increase based on number of currently employed.

TABLE IX
ESTIMATED PERSONNEL NEEDS BY REGION
ORTHOTISTS

	REGIONS											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	TOTAL
CURRENTLY EMPLOYED	9	17	24	57	24	19	26	34	28	21	12	271
ESTIMATED PERSONNEL NEEDS												
Needed now	12	31	28	62	31	23	30	37	30	23	13	320
Increase in No.	3	14	4	5	7	4	4	3	2	2	1	49
*Percentage Inc.	33.3	82.3	16.6	8.8	29.2	21.0	15.3	8.8	7.1	9.5	8.3	18.1
Needed in 1 year	13	35	35	77	34	25	36	42	39	28	15	379
Increase in No.	4	18	11	20	10	6	10	8	11	7	3	108
Percentage Inc.	44.4	105.9	45.8	35.1	41.7	31.6	38.5	38.2	39.3	33.3	25.0	39.8
Needed in 5 years	19	38	38	93	36	35	39	50	45	30	19	442
Increase in No.	10	21	14	36	12	16	13	16	17	9	7	171
Percentage Inc.	111.1	123.5	58.3	52.6	50.0	84.2	50.0	47.0	60.7	42.8	58.3	63.0

*Percentage increase based on number of currently employed.

TABLE X
ESTIMATED PERSONNEL NEEDS BY REGION
ORTHOTIC TECHNICIANS

	REGIONS											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	TOTAL
CURRENTLY EMPLOYED	27	19	33	63	26	23	16	19	17	16	7	266
ESTIMATED PERSONNEL NEEDS												
Needed now	30	26	43	80	39	29	22	24	20	21	8	342
Increase in No.	3	7	10	17	13	6	6	5	3	5	1	76
*Percentage Inc.	11.1	36.8	30.3	27.0	50.0	26.1	37.5	26.3	17.6	31.2	14.3	28.6
Needed in 1 year	30	32	47	96	45	34	29	30	24	20	14	401
Increase in No.	3	13	14	33	19	11	13	11	7	4	7	135
Percentage Inc.	11.1	68.4	42.4	52.4	73.1	47.8	81.2	57.9	41.2	25.0	100.0	50.7
Needed in 5 years	35	37	60	113	77	49	38	41	35	20	21	526
Increase in No.	8	18	27	50	51	26	22	22	18	4	14	260
Percentage Inc.	29.6	94.7	81.8	79.4	196.1	113.0	137.5	115.8	105.9	25.0	200.0	97.7

*Percentage increase based on number of currently employed.

TABLE XIII
EDUCATIONAL LEVELS

CATEGORY	LEVELS						
	M.A.	B.S. or B.A.	A.A.	HIGH SCHOOL	SOME COLLEGE	LESS THAN HIGH SCHOOL	TOTAL
Pros.-Orth.	1 (1.2%)	10 (11.6%)	1 (1.2%)	49 (57.0%)	20 (23.2%)	5 (5.8%)	86
Pros.	2 (1.0%)	20 (8.8%)	6 (2.7%)	154 (68.1%)	20 (8.8%)	24 (10.6%)	226
Orth.	0	12 (5.6%)	0	148 (68.5%)	34 (15.9%)	21 (10.0%)	215
Pros. Tech.	0	2 (1.0%)	5 (2.6%)	101 (53.2%)	11 (5.8%)	71 (37.4%)	190
Orth. Tech	0	2 (1.0%)	1 (0.5%)	140 (69.6%)	13 (6.5%)	45 (22.4%)	201

TABLE XIV
RECOMMENDED EDUCATIONAL LEVELS

CATEGORY	LEVELS						
	M.A.	B.S. or B.A.	A.A.	HIGH SCHOOL	TECH. SCHOOL	ELEM.	TOTAL
Pros.-Orth.	15 (10.2%)	61 (41.5%)	31 (21.1%)	26 (17.7%	14 (9.5%)		147
Pros.	7 (4.5%)	43 (27.6%	61 (39.1)	29 (18.6%)	16 (10.2%)		156
Orth.	8 (5.0%)	39 (25.0%)	63 (40.4%)	29 (18.6%)	17 (11.0%)		156
Pros. Tech.	0	3 (2.0%)	22 (14.6%)	48 (31.8%)	71 (47.0%)	7 (4.6%)	151
Orth. Tech.	0	2 (1.9%)	20 (18.9%)	53 (50.0%)	29 (27.3%)	2 (1.9%)	106

TABLE XV
PERSONS WITH MORE THAN HIGH SCHOOL EDUCATION

	CATEGORY				
	PROSTHETIST-ORTHOTIST	PROSTHETIST	PROSTHETIC TECHNICIAN	ORTHOTIST	ORTHOTIC TECHNICIAN
Above Median Salary Range	17 (54.8%)	30 (62.5%)	11 (57.9%)	32 (66.7%)	5 (33.3%)
Below Median Salary Range	14 (45.2%)	18 (37.5%)	8 (42.1%)	16 (33.3%)	10 (66.7%)
TOTAL	31	48	49	48	15

TABLE XVI
PROFILE

	AGE (MEDIAN)	SALARY (MEDIAN)	EDUCATION (AVERAGE)	YEARS IN FIELD (MEDIAN)
Prosthetist-Orthotist	46	$11.500*	High School	25
Prosthetist	44	9,500*	High School	18
Prosthetic Technician	37	5,900	High School	4.5
Orthotist	43	8,900*	High School	18
Orthotic Technician	36	6,000	High School	5

*These may be somewhat low because exact salaries over $25,000 were not always given.

TABLE XVII
DEMAND FOR GRADUATES AND ESTIMATE OF SALARIES

	NOW		FIVE YEARS	
	NO.	SALARY	NO.	SALARY
B.S. Degree (P. & O.)	68	$6,000 - 15,000	122	$7,000 - 50,000
Certificate Program	59	3,120 - 12,000	113	5,200 - 15,000
AA Degree - Prosthetics	60	5,000 - 10,000	116	6,000 - 15,000
AA Degree - Orthotics	59	5,000 - 12,000	82	5,000 - 17,000
AA Degree - O. & P.	42	4,800 - 10,000	56	6,000 - 15,000
Orthotic - Internship	36	3,100 - 9,500	65	5,200 - 13,000
Pros.-Orth. Technician	80	3,600 - 8,000	146	4,000 - 15,000

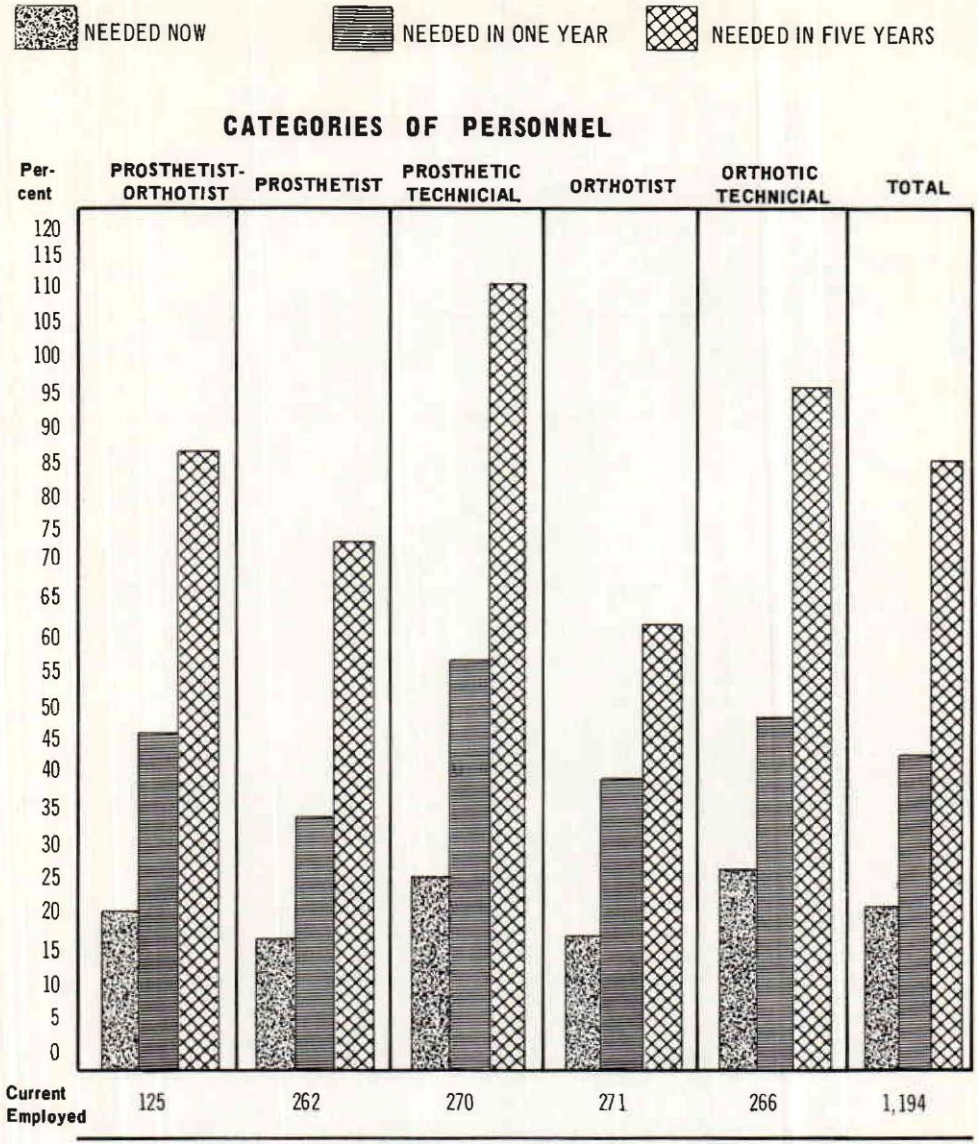

Figure 1. Graphic representation of percentage increases as shown in Table V.

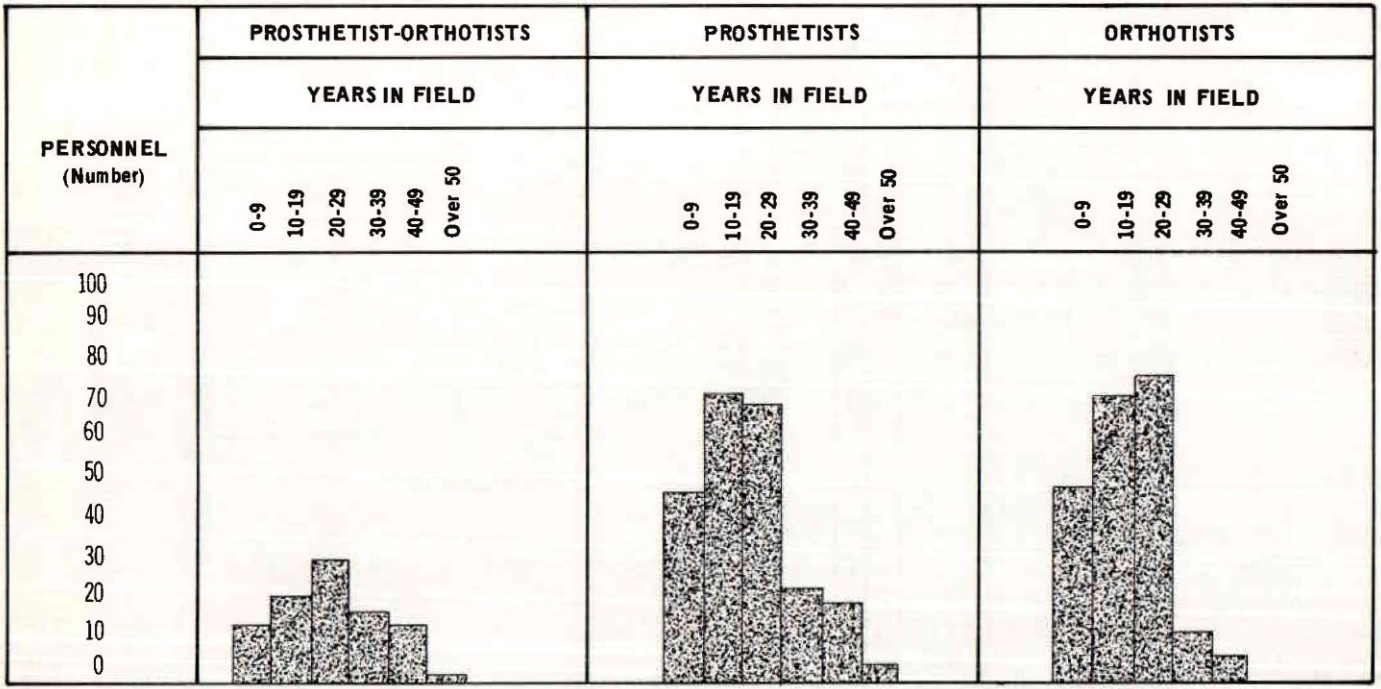

Figure 2. Number of years in field for Prosthetist-Orthotists, Prosthetists and Orthotists

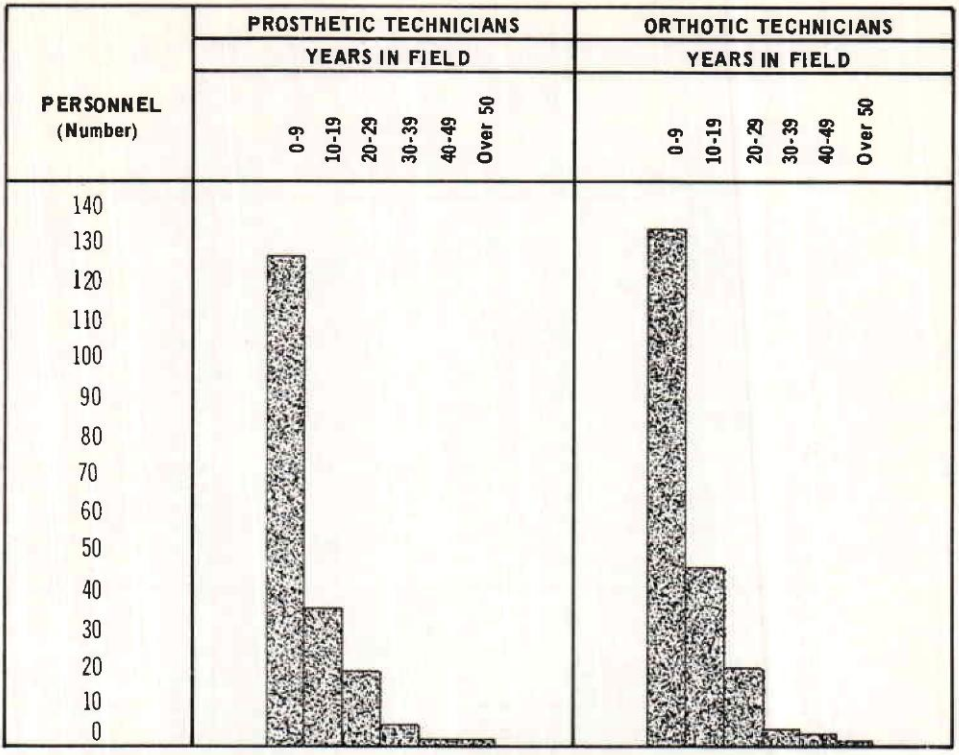

Figure 3. Number of years in field for Prosthetic Technicians and Orthotic Technicians

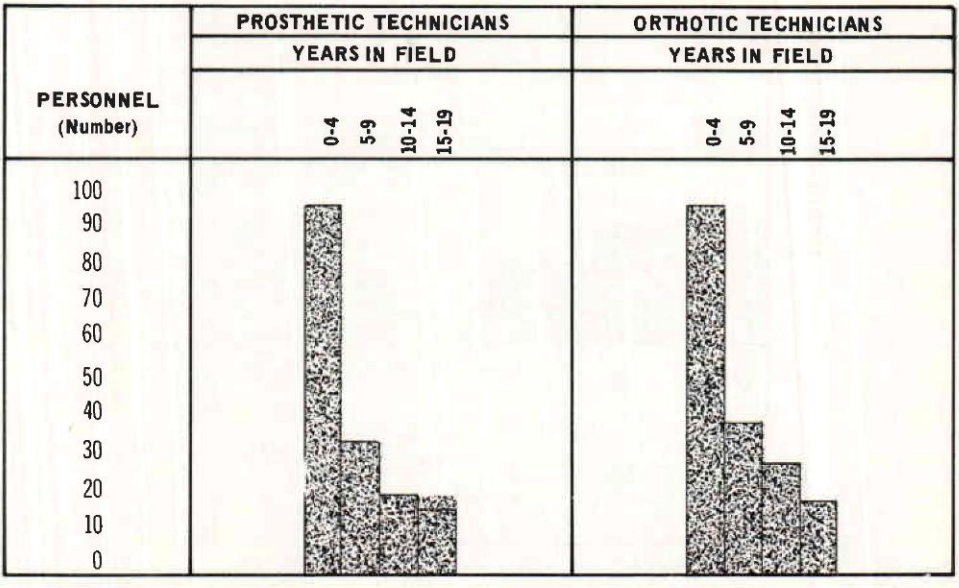

Figure 4. Number of years in field for Prosthetic Technicians and Orthotic Technicians (by smaller increments)

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Region I:	Maine
	New Hampshire
	Vermont
	Massachusetts
	Connecticut
	Rhode Island
Region II:	New York
	New Jersey
Region III:	Pennsylvania
	Maryland
	Delaware
	Virginia
	District of Columbia
Region IV:	North Carolina
	South Carolina
	Georgia
	Florida
	Alabama
	Mississippi
	Tennessee
	Kentucky
	S. E. Louisiana
Region V:	West Virginia
	Ohio
	Michigan
Region VI:	Wisconsin
	Illinois
	Indiana
	S. E. Missouri
Region VII:	Minnesota
	Iowa
	Missouri
	Kansas
	Nebraska
	South Dakota
	North Dakota
	Wyoming
	Colorado
Region VIII:	New Mexico
	Texas
	Oklahoma
	Arkansas
	Louisiana
Region IX:	Arizona
	So. California
Region X:	Utah
	Nevada
	No. California
Region XI:	Washington
	Oregon
	Idaho
	Montana
	(Alaska)
	(Hawaii)

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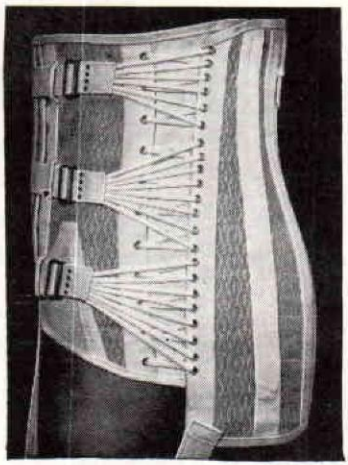

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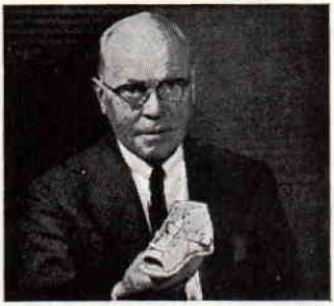

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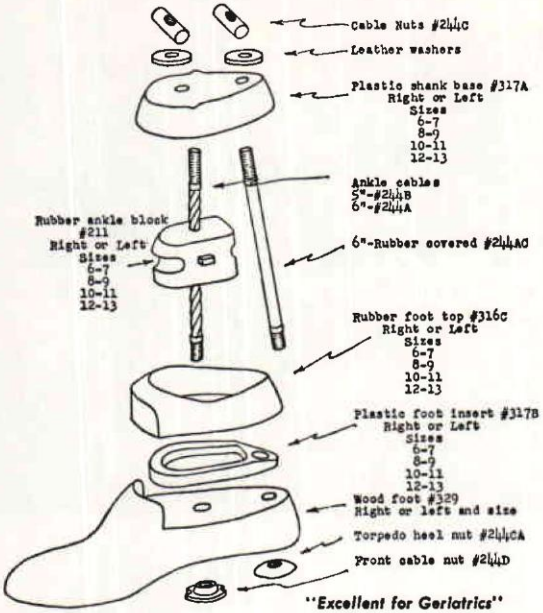

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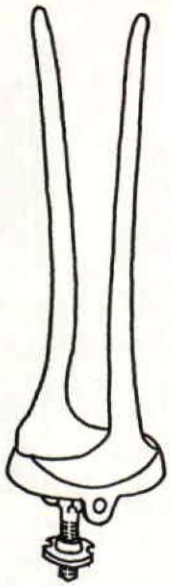
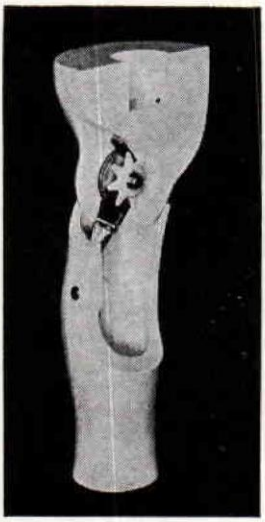


Symes Frame #270A with ankle joint, shaped to cast and measurements.



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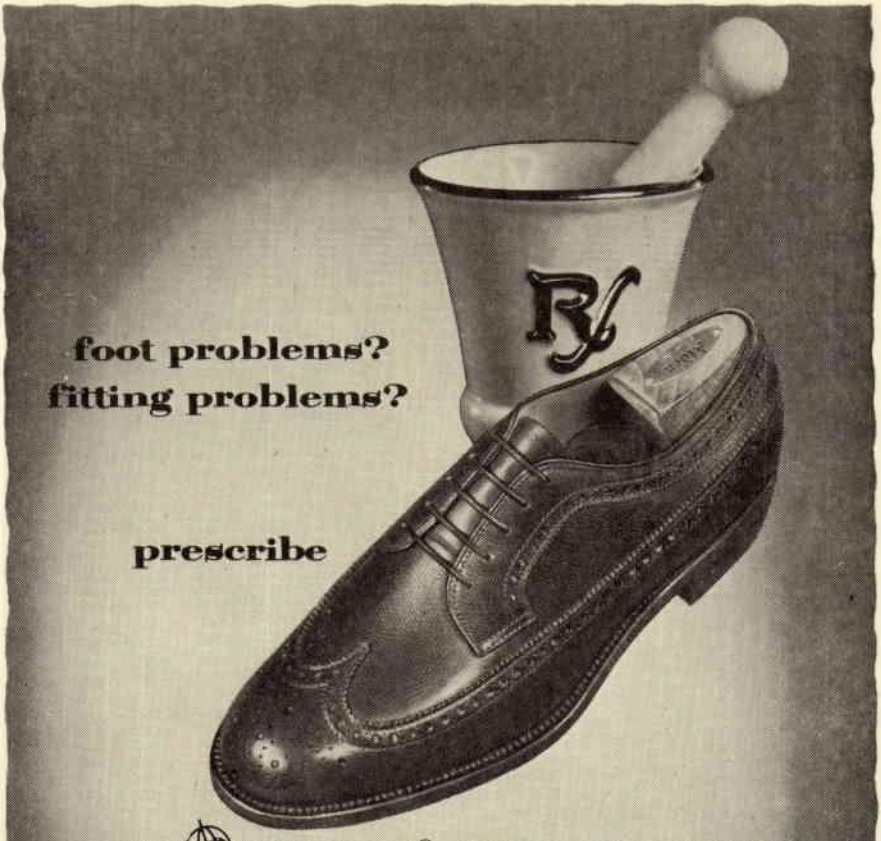

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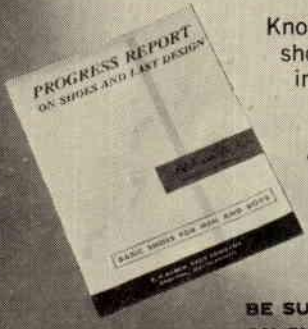

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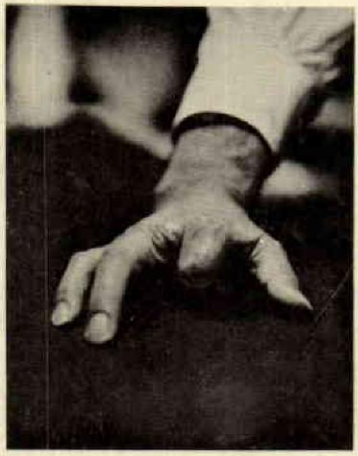

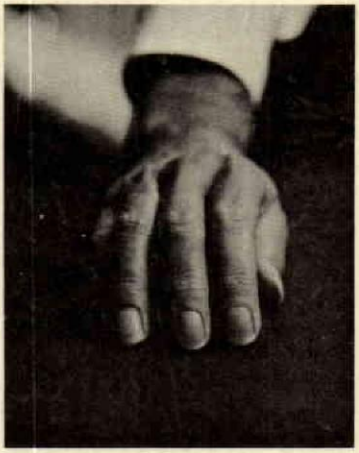

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