Newsletter

Prosthetics and Orthotics Clinic

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PROSTHETIC SENSORY FEEDBACK LOWER EXTREMITY

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This is a progress report of a Duke University research project involving sensory feedback from lower extremity amputation prostheses.

It has been assumed for many years that replacement of sensory function in prosthetic limbs was a nearly impossible task. Developments in electronics have made possible small amplifier systems and usable transducers, but the basic difficulty remains that of getting the signals into the central nervous system in a fashion that is interpretable, comfortable, consistent, and convenient.

The problem has not been ignored and the obvious routes—auditory signal, electrical stimulation of intact skin, mechanical stimulation, and developments leading to solving the skin barrier with compatible percutaneous materials have been explored.

From 1969 to 1975, this laboratory developed the mechanism to produce sensation from upper limb prosthetic terminal devices. This system was built around the concept of proportional peripheral nerve stimulation by means of a surgically implanted, induction coupled radio receiver-pulse generator, driven by an external amplifier and transmitter that relayed frequency modulated signals, controlled by a strain gage transducer in the terminal device.

The conclusions from this study were:

(1) The system is feasible and signals can be interpreted with reliability relative to the stimulating activity.
(2) The brain interprets the signal as coming from the normal peripheral distribution of the nerve stimulated.
(3) Signal threshold and nerve excitability does not deteriorate with time, at least in this application.
(4) The implanted device is reliable, and durable, there having been no implant failures in twelve years.

In 1975, a grant was received from the National Cancer Institute to apply this technique to the lower limb amputee. This study is to determine whether sensory feedback, in addition to that provided normally from the stump-socket interface and terminal knee impact, is either useful or advantageous.

To date, 21 patients have been fitted with a lower extremity sensory feedback system, including below knee, above knee, and hip disarticulation amputees. The majority of these have been cancer patients.

The new amputee from malignancy presents a special problem. It is difficult to subject a person recently amputated for cancer to another surgical procedure to insert a stimulator implant. In addition, the amputation is followed by months of chemotherapy during which time wound healing is compromised and the patient does not feel well. Emotional factors must be considered also.

For this reason, it was necesary to develop a noninvasive system as well as the implanted nerve stimulator. After a brief unsuccessful trial with a skin vibrator, the auditory route was selected.

The electronic systems of both the implanted and auditory devices are similar. The system consists of a set of strain gages which measure anteroposterior and mediolateral bending moments incorporated into the below knee segment of the prosthesis utilizing an endoskeletal unit developed by the Department of Bioengineering at Duke, hybridized with Otto Bock endoskeletal prosthetic components.

In addition to the strain gages, a pressure activated piezo-electric crystal is imbedded in the heel of a SACH foot. This is activated on heel strike.

When the weight is balanced in mid stance or when the prosthesis is unloaded, as with the patient sitting, there is no signal produced by any of the transducers. The system is designed to provide proportional feedback as soon as weight is biased in any direction.

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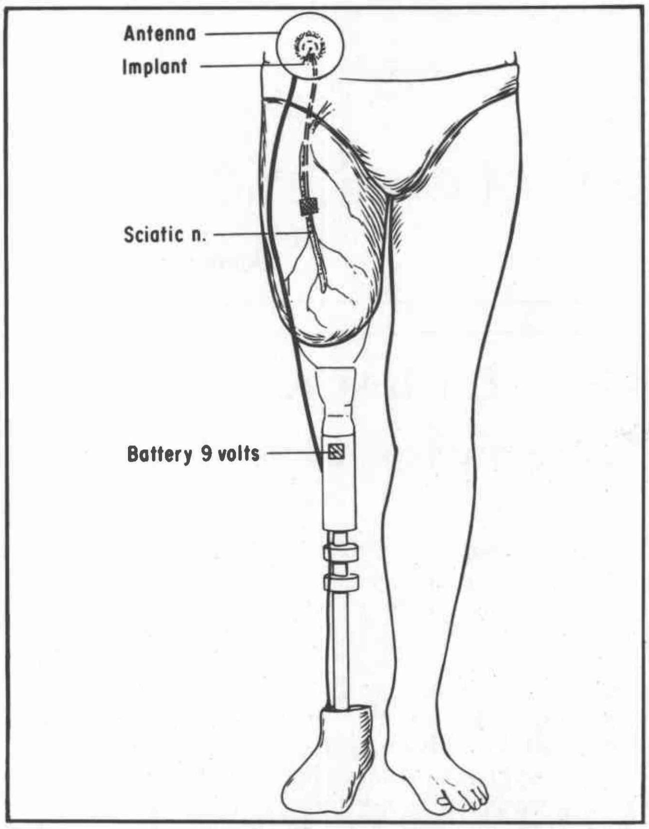

For the implant system, the signal to the nerve is frequency-modulated with the frequency of stimulus increasing from 0 to 90 Hertz proportionate to the load. With frequencies greater than 90 Hertz, a decrease in signal or complete loss of signal has been experienced routinely. Voltage is adjusted to a level that is comfortable for the patient. Threshold in these patients has varied between .5 and .9 volts.

Newsletter
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The implanted receiver is identical to that used in the upper limb project except that four electrodes are placed around the sciatic nerve in the buttock rather than the two that were used for the median nerve in the upper limb project. The receiver is placed subcutaneously in the lower abdominal wall and the antenna is taped to the overlying skin. Only two electrodes are stimulated and the pair which produces the best response is selected. Electrode orientation is important and this is a compromise. The alternative would be to do the surgery with the patient awake which has obvious disadvantages.

In all patients, an interpretable signal was produced although the mental imaging, which was 90 percent correct in the upper limb, has been haphazard in the lower. No patient has reported that the stimulus or the mental image produced was uncomfortable, unpleasant, or confusing, however.

The auditory system uses the same external transducer unit, but the signal is fed to a hearing aid earpiece placed behind the ear without blocking the external auditory canal.

In that the end result of any sensory feedback is a subjective response, it is difficult to assay its effect in scientific terms.

A gait laboratory has been developed to analyze walking with and without the sensory feedback system. This provides computer-assisted analysis of force plate and segmental accelerometer data. This facet of the study has just started and at the moment, insufficient data analysis is available to be meaningful.

It is felt, however, that the subjective individual patient response will actually be more helpful in the long run. This is "quality of life" response and is voiced as statements like: "I can walk out in the driveway at night without worrying", "I feel better about going downstairs", "I can play basketball better with it turned on", "I can control the accelerator on my car far better".

Not all the subjects have found the system useful. Table I outlines the patients who have had the sensory feedback systems and their outcome. Most of those who have abandoned it, however, have had the auditory unit.

Conclusions

1. Sensory feedback systems in lower extremity amputees appear to have advantages. How much better the amputees are is still under investigation and whether the system is cost effective is still not determined.
2. The auditory system is somewhat confusing and cumbersome. It may end up being a good training apparatus but not appropriate for long term use.
3. The electronics package in the below knee segment of the prosthesis presents some problems related to the cosmetic cover which has to allow frequent access for adjustment and battery changes. An attempt is underway at present to replace the instrumented pylon with an instrumented ankle bolt.
4. Investigation is still needed to determine exactly what information is useful. Knee position, for instance, may be more useful information than the direction and magnitude of loading.

TABLE I

PATIENT	AGE	AMPUTATION	SIDE	DIAGNOSIS	SYSTEM	OUTCOME
D.B.	27	Hip Disart	Left	Osteogenic Sarcoma	Skin, then Auditory	Independent. Using prosthesis all day. Quit study because information not helpful enough. Decreased prosthesis wear and did not need for work as before.
J.B.	70	Above Knee	Left	Trauma	Auditory	Independent. Wears leg all day. Useful for walking without looking down.
R.C.	23	Hip Disart	Right	Osteogenic Sarcoma	Auditory	Chemotherapy and prosthesis discomfort prevents use of prosthesis more than 1-2 hours per day. Too soon to evaluate.
K.C.	23	Below Knee	Right	Trauma	Auditory	Quit study. Information not helpful. Device too much trouble.
M.D.	15	Hip Disart	Left	Osteogenic Sarcoma	Auditory	Quit study. Too many repairs. Useful for training but not helpful anymore. Wears leg all day.
B.D.	58	Below Knee	Left	Angiosarcoma	Auditory	Too soon to evaluate.
R.H.	58	Above Knee	Right	Liposarcoma	Auditory	Wore leg all day. Useful for walking without looking down, for increasing his confidence in walking, and lessening dependence on cane. Expired.
B.H.	26	Above Knee Knee Disart	Left Right	Trauma Trauma	Auditory	Wears leg all day. Too soon to evaluate.
J.L.	13	Hip Disart	Left	Osteogenic Sarcoma	Auditory	Independent. Wore leg during school one year, stopped wearing leg much for one year, and now is wearing leg during school. Device breaks down frequently but when working, it is useful for walking and playing sports, especially basketball because no need to look down.
S.O.	28	Above Knee	Right	Giant Cell Tumor	Auditory	Quit study because information not helpful, plus cosmesis of earpiece, cable, and prosthetic cover inadequate.
B.P.	18	Hip Disart	Right	Osteogenic Sarcoma	Auditory	Useful for walking without looking down but quit study because information not that helpful. Device required too frequent repairs, and it was too much trouble.
R.R.	29	Below Knee	Bil.	Trauma	Auditory Right BK	Quit study because information not helpful. (Identifies location of his leg by stump feeling and eye sight.) It was useful for walking without looking down, but not significant enough to keep device on prosthesis. Did not like cosmesis of earpiece, cable, and prosthesis cover and inconvenience of wiring under clothing.
J.W.	37	Hip Disart	Left	Malignant Fibrous Histocytoma	Auditory	Too soon to evaluate. Independent. Wears prosthesis 2 hours per day due to a fall and weakening due to chemotherapy treatments.
D.A.	12	Hip Disart	Right	Osteogenic Sarcoma	Implant	External Stimulator useful for lessening phantom limb pain postoperatively and one month before death. Useful for walking without looking down. Provided feeling that leg really was there. Independent and wore prosthesis all day until paralysis. Expired.
G.C.	34	Above Knee	Right	Trauma	Implant	First and second implant procedure failed. Third planned for 3-4-81. External stimulator useful for lessening phantom limb pain. Useful for walking without looking down. Not able to wear prosthesis because of continued stump pain and other physical problems. Only implant failure in series.
G.G.	16	Above Knee	Right	Osteogenic Sarcoma	Implant	External stimulator useful for lessening phantom limb pain. Quit study. Independent and wears leg all day. Useful for training but information not helpful anymore.

PATIENT	AGE	AMPUTATION	SIDE	DIAGNOSIS	SYSTEM	OUTCOME
H.M.	47	Below Knee	Bilat	Trauma	Implants	Stimulator originally for phantom limb pain. System useful for walking without looking down. Independent and wears prostheses all day. Useful in car-acceleration and braking, on stairs, balance on flat or rough terrain, and increasing confidence in walking. Develops feeling of being more compatible with man.
C.O.	27	Hip Disart	Left	Carcinoma, testicle with met. to lung and femur.	Implant	External stimulator useful for lessening phantom limb pain. Useful for walking without looking down and for providing a feeling that you had a leg. Wore prosthesis all day with device until cancer complications. Expired.
A.S.	16	Hip Disart	Right	Osteogenic Sarcoma	Implant	External stimulator useful in lessening phantom limb pain. Useful for training but information not helpful anymore. Quit study.
G.L.	27	Hip Disart	Left	Fibrosarcoma	Implant	External stimulator useful for lessening phantom pain. Never received prosthesis because of cancer metastasis. Expired.
J.S.W.	12	Above Knee	Right	Osteogenic Sarcoma	Implant	External stimulator useful for lessening phantom limb pain. Useful especially during training period. Good on stairs and for walking without looking down. Independent and wore prosthesis during day until cancer complications. Expired.
S.D.	18	Hip Disart	Right	Hemangioma	Control	Independent and wears leg all day. Initially was difficult for him to keep leg straight, thus, disturbing his balance.
W.H.	63	Above Knee	Left	Peripheral Vascular Disease	Control	Independent in ADL but does not use prosthesis. Knee too difficult to learn how to use.
E.T.	16	Hip Disart	Right	Osteogenic Sarcoma	Control	Independent. Did not wear prosthesis when he joined study but now wears prosthesis during school.

QUESTIONNAIRE

1. In the past year, approximately how many scoliosis patients received an orthosis at your facility? ________

2. Please provide an approximate percentage breakdown of the types of orthoses you fitted:

Conventional Milwaukee Brace ________%

Low Profile Orthosis ________%

Boston System ________%

Other (please list):

____ ________%

____ ________%

TOTAL 100%

3. Additional comments:

____

____

____

____

Send responses to:

Charles H. Pritham, C.P.O.
Snell's of Louisville
744 East Broadway
Louisville, Kentucky 40202

Editorial

TIGHTENING THE LOOPS ON SENSORY FEEDBACK

Ma Bell's radio and TV ad theme, "reach out and touch someone", appeals to everyone. It represents contact with those sensitive, often sentimental, emotional connections we have with our environment and the people and things that we value. In real life, it is only one's voice and the feedback of the voices of our familiar compadres that makes situations comparable to the telephone company ad warm and real. We all know the experience. What makes it work?

Many years of experience in the serious pursuit of possible answers to this question, and its broader implications concerning the role of sensory feedback in shaping human performance, have brought us only a few answers on which we can count. Mostly, we only know that the importance of sensory feedback varies greatly with specific situations, and that the role of the senses is very complex because of two-way filter interactions with the central nervous system. We do know quite a lot about the specifics of the sensory receptors themselves. It is, however, the manner in which the patterns of sensory stimuli provide information for processing by the spinal cord and higher levels that is clinically provocative.

With specific reference to limb amputees, everyone agrees that to achieve functional unity with a prosthesis, there must be some form of awareness established by the wearer about the capabilities of the prosthesis. How reliably does it respond to the amputee's command? Does it react predictably to each familiar environmental situation so that the wearer has an accurate mental model of what to expect? Getting a wrong number does not reach out and touch the expected connection. After too many wrong numbers or too much noise in the connection, one tends to lose that warm feeling of predictable expectation. This appears to be the case in the matter of the state-of-the-art with sensory feedback in limb prosthetics.

We have long known that the primary source of sensory feedback for limb prosthesis wearers was an "open loop" mental model of the space occupied by the prosthesis, its dynamic control features and pressure patterns on the stump—all modulated by visual, and sometimes auditory, information from both the prosthesis and its situational environment.

To date, except for blind amputees where any feedback from the environment is helpful, we have not been able to definitively establish whether or not specialized sensors located on the prosthesis itself could effectively communicate signals to the wearer that would significantly enhance task performance. Experimental results have, for the most part, been marginal and frustrating, both scientifically and clinically.

Despite many disappointments, especially in terms of immediately useable clinical benefits, our knowledge base has been substantially broadened, mostly concerning the scope and complexity of factors that realistically must be brought under control. For example, in the biological model of a limb, it is known that receptor density for cutaneous and kinesthetic senses (pressure, pain, thermal, etc.) may reach several hundred per square millimeter. These high receptor densities provide precise patterns of environmental information. They generate functionally important physiological and psychological adjustments of information flow rates. Refined movement may require highly defined sensory patterns to optimize the available muscle capability of the normal limb. The stability and continuity of these patterns is identified with the integrative function of the central nervous system. The distortion of the patterns by modification from disease, or by total physical destruction, requires laying down new cognitive adaptations. These adaptations can only reach a degree of approximation to the original system. The extent of the sensory side of the approximation is dependent on the capability for sensory input that remains or is replaced. Substitution of one pattern of signals for another depends on achieving a common coding scheme. Whatever scheme is achieved, it must be compatible at both the input and output sides of the person-prosthesis loop. Missing or distorted patterns are functionally reconstructed into new channels, both by means of the "software" of the brain, and substitution of sensors. When the sensations are natural, e.g., from the surface of a stump, the sensors available probably were not previously used for primary information about the location of and forces on the limb in space. New cognitive patterns must be brought into association. These new patterns may only provide part of the information previously presented, or the information provided may not be relevant. Thus, there may be a permanent substantial loss of skill.

The original, natural, learning process in the intact person seems to make use of whatever sensory function is available to provide a pliable, plastic motor output capability. This is subject to refinement of precision according to criteria set genetically (e.g., walking), or learned according to environmental and personal, i.e., cognitive set standards for performance. "Normal" gait for a leg prosthesis wearer, "smooth," "coordinated" delivery of a fork full of food by an arm amputee, may have to come to mean something different, cognitively, than these actions for the non-amputee.

For the amputee, complex situational vectors are set up by a combination of motor deficits and sensory deficits. This makes it especially difficult to independently assess the role of sensory feedback in task performance. For example, direct observations of the role of the senses is confounded by factors such as the transmission precision of the power train, by dynamic stability properties of the structural interface between the stump and the socket, and by task complexity, e.g., climbing stairs, rotating a door knob, etc. A simple analog would be to try to observe the role of sensory feedback in the performance of a non-amputee who was trying to write with a pencil that had the tip attached to a soft, compliant, rubber-like shaft. The capricious relationship between the tip of the pencil and the writer would make interpretation of the performance associate more closely with the hardware interface between the writer and his task than with the properties of the writer's sensory-motor system.

To function with maximum effectiveness, the communications channels, as well as the energy (power) transfer channels, must be locked intimately and reliably together in both the relationship of time, e.g., minimum transmission time-lag, and geometric positions. It seems probable that sensory information, to be effective, must have a tight, reliable, one-to-one superposition with a tight, reliable motor output system.

It is, thus, our view that perhaps a major reason for not being able to obtain clear-cut experimental results with artificial sensory feedback techniques for limb prostheses is that the linkages between the subsystem interfaces have usually been excessively "loose." The messages in both directions are garbled. As the requirement for task precision increases, the effects of loose communication links become increasingly evident. Softness of fit between the prosthesis and the flesh of the stump, for example, generates uncertain messages in both directions. The "reach out and touch" is a spongy approximation, a sensory haze at the cognitive level.

The bad news is that in the prevailing situation, where direct bone attachments have not reached a level of development suitable for standard clinical practice, the tightening of sensory feedback loops and feed-forward loops seems to be inherently limited in promise. The good news is that with each year, the background research and technology is progressing to significantly more sophisticated levels, achieving denser, more accurate and less power-consuming transducer arrays for picking up the tactile features of the environment. As has often been the case before in the history of important prosthesis development, much of the technology for sensory augmentation is to be found in other applications, in this case, industrial automation and robotics. When, as will happen sooner or later, art and technology reach out and come together, the parts of the limb-prosthesis system will indeed, touch—with feeling.

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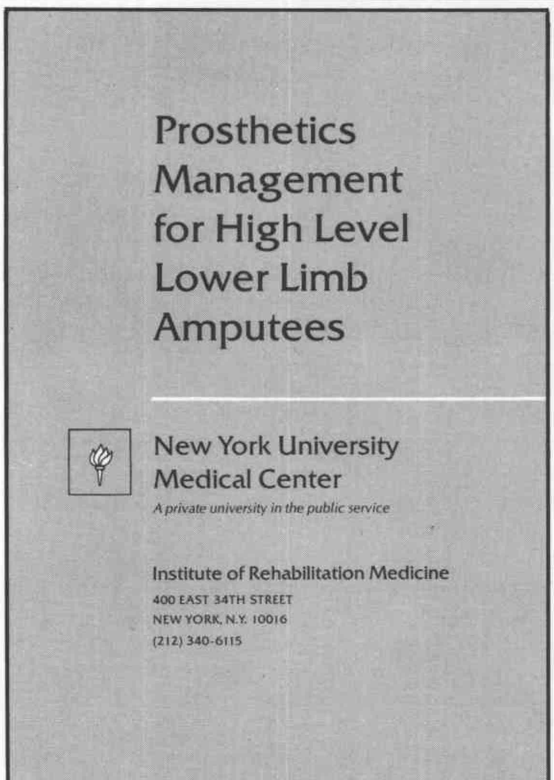


A brochure entitled "Prosthetics Management for High Level Lower Limb Amputees" is now available to our readers free of charge. It may be ordered through Orthotics and Prosthetics, Institute of Rehabilitation Medicine, NYU Medical Center, 400 E. 34th Street, New York, New York 10016.

Winter/Spring Honorarium

Louis Ekus, C.O. has been awarded the $100 honorarium for his article "Cross-Diagonal Closure of Pelvic and Spinal Appliances." Congratulations!

FEEDBACK FOR ELECTRICALLY POWERED PROSTHESES AND ORTHOSES[1]

Warren Frisina, B.E. (in M.E.)[2]

James A. Reeve, B.S. (in E.E.)[3]

Basically, pressure feedback systems for upper limb electrically powered prostheses consist of sensors about the prehensile area, electronic processing circuits, and actuators that contact the body. Sensors require careful installation and tend to be vulnerable to damage. Processing circuits leave that much more delicate equipment to coordinate. Actuators sometimes unduly complicate construction and fitting.

The system to be described here makes use of the characteristic current response of an electric motor encountering a load — current increases in proportion to the load. This response is directly employed as the combined feedback/actuating signal. It is sent to a miniature direct current electric motor.[4] (fig. 1). The top of figure 1 shows three Micromo motors and the bottom of the figure, the assembled unit. On the shaft of the motor an eccentric mass is mounted. (Several such masses are shown on the right of figure 1.) This causes the motor to vibrate in proportion to the motor speed (motor speed is proportional to current). When this motor is rigidly mounted to virtually any portion of a prosthesis, the entire prosthesis will vibrate in turn (fig. 2). Thus, the entire surface of the skin in contact with the prosthesis receives feedback information. The units installed thus far in patients' below-elbow myoelectric prostheses have been fixed at the distal end of the socket with a hose clamp which has been laminated to the socket (fig. 3).

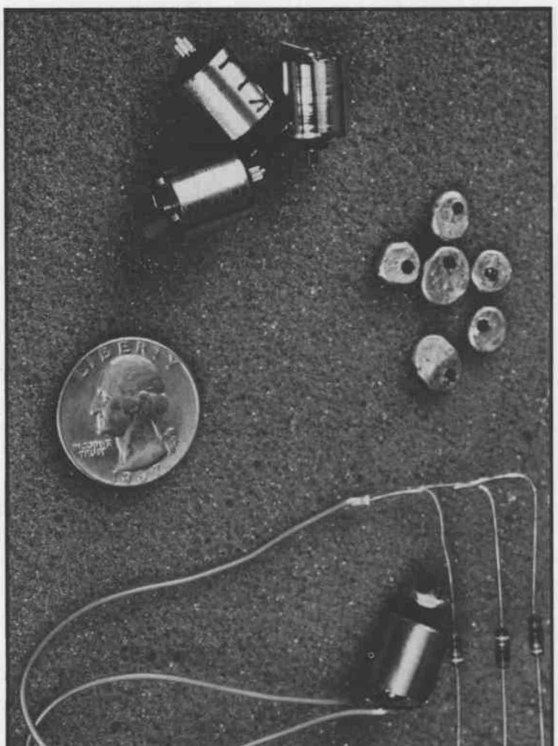


Fig 1

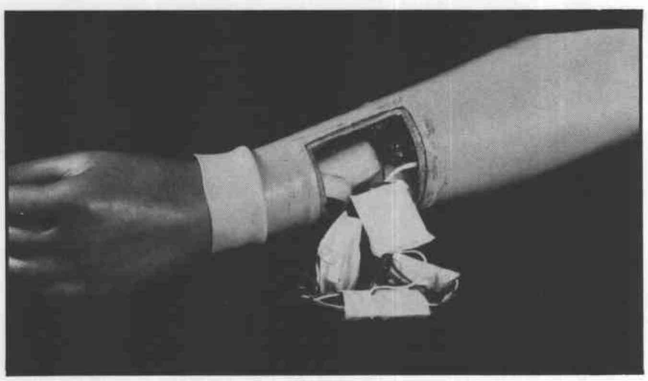


Fig 2

Fig 3

The feedback motor can be installed in virtually any electrically powered prosthesis by putting it in series with the drive motor(s). So that most of the current flows to the drive motor(s) and to avoid overloading the small feedback motor, a resistor of approximately three ohms is placed in parallel with the feedback motor. In order to fine tune the system, it would be convenient to have this resistor be of the variable type.

This system has been applied to myoelectric prostheses for seven patients at the Institute of Rehabilitation Medicine, New York University Medical Center. It is being applied explicitly for force feedback. But it appears to serve for position feedback as well, since the prosthetic hand unit and glove offer resistance to the drive motor as the hand opens, i.e., the greater the opening, the higher the vibration frequency. The hardness or, more importantly, brittleness, of objects could also possibly be determined by the sensing of rate of change of vibrations, i.e., vibration rate of change for a hard object like an egg is greater than that for a soft object like a paper cup. There have been no controlled studies as yet to verify these possible benefits.

A variation of the principle has been applied in the laboratory to an electric arm orthosis tried by a C-4 lesion quadruplegic patient. The feedback motor is either clipped to the user's lapel (fig. 4) or to the back of his wheelchair.

Another orthotic variation of the principle was tried in the laboratory by replacing the feedback motor with a flashlight-type light bulb to provide proportional visual feedback. Brightness of the bulb is proportional to pressure at the desensitized finger tips when used with an electrically-driven prehension orthosis.

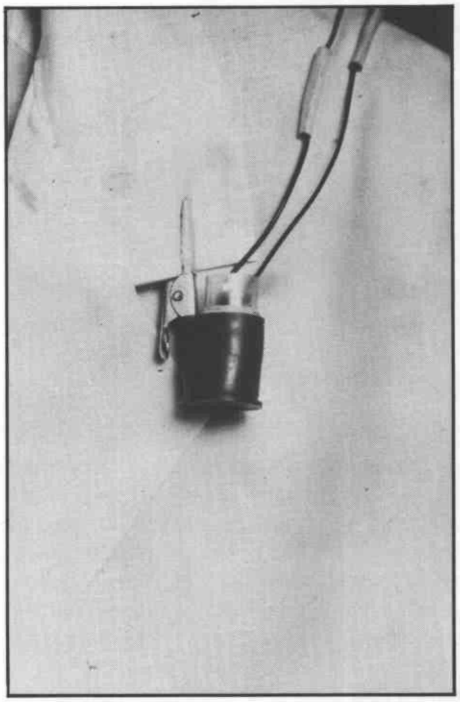
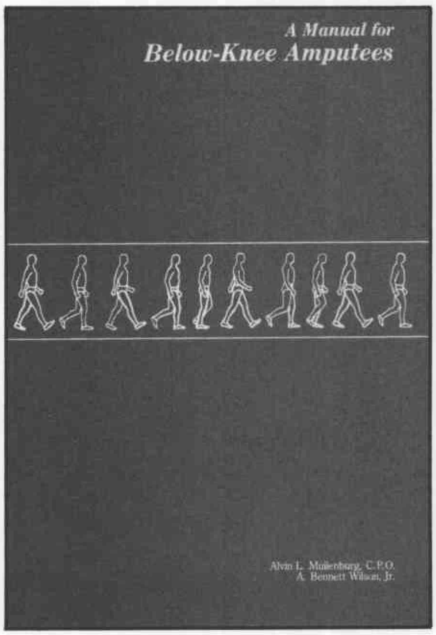


Fig 4

1. This research was supported by the National Institute of Handicapped Research under the designation of New York University Medical Center as a Research and Training Center.
2. Formerly Associate Research Scientist, Orthotics & Prosthetics, Institute of Rehabilitation Medicine, NYU Medical Center.
3. Project Engineer, Orthotics & Prosthetics, IRM, NYU Medical Center.
4. Available from Micromo Motor Company, Cleveland, Ohio.

A Manual For Below-Knee Amputees

A new booklet is now available for below-knee amputees. Therapists, prosthetists, orthotists and doctors may wish to furnish their patients with this informative manual, entitled **A Manual for Below-Knee Amputees.** To obtain copies of the booklet write to Alvin L. Muilenburg, C.P.O. or A. Bennett Wilson, Jr., P.O. Box 8313, Houston, Texas 77004. The charge is $1.00 per copy or $80 per 100 copies.



PRESIDENTIAL MESSAGE

As the new President of A.A.O.P., I'm happy to have this opportunity to express some of my thoughts, concerns and goals for 1981.

The role of the National A.A.O.P has changed since its inception. True, we still are primarily interested in education, continuing education and communications. However, we now have another primary function — "Public Relations."

There are many more people now practicing Orthotics and Prosthetics other than Certified Orthotists and Prosthetists. In particular, a large percentage of orthotic devices are now prefabricated; and the more availability there is of devices off the shelf, the more others outside our ranks will be fitting patients, thereby reducing the number of patients treated by the certified orthotist. Prefabricated devices are fabricated and distributed by many of our own colleagues with some even teaching casting techniques and custom-fabricating for any interested party.

As I stated in an article in the AOPA Almanac, the Academy cannot control who provides patient services, for there are legal areas controlling this. We all are aware there are many devices that do not require the expertise of a certified practitioner, e.g.; soft goods, back supports, etc. We should be intelligent enough to accept the reality that others are going to be heavily involved. However, there is a tremendous difference between most prefabricated orthoses or prostheses and a custom fabricated one. Also, the fitting of even the simplest device by a certified practitioner is far more appropriate to a patient's needs, for the practitioner is able to fit, evaluate and manage the patient — a total service — versus others who apply the device and sell a product. There are also some excellent very special prefabricated devices, i.e., halo tractions, spinal orthoses, etc. These devices require the skill of a certified practitioner and those manufacturers will not sell to unqualified individuals. It will be a major concern of the Academy via its Public Relations and Educational Programs to make both the prescribing physician and, most importantly, the patient aware of the importance of being provided a professional service rather than buying a product.

I have recently returned from a meeting of the Academy of Orthopedic Surgeons Committee on Orthotics and Prosthetics. I was invited as the Academy representative to give a report and discuss mutual educational endeavors. I am happy to report it was a very productive meeting. We will attempt to co-ordinate some educational programs which should give us some Seminars with both the medical and technical education we need to better manage our patients.

This follows my plan to co-ordinate programs rather than compete. This hopefully will give us fewer programs, reducing expenses of travel and time away, while at the same time giving us programs of greater depth. To give you an example, the A.A.O.S. next year is having an extensive two-day program on scoliosis. We are going to look into the possibility of conducting a workshop on the same subject matter before or immediately after their program. Hopefully, one meeting will enhance the other, and I would think many of our orthotists would register for both programs.

I would like to discuss another area of primary concern to us. There have been many changes over the past eight years regarding educational requirements for certified practitioners, technicians and assistants, the latter non-existent — at least officially. It was an honor for me to be involved with the Advance Planning for A.B.C. Credentialing eight years ago. It's reassuring that our foresight and predictions for 1980 were very accurate and that we had adopted appropriate measures so that, when the crunch of the 4-year college requirement became effective, there would still be adequately trained personnel to satisfy the needs of our profession and the people we serve.

I'm sad to say those plans were constantly changed over the past eight years, so that now we are at a point where there is (depending on whom you talk to) no consistency as to what our manpower needs are and what educational requirements should be pursued, i.e., 4-year bachelor's degree, 2-year A.A. plus a certificate, or a return to high school diploma and short term courses and expanded O.J.T.

I would like to backtrack to 1972 and try to explain the thinking at that time and allow you to decide if it would not apply today. In 1972, when some thought that our field, in order to be recognized as a profession, must some day bite the bullet and require a four-year college degree (as is required by all other allied health professions), we evaluated the state of the art then and tried to determine what steps needed to be taken. It was obvious that the non-college trained certified practitioner then was an extremely talented and valuable person and there was no question as to his ability to carry out good P & O services. That type of individual (usually with a high school diploma or A.A. degree and short term courses) is the backbone of our profession and will continue to provide much of the patient care in this country. It was our feeling that the practitioner of 1972 and beyond would be the assistant of 1980. The difference separating the two would be a 4-year college degree. It was planned that, over the past eight years, the assistant should have credentialing, examinations, and continue his responsibilities under supervision. This plan would not have created a manpower shortage and still would have allowed us to achieve a professional college level of entry into our profession.

Now to get to the point of whether or not we have a manpower shortage. If you make that statement in general, I think most would agree. However, if you say we need more certified practitioners, the response—depending in what area of the country you're asking—will vary. There is a trend taking place and has been for some time, a redistribution of size and number of P&O facilities. For example, the large, 15-person or more facility serving outreaching areas has been reduced in size, with the addition of several one- and two-man facilities opening in many cities once served by the larger company. This is enhanced by the fact that people want to be treated as locally as possible for many obvious reasons. The insurgence of these small and, most of the time, one- and two-man facilities is a trend I believe will continue. Keep in mind the majority of college level personnel will seek employment for a few years to gain experience before starting their own practice or be employed by a hospital or institution developing a P&O department. I hope by now you are beginning to get the message: Are the college-level persons being employed for long periods by existing facilities? I think not.

It's my opinion that along with the bachelor's degree (and I certainly support them), we should give rebirth to the assistant who was put to rest several years ago for some insecure fears. The assistant would not be a threat but an asset to all, especially to the many baccalaureate-trained practitioners whose technical skills and practical experience are usually limited. Perhaps combining the technician and assistant into one super support-type person is the way to go.

In conclusion on this subject, I believe that the majority of P&O services being directly provided to patients, particularly in the larger facilities, are not being provided by a certified practitioner but by a support person under his supervision. This will continue as it has with success for many years. Do we say these persons don't exist and sweep them under the rug, or educate and acknowledge by credentialing this important individual who, under supervision of the practitioner, will help satisfy our profession's manpower problems?

I have expressed my thoughts to both the President and President-Elect of A.B.C., for this is in the area of jurisdiction, but it is also a primary concern of the Academy and all who practice orthotics and prosthetics.

I look forward to a constructive year ahead.

Most sincerely,

Robert F. Hayes, C.P.
President of American Academy of
Orthotists and Prosthetists

Meetings and Events

1981, July 24-25, AAOP Seminar, Atlanta Marriott Motor Hotel, Atlanta, Georgia.

1981, August 24-27, University of New Brunswick, Fredericton, New Brunswick, Canada. Course: Myoelectric Control of Artificial Limbs. Contact: Director, Myoelectric Controls Course, Bio-Engineering Institute, University of New Brunswick.

1981, September 9-11, First Annual Course in Lower Extremity Prosthetics, Nassau County Medical Center, East Meadow, New York.

1981, September 11-12, AAOS Continuing Education Course, Modern Amputation Surgery and Prosthetic Rehabilitation, Seattle, Washington.

1981, September 18-19, AAOP Workshop, Houston, Texas.

1981, October 27-November 1, AOPA National Assembly, Sahara Hotel, Las Vegas, Nevada.

1981, November 21-22, AAOP Seminar, California.

1981, December 9-12, AAOS Seminar, Sheraton, Miami Beach, Florida.

1981, December 13, AAOP Workshop, Sheraton, Miami Beach, Florida.

1982, February 17-20, AAOP Annual Meeting and Round-up Seminar, Royal Sonesta Hotel, New Orleans, Louisiana.

1982, April 16-17, AOPA Region I Meeting, Marriott Hotel, Worcester, Massachusetts.

1982, April 29-May 2, AOPA Regions VII and VIII Combined Meeting, Alamada Plaza, Kansas City, (Tentative).

1982, May 6-9, AOPA Region IV Meeting, Radisson Plaza Hotel, Nashville, Tennessee.

1982, May 13-16, AOPA Regions II and III Combined Meeting, Caesar's World, Atlantic City, New Jersey.

1982, June 17-20, AOPA Region VI Meeting, Indian Lakes Resort, Bloomington, Illinois.

1982, October 17-24, AOPA National Assembly, Hyatt Regency, Shamrock Hilton, Houston, Texas.

1983, May 12-14, AOPA Region II and III Combined Meeting, Colonial Williamsburg, Williamsburg, Virginia.

Dr. Lehneis Welcomes New Members To Publications Committee

Editorial Board Changes Announced

The Editor wishes to express his thanks and deep appreciation to two retiring members of the Editorial Board, William Susman, M.A., R.P.T., and Gary Fields, C.O., who served for the past two years. Both contributed enthusiastically toward the improvement and present quality of the *Newsletter.*

At a meeting of the Academy's Publications Committee on April 30, 1981, at the National Office, Chairman H.R. Lehneis, Ph.D., C.P.O., welcomed Tamara Sowell, R.P.T. and Charles H. Pritham, C.P.O. to the Editorial Board, and Barbara Muller and Helene M. Murphy, respectively, to positions as Managing Editor and Assistant Editor of the *Newsletter.*

Ms. Sowell received a B.S. degree in physical therapy from New York University. She currently is project manager for the VA Rehabilitation Engineering Center and has been Associate Editor of the *Bulletin of Prosthetics Research* since 1977, and is also the author of several articles. Earlier in her career, she worked with Dr. Lehneis at the Institute of Rehabilitation Medicine.

Charles Pritham received a B.S. degree in prosthetics and orthotics at NYU in 1971. After graduation, he went to work for the Department of Orthopedics at the University of Virginia at Charlottesville. Starting in June, 1976, he worked at the Rehabilitation Engineering Center at Moss Rehabilitation Hospital in Philadelphia. As of May 1, 1981, Mr. Pritham became branch manager of Snell's of Louisville, a branch of Durr-Fillauer. He has written extensively for the *O&P Journal,* the *Newsletter,* and for publications of the Rehabilitation Engineering Center.

Ms. Barbara Muller, Managing Editor of the *Newsletter,* received a B.S. degree from the University of Maryland in Journalism-Science Communications. She specialized in communicating scientific and technical concepts to lay audiences. Ms. Muller became director of publications for the Academy, AOPA and ABC shortly after the move of the National Office to Alexandria, Virginia.

Assistant Editor of the *Newsletter,* Helene M. Murphy has had ten years of direct experience in publishing and 25 years of exposure to orthotics and prosthetics as the wife of Dr. Eugene F. Murphy, editor of the *Bulletin of Prosthetics Research.* She has worked with Dr. Lehneis for the past three years.

The Academy extends its congratulations to the new members of the Editorial Board and the staff, and its thanks to Mr. Susman and Mr. Fields for their many contributions.

L to R—H. Richard Lehneis, Barbara Muller, Bill McCulloch & Tamara Sowell

Charles Epps, Jr., MD, who was a board member last year, will be a member again this year.

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