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EDUCATION AND TRAINING DIRECTIONS[1]

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The techniques and formats of prosthetics-orthotics education should be discussed mostly by the specialists — they with their better knowledge of the pathways to more efficient and productive learning. But there is also need for those concerned with broad ranging programs of patient care, development, and evaluation to be heard and read, because of the need for patients to be served safely and properly by new technology as soon as practical. It is for this reason that I now speak out.

A BRIEF HISTORY

The practitioners of prosthetics and orthotics have come a long way with the base established by research and development groups mainly in the form of an array of new devices and techniques founded on sound principles and disseminated by the education establishment. A short twenty-five year period has been the span for the conversion of "limb and brace makers" to prosthetists and orthotists. The present-day "sons" of the craftsmen have been fortunate, experiencing as well as helping to promote the growth of a new calling — a professional one, now based on preparation at the level of a college degree. The patients of today are the chief beneficiaries of this. They are now surely better served.

Where do we go in the next twenty-five years — for the next generation — and how do we get there?

The history of prosthetics-orthotics education is reflected in the rapid growth in the university-based programs, a grossly different format from the loosely organized apprenticeship system formerly used in the United States. When it became apparent that prosthetics and orthotics was no longer a trade but a profession based on biomechanical and social principles of practice, the preparatory process took a form which had professional service as a product. Originally this was by means of short-term courses offered by the universities to up-date certain practices on the basis of products of research and development. With these came the teaching of basic principles underlying prosthetic fitting, nearly all derived from the VA-sponsored work of the University of California in both upper- and lower-limb prosthetics.

Later, certificate programs were established to offer the necessary prosthetics-orthothics supplement to a person prepared in a regular college program in a related field such as biology or rehabilitation therapy. Baccalaureate programs in prosthetics-orthotics, now at several universities, are intended to begin the preparatory process even earlier.

A landmark conference supported by the United Nations was held in Holte, Denmark in 1968 (*2*). At this conference standards for training in prosthetics and orthotics and associated curricula were recommended for use throughout the world. It was here also that the first precisely specified job descriptions for the prosthetist and orthotist and for the supporting technicians were written. All other conferences which followed, all other deliberations and discussions which came after did not alter significantly the base established in Holte.

As an example, the second U.S. educational conference held at Ponte Vedra, in 1976, restored the two-level concept of practice established in Holte after a temporary period during which U.S. practitioners felt a need for a third, intermediate level of "Associate."

Ponte Vedra II also gave deserved recognition to the certificate programs and appropriate cog-

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nizance of the involvement of the prosthetics-orthotics profession in "rehabilitation engineering." The relationship of the prosthetist and orthotist to this broader field, rehabilitation engineering, must indeed be considered as we contemplate and then offer future directions.

DIRECTIONS

PREPARATORY PROGRAMS

An education based on a baccalaureate degree in prosthetics and orthotics and those training efforts employing certificate programs after bachelor degrees from other, related fields will if properly supported meet the demand for professionally trained prosthetists and orthotists. Directions for the future should offer that such preparatory programs be sustained with perhaps more emphasis on the early degree preparation in prosthetics and orthotics and less dependency on certificate programs. But a properly constituted data base to predict both future needs and future supply should be used to guide the educators.

UPGRADING

From my own point of view an important arena for education and training in the future should be that associated with up-grading, or continuing, education. We see no shortage of innovation, either products of individual initiative or Government-funded programs. There will be constant change in techniques and devices. So that patients can benefit as soon as possible, there is a need for efficient dissemination of information to the practicing professionals.

We need first to identify the relationships between the research, development, and evaluation efforts and the education and training programs. Secondly, we need to have the practitioner in prosthetics and orthotics involved closely with all phases of the overall program. It would be very useful if the prosthetist and orthotist, as part of his commitment to his profession, became involved in those evaluation programs which require structured protocols and are funded by his and other professional societies and the Government. Thereby he would participate in activities which determine the route of change.

Here is a major role for the American Academy of Orthotists and Prosthetists to play as a participant in evaluation, as a part of a management team which needs to be structured to play the role which for many years was filled by the U.S. National Academy of Sciences through its Committee on Prosthetics Research and Development.

By such involvement in evaluation, the prosthetist and orthotist will become directly aware early of some of the innovations. He will be thus well equipped to teach the application of them, perhaps even better than the original innovators, but he must learn how to teach, and he should, for teaching, use a forum in which teaching is most efficient, something which depends on that which must be taught. Some of this has been done in the past, in a manner wherein the evaluator served also as the teacher, but only as part of a University or National Academy of Sciences program but even then, it was not the practitioner who was the real teacher. Now is the time for the prosthetist's and orthotist's own professional society to do much of the teaching in prosthetics and orthotics (*3*).

We all know there is need for continuing education in prosthetics and orthotics but there has been difficulty in getting support for such training. However, are laboratory courses (Fig. 1) needed for all such education? There are other mechanisms that we should encourage use of, such as the AAOP seminar programs. In these, better direction, with over-all long range planning of a course series seems needed. Large consumers such as the government's health care agencies should participate, not only helping with course plans, but most importantly, with financial support and with recognition of these courses as qualification channels for fee

schedules with special requirements for new product or process.

A possible additional training mechanism is that of a preceptorship, properly organized and administered. This method commonly used by other professionals, is based on a system wherein a "student" works with a recognized teacher, or preceptor, for a certain period of time in the preceptor's laboratory or clinic (Fig. 2). For certain needs, for example, powered

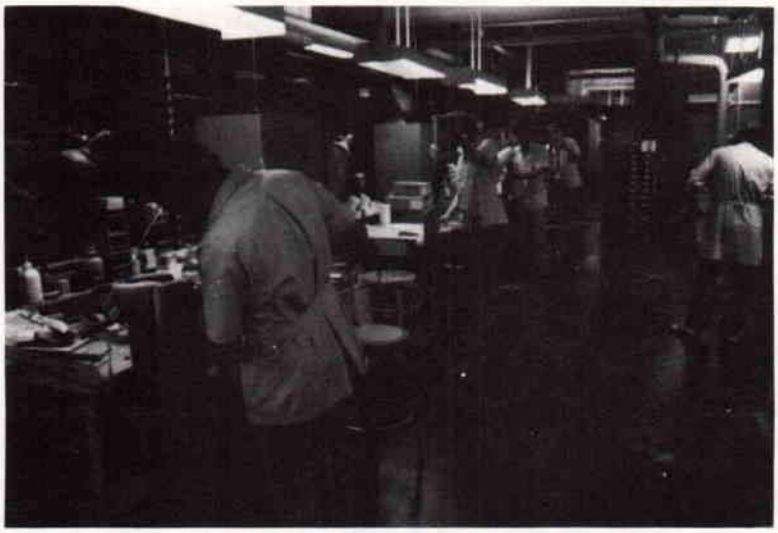

Fig. 1. Laboratory instructional course in prosthetics.

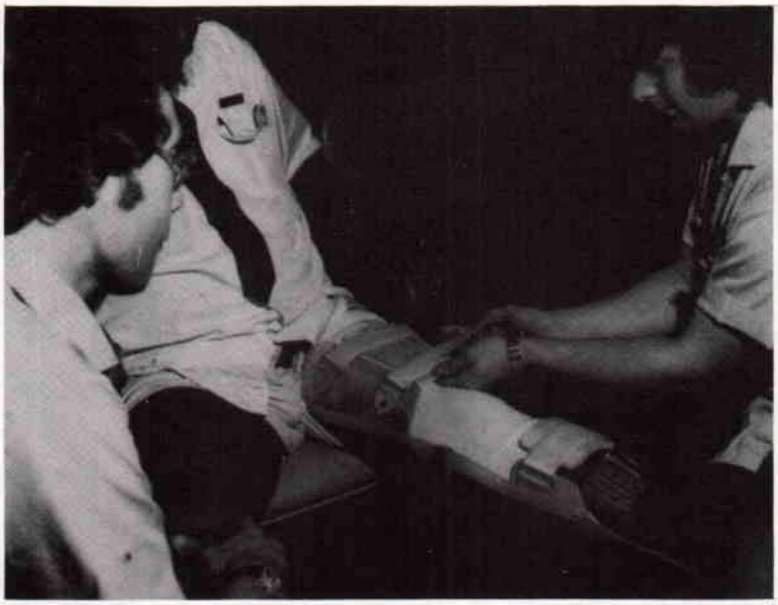

Fig. 2. Preceptorship — Learning by serving the patient with a "new" system under the watchful eye of an orthotist experienced with the item.

limb orthoses or prostheses, the preceptor method may be the most efficient way of transferring information and certifying qualification. Indeed one could have practitioners, after participation in a structured evaluation program, become "certified" preceptors on a certain item, teaching others assigned on a scheduled basis and establishing some of the students as preceptors themselves.

Also not to be overlooked is the use of "canned" home instruction systems using video and audio facilities (Fig. 3). Increased government support of this approach is needed.

MORE ON GOVERNMENT SUPPORT

Unquestionably, the government, through its health care agencies, should support upgrading education and training efforts as it supports the research and development which forces the change requiring the dissemination of information. The government now supports evaluation; as a consequence, it must participate in planning the scope of any education and training efforts to be organized by the practitioners. Together, the practitioners and the Government should structure an enduring system with balance among laboratory courses (but only after carefully scrutinizing the real need for these), seminars, and preceptorships, the balance being determined as a function of the requirements of individual innovations.

The government can also recognize the *professionalism* of prosthetics and orthotics by establishing fee schedules to replace the "artificial limb contract." But equally important is a recognition the practitioner himself must provide — a recognition of his own identity as a professional. That the prosthetist and orthotist act like professionals is necessary, so that the attempts being made by the government to establish professional methods for reimbursement will be acceptable to those who still consider the prosthetist and orthotist as "limb and brace makers."

REHABILITATION ENGINEERING

The term "rehabilitation engineering" has bothered some people in prosthetics and orthotics because it is a field which embraces prosthetics and orthotics as well as all other technologies associated with patients during the rehabilitation process. Distorted are the current

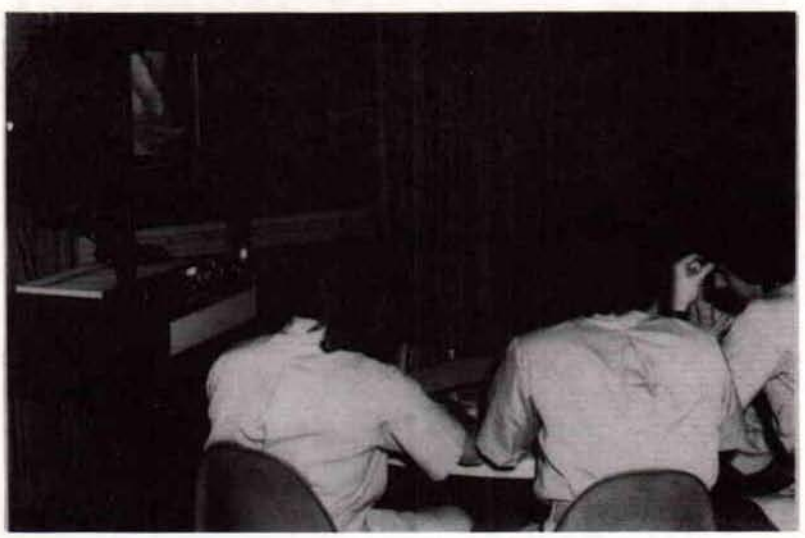

Fig. 3. Team instruction by the use of video and audio tapes.

visions of Ph.D. engineers dominating or usurping prosthetists and orthotists in their milieu, the fitting laboratory, telling them what, when, where, and how to perform.

Because of its expanding interest in all aspects of rehabilitation technology, the Government's several health care agencies have encouraged the identification of rehabilitation engineering, particularly through HEW's Rehabilitation Engineering Centers. This constitutes no threat to prosthetists and orthotists.

In writing about the clinical engineer some years ago (*1*), we foresaw that many of the duties of the rehabilitation engineer would put him in the clinic as a colleague and collaborator of the prosthetist and orthotist.

Since that time and true to our early estimates we have had great success in the Veterans Administration with our own clinical engineers. Specializing on the problems of the severely handicapped, they contribute on all aspects of rehabilitation engineering including the selection of beds, patient transfer and lift systems, environmental controls, wheelchairs, licensed vehicles, and even occasionally prosthetics and orthotics.

They participate in the hospital clinic teams in which surgery and rehabilitation are involved. They go on daily rounds, working closely with the physicians and surgeons, prosthetists, orthotists, nurses, therapists, and other professional personnel.

They are active in discussions of the prescription, and with their wide knowledge of the many kinds of equipment available, they serve a major role in the specification of the devices and processes needed for a particular patient. In fact they go into many patients' homes, serving needs there by recommending new devices and in some cases, installing those devices, later seeing to their repair and maintenance (Figs. 4 and 5).

The VA clinical engineers have been particularly valuable in evaluations of new hardware, for their proximity to the care of severely handicapped patients gives them an excellent orientation for analysis of the quality and effectiveness of new systems. In this way they are close to the development process as it occurs elsewhere, and in some cases project themselves and their ideas into the process. But their forte is the clinical role; their service to pa-

Fig. 4. Hospital-based home care in rehabilitation engineering: Installation of communication devices and other appliances for patient use throughout the home.

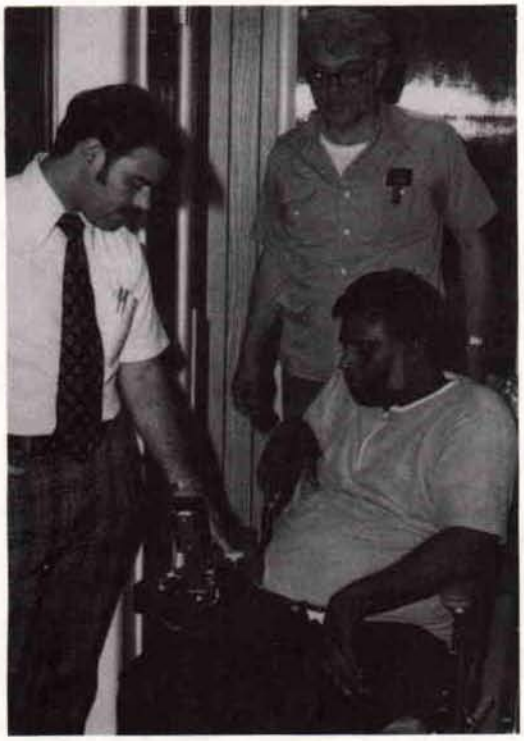

Fig. 5. Hospital-based home care in rehabilitation engineering: Introduction of remote control of appliances from the wheelchair.

tients. Evaluation is an essential part of this, as it is with any other professional, particularly the prosthetist and orthotist.

Our prosthetists and orthotists have now learned to use their services especially in fitting the more sophisticated electronic systems such as powered upper-limb prostheses and orthoses (Fig. 6). They have also been used quite regularly in our functional electrical stimulation projects.

Our handicapped drivers have benefitted by the availability of our clinical rehabilitation engineers; for these people we are able to provide help in selecting adaptive equipment and, in some cases, having the engineers install the devices (Fig. 7).

They have in fact learned to be bedside-oriented engineers, developing with patients a rapport that meets the highest standards of professional practice.

In originally writing of the clinical engineer and proposing his employment in the VA health care system, we did not ever believe that such a job would present a threat to prosthetists and orthotists. It has not become one. The clinical

Fig. 6. The engineer and prosthetist team serving the patient.

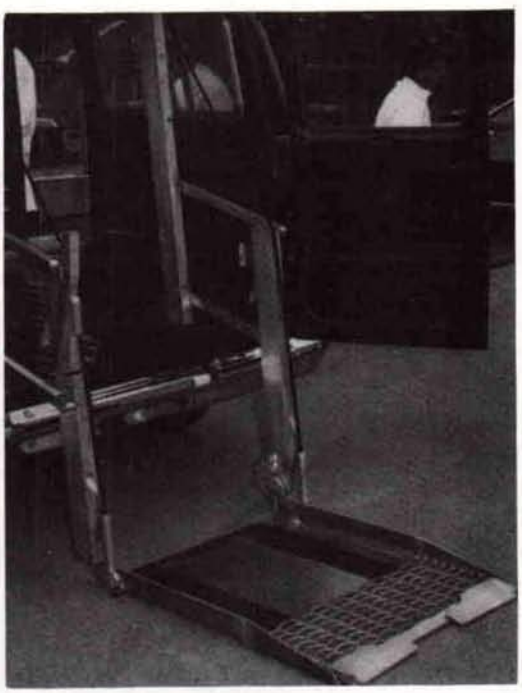

Fig. 7. A lift system for wheelchair access to a vehicle. This kind of item requires professional engineering inspections at installation and periodically thereafter.

ehabilitation engineer is a generalist with his attention directed to those broader areas of technology which are especially responsive to the needs of the severely handicapped; prosthetics and orthotics fittings will not be his forte, but he will be involved. Although he will necessarily have an interest and will indeed be of assistance to the prosthetist and orthotist responsible for fittings of such devices as those associated with bioelectric systems (FES and the like), the prosthetist/orthotist role will not be jeopardized.

If the clinical rehabilitation engineer does his job well, he will be nearly fully concerned with the severely handicapped, in the hospital and in the home; he will worry about transport systems (Figs. 8 and 9), environmental controls, and the like; he will concern himself with the architecture in and around the disabled person's environments and, most importantly, he will try to design job modules for restoration of vocational potential — a form of industrial engineering.

A part of all this is, of course, prosthetics and orthotics design; in this he, the clinical engineer, and the prosthetist and orthotist will develop those special systems needed to interface a severely handicapped patient with a transport system; with a vehicle, with his job, and with needs in his home. The technology introduced for the rehabilitation of patients can not be considered independently of the total system, a part of which is the prosthetic-orthotic restoration whenever possible.

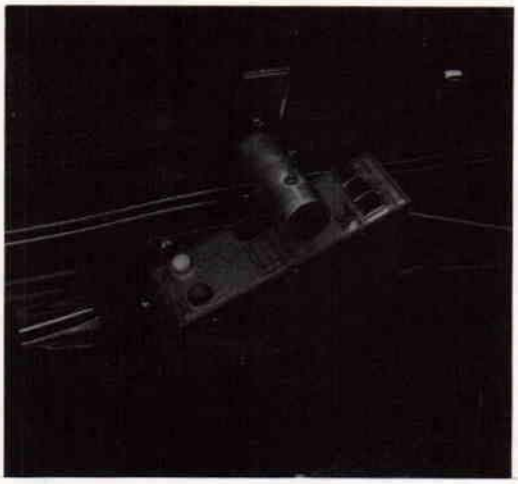

Fig. 8. A "joy-stick" control for braking and acceleration: — uses servomechanisms in engine compartment.

Fig. 9. Another form of joy-stick control: — an adaptation of the lunar rover module control developed by NASA for the Apollo project.

Our concept of the clinical rehabilitation engineer (not Ph.D.'s but baccalaureate and master's degree recipients) is a person *on the same level* as the prosthetist and orthotist, with each enhancing the knowledge and capability of the other. The prosthetist and orthotist, especially with the upgrading programs which have evolved, has become as well-prepared as the clinical rehabilitation engineer. We can structure further change by developing new courses for some prosthetists-orthotists, who may wish to expand their scope beyond prosthetics and orthotics into rehabilitation engineering. We now see a need for new bachelor degree programs to be developed to prepare rehabilitation engineers, but before that we may need to have graduate degree programs for those who have already graduated from regular engineering programs. We can visualize other programs, structured either through an organized upgrading process or through a full-year, full-time program, to provide a graduate degree in rehabilitation engineering for prosthetists and orthotists.

SUMMARY

These, then, should be the directions: properly, structured, efficient upgrading of prosthetists and orthotists prepared at the bachelor's level, to include the involvement of prosthetists and orthotists in evaluation and the use of new formats such as preceptorships and "canned" training programs, and less dependency on expensive laboratory courses; more generalized recognition of prosthetics and orthotics practice as professional; the clarification of lines of demarcation between the prosthetist and orthotist and the clinical rehabilitation engineer, but with cognizance that such lines will gradually become less clear as better designed upgrading programs have more impact; and the structuring of special undergraduate and graduate curricula in clinical rehabilitation engineering.

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