Newsletter...

Prosthetics and Orthotics Clinic

Vol. 2, No. 2 / 1978 Issued Quarterly

A Proposal for Delivery of Externally Powered Upper-Limb Prostheses

There are about 322,000 amputees in the United States today. Of this number, approximately 9,000 people have upper-arm amputations and 16,000 have forearm amputations. Many arm amputees choose not to wear a prosthesis for three major reasons; 1) lack of sensory feedback, 2) poor function and 3) poor cosmesis.

Unfortunately, the vast majority of physicians, therapists, and prosthetists seem to believe that new amputees should always be provided a hook first, and a hand later, if the hook is accepted. Nearly all patients, however, want a hand first and dread the thought of using a hook for obvious cosmetic and psychological reasons. In a great number of cases, the hook and prosthesis are rejected due to the undue amount of attention attracted to the wearer.

Body powered mechanical hands are heavy, cumbersome, and far less functional than hooks. The same amount of harnessing and body power is required to control these hands as with the hooks. The cosmetic gloves that cover these hands are easily stained, torn, and discolored. The major indication for prosthetic hands has been for unilateral amputees who are engaged in light-duty work and are very conscious of cosmesis.

The introduction of the VA- Northwestern University, Otto Bock, Variety Village, and other powered hands and elbows for prostheses should change the dismal attitude concerning prosthetic hands. These prostheses are extremely cosmetic, and require very little body motion and little or no harnessing to control the hand. The hand can be controlled easily whether the wearer is reaching for something over his head or behind him, which was previously very difficult. Powered prostheses are of greatest value for patients with high amputations, whether they are unilateral or bilateral. These patients are normally present complicated problems because they lack the muscle power and leverage to control mechanical prostheses, but they can easily control powered prostheses by myoelectric or switch controls.

"Powered prostheses have received a very cool reception in the United States due to—high cost and a greater expertise required to fit."

Powered prostheses have received a very cool reception in the United States due to a number of factors; the cost of the prostheses is high—four to five times that of conventional prostheses—and therefore many third-party payers refuse to pay for them. The prosthetist fitting an externally powered prosthesis must be well trained in order to evaluate myoelectric potentials and to properly fit and maintain the prosthesis. As most prosthetists have no background in electronics, more that a short orientation course is required. Even after thorough training is obtained, the prosthetist may only see two or three patients per year requiring these types of prostheses, and therefore much of the information will be forgotten. In many cases, components that were intended to be modular in concept and simply plugged in need to be reworked or redistribued around on the socket in order to accommodate a long or non-standard type of amputation. In a study conducted by the Veterans Administration 18 prosthetists were involved in an evaluation of powered prostheses. All prosthetists were given a one-to-two-week course by the VA on myoelectric prostheses and patients were referred to them through VA clinics for fittings. Despite all this education, prosthetist errors were responsible for more malfunctions than any other cause. Faced with all of the above facts plus the fact that the cosmetic glove is still a problem, most prosthetists chose not to handle externally powered prostheses. Further, since such a small percentage of the amputee population can be fitted with this type of prosthesis,

Prepared by the American Academy of Othotists and Prothetists, 1444 N St., N.W., Washington, D.C. 20005. Editor: A. Bennett Wilson, Jr., B.S. M.E.; Managing Editor: Brian A. Mastro, B.A.; Editorial Board: Joseph M. Cestaro, C.P.O., Charles H. Epps, Jr., M.D., Robert B. Peterson, R.P.T.

most prosthetists find it impractical to invest the great amount of time and money for education and equipment before they can provide satisfactory service.

It has been shown that in areas where prosthetists learned enough about powered prostheses to be able to properly fit and maintain them, the prostheses received wide acceptance. John Billock, C.P.O., in Warren, Ohio uses a number of different powered prosthesis systems, including hybrid models using components of different systems on severely disabled upper-limb amputees that are referred from all over the Midwest. William Sauter at Ontario Crippled Childrens Center has also proven the practicality of powered systems on adults and children. In each area, however, institutional support has been the determining factor. Mr. Billock's success was achieved after years of participation in the research program at Northwestern University and Mr. Sauter's work is done in a large Rehabilitation Center. Similarly, the Bock system is used in Minneapolis due to a great amount of support from the Germany-based Otto Bock Company to its United States headquarters in Minneapolis. The Otto Bock Company is presently offering a free one-week course on the basic below-elbow system, and plans future courses on advanced powered components.

We are faced with the situation that powered upper-limb prostheses are presently available but are not used for the many reasons stated previously. How do we solve the service delivery problem, particularly for the more severely disabled upper-limb amputee? I suggest that specialized fitting centers are the best solution to the problem. Such centers can be privately owned or located in an institution. The advantage of this system is that the prosthetist would see enough patients to become truly expert in the area of powered prostheses, and could well afford the expense of taking all relevent courses or preceptorships and obtaining the necessary staff and equipment.

"It seems obvious—"powered prostheses will be more common than body powered prostheses."

I have visited one such center in Warren, Ohio, which is owned by John Billock, C.P.O. Mr. Billock and his staff at Warren Orthotics and Prosthetics Restoration Laboratory fit three to four powered upper-limb prostheses per month, including all levels of amputation. His staff includes a full time electrical engineer and an electronics technician. There are enough equipment and spare parts available so that essentially all maintenance is carried out on the scene, which avoids long delays when repairs are done elsewhere. Patient referrals are mostly from the Midwest and East Coast, although patients from the West Coast are not uncommon. One patient being seen during my visit had a right shoulder disarticulation and a left above-elbow amputation and was being fitted with powered hands, elbows and wrist rotators controlled by switches. Components from at least three manufacturers had to be made compatible in the ten-month long project.

I feel that a total of four centers in the United States could adequately handle the patient load. The average prosthetist with a good understanding of powered prostheses will be able to treat most unilateral below-elbow patients, so referrals to a powered prosthesis center will usually be for more difficult cases. It will be important for private centers to be closely allied with a rehabilitation center, as these patients will require therapy, counseling, and other services while the prosthetic services are being performed.

It seems obvious to me that powered prostheses will be more common than body powered designs within the next twenty years, and it is time now to establish an efficient service delivery system.

by
Michael J. Quigley, C.P.O.

Concerning Suspension Alignment, and Control

In the prescription of any prostheses consideration is naturally given to the proper means of suspending the prosthesis and maintaining it in place. In contrast, not as much concern seems to be given to this crucial matter in the prescription of an orthosis.

Paradoxically, this relative state of neglect is undoubtedly due to the very success with which suspension has been incorporated in most conventional orthosos. To cite but one example, the shoe that inevitably must be used with any ambulatory AFO, KAFO, or HKAFO provides for suspension of the device as well as providing support to the ground.

In recent years with the expansion of new technology in the area of prosthetics and orthotics there has developed a corresponding interest in new techniques to overcome shortcomings in conventional devices. In the process, however, new problems can arise as a result of the intertwining roles played by various components of the device under consideration, and it would therefore appear worthwhile to attempt to sort out these various roles with special emphasis on suspension in order to clarify the picture, and possibly, as a result, to suggest new and unique applications for the various suspension systems available.

For clarity a brief glossary has been prepared, and is included at