Editorial

Externally Powered Prostheses for Children—1984

by Charles H. Epps, Jr., M.D.

Not so many years ago children with upper limb deficiencies who appeared in our clinic with body powered prostheses asked for an arm like the one used by the six million dollar man. The television character routinely performed miraculous feats of strength and prehension that made the body powered prostheses look primitive by comparison. I was unable to satisfy such requests at that time. Now, at least for some patients, the long sought externally powered fitting is possible. The available arms do not approach that of the six million dollar man, but we have the means of fitting the below-elbow patient with a myoelectric prosthesis that is gratifying to patient and parents. In our own setting, two factors have converged to make this possible.

First, the most important development in our clinic has been the affiliation of the local Variety Club, which established a Limb Bank. The concept is simple, the Variety Tent raises funds for myoelectric limbs, component parts and services. In some cases, the cost of the entire prosthesis is underwritten; in other situations Variety pays the balance not covered by insurance depending upon family finances. There are also components and spare parts available for repairs, courtesy of Variety. Such components keep the down time to a minimum and eliminate the need for two myoelectric prostheses. This arrangement developed between the Juvenile Amputee Clinic (Maternal and Child Health and Crippled Children's Services) at D.C. General Hospital and Washington, D.C.'s Variety Tent Number 11 is an example of how a public-private relationship can benefit the patient. Variety Tents are operational in Grand Rapids, Michigan; Memphis, Tennessee; Detroit, Michigan; Los Angeles, California; Toronto, Canada and other cities.

Secondly, the technology has been available for a number of years, but we delayed because of the cost of myoelectric fittings and because the policies of many insurance carriers did not include such devices. It seemed undesirable to fit a child if one could not reasonably expect to continue with subsequent fittings and provide timely repairs. Sörbye in 1971 was among the first to apply myoelectrics to the young preschool amputee. His group operating in the government support health system in Sweden overcame these same problems by providing each patient with two prostheses. The second remained on the shelf as a back-up limb when the first needed repairs. In this manner, down time was eliminated and the child was not without the prosthesis.

In the United States there has been a recent change in the policies of many third-party insurance carriers. Today, most will provide funds not only for the initial prosthesis but for replacements and necessary repairs, a not inconsequential cost. Some insurance companies pay total cost while others pay a fixed percentage.

EXTERNAL POWER

Over the years, a number of battery powered switch operated devices have become available. The Michigan Feeding Arm was specifically designed to assistance in eating activities and was the first externally powered device developed in the United States for the pediatric age patient. In the early 1970's the Ontario Crippled Children's Center developed the OCCC Coordinated Arm. This was followed by the OCCC Elbow. Both were operated by switches and were designed for the 4-10 year age group. The Michigan Electric Hook (10x size) appeared in

1973 and was appropriate for the child approximately 2-10 years. Its successor, the Michigan Area Child Amputee Clinic Hook (MACAC) (10x size) was an improved version of the earlier hook designed for the same age group. In 1977 we saw the advent of a second elbow, the NYU Motor Lock Elbow, sized for a child six to a small teenager. This item remains experimental. To overcome the objectionable operational noise of the previous powered elbows, the NYU "Hush" Electric Elbow was developed in 1982. A versatile unit, it can be operated by push button or harness pull. Complimenting this armamentarium is the switch operated NYU Prehension Actuator (1982) which is applicable to any cable voluntary opening terminal device. More recently, the Utah Elbow was developed for the adult population but may be used with a child about age 12 years; it can be used with any terminal device and utilizes a dual site myoelectric system.

MYOELECTRIC

The available myoelectric devices also offer a spectrum of choices. There is the University of New Brunswick System which is appropriate for ages 12 and up. This unit uses a surface electrode over one muscle. A small contraction is for closing and a strong contraction for opening. Relaxation of muscle contraction stops the hand at the current position. Sweden contributed the Systemteknik hand in two sizes; 2-6 years for the small child and 5-9 years for the larger child. The unit utilizes a single or double myoelectric electrode. The Steeper hand produced in England has the same size and age indication and similar choice of myoelectric controls. The German contribution is the Otto Bock System covering ages nine to adult with a dual myoelectric site system. These units are expensive but commercially available. The absence of a myoelectric unit developed in the United States is conspicuous.

This array of devices presents a challenge to the physician prescribing external power for his patient. There are wide differences in the weight which may be crucial in the young patient with a short stump. However, all are heavy when compared to the body powered prostheses. The battery systems vary from 5 volt to 12 volt with varying useful life after charging. The prescription, therefore, is best written as a collaborative effort by the physician, the prosthetist, and the occupational therapist who has evaluated the patient and will provide the training.

PATIENT BENEFIT

After witnessing the satisfaction of the patient and parents after a successful fitting has been accomplished, there is no doubt that external power is preferred over body power in most instances. Function seems more natural when hand opening and closing are controlled by forearm extensor and flexor muscle activity. It is obvious that the psychological benefit of the cosmetic effect is profound on patient and parents alike. The dramatic change can be seen even with the initial application of the arm. External power and myoelectric applications are now state-of-the-art in below elbow cases and should be made available to all who have the interest and proper indications.

THE CHALLENGE

There is still much to be done for the amelia and the high above elbow amputee. Efforts must continue to bring the maximum degree of function to patients who are less well served at present. The numbers of patients in this category are small and there are not the normal incentives to manufacturers to expend funds for research and development in this area. The Federal Government may have to support the requisite research to accomplish the necessary break-through. It is ironic that the below elbow patient who enjoys reasonably good function with conventional prostheses would benefit most from the new technology. This is explicable when we realize that this level of limb deficiency makes the task easier. Although the numbers of high level deficiency patients by contrast is small, the need is great. We must continue to work for solutions for these patients who remain underserved at this time.

AUTHOR

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