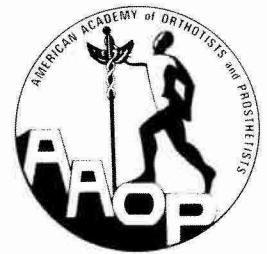


Newsletter...



Prosthetics and Orthotics Clinic

Vol. 2, No. 3 / 1978

Autumn (Issued Quarterly)

Concerning Externally Powered Prostheses

The first issue of Volume 2 of the Newsletter contained an article that outlined the history of externally powered prostheses and posed the question "why aren't externally powered devices generally available to patients in the U.S.?"

The next issue contained an article by Michael Quigley stating that in his opinion the primary reasons were

that prosthetists have not yet had available adequate training as well as the high costs of components, and suggested that specialized regional centers be established to meet the needs of those patients for which externally powered prostheses are indicated.

The following article and letters were received in response to these two articles.

EXTERNALLY-POWERED UPPER-LIMB PROSTHESES

AN AMERICAN DILEMMA

The discussion by A. Bennett Wilson, Jr., in Vol. 2, of the Prosthetic and Orthotic Clinic Newsletter is an excellent historical summary of the saga of externally powered upper-limb prostheses. Ben Wilson has brought to this forum an abundance of personal knowledge about the development of these devices that can only be known by one who has been intimately involved with the problem. I think it also raises the question, when one considers the present state of the art and the availability of American made components why more could not have been done and is not being done.

As one who has been intimately involved in the treatment of patients with upper-limb deficiency for the past 17 years, I have experienced the frustrations that are unique to this area of medical delivery. In the Juvenile Amputee Clinic at the D.C. General Hospital, in Washington, D.C., we have cared for almost 300

children with one or more limb deficiencies. I remember, vividly, when I first began this work in 1961, telling parents that in five years we should have available for the child (bilateral upper amelia), a good set of externally powered arms. Much to my chagrin, five years later we were unable to deliver this needed service to a degree that satisfied the patient or the Clinic Team. After 17 years, there are still unfulfilled expectations.

One then has to ask the question, why has there not been greater progress in the United States? Research money has been available, to a limited extent and powered arms have been developed. These events have been developed historically by Ben and will not be reported in any depth here. I would mention the Michigan Feeder Arm, which was a very useful arm for the purpose of eating, in the young age group. Once the child became older, there

was no model available. The Michigan Electric Hook was developed out of a similar need and can be purchased commercially today. We are using, at the present time, a number of these in our clinic. The Coordinated Arm, developed at the Ontario Crippled Children's Center, and which succeeded the feeding arm, can be purchased from a Variety Village in Toronto, Canada, but the problem is that this unit is suitable only for the younger child. There is literally nothing as good as the Coordinated Arm available for the older child or adult.

Another approach we have utilized is the combination of the OCCC electric elbow with the Michigan electric hook, in what we have termed a "Hybrid" prosthesis. Today, our experience has been satisfactory, as we are able to combine both units to operate with a single electrical system, supplied by one battery. Even under these circumstances, it is very difficult to import the electric elbows from Canada. The cost is not inconsequential, when one considers that the purchase of both items will be close to \$1,000 and then one has to consider the cost of fabrication.

The net result is that unless one is extremely zealous, it is not possible

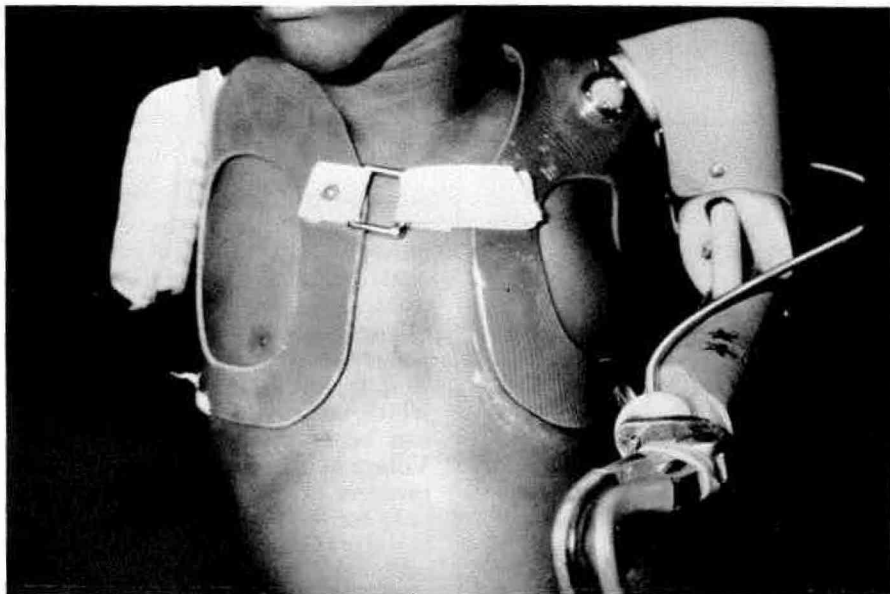
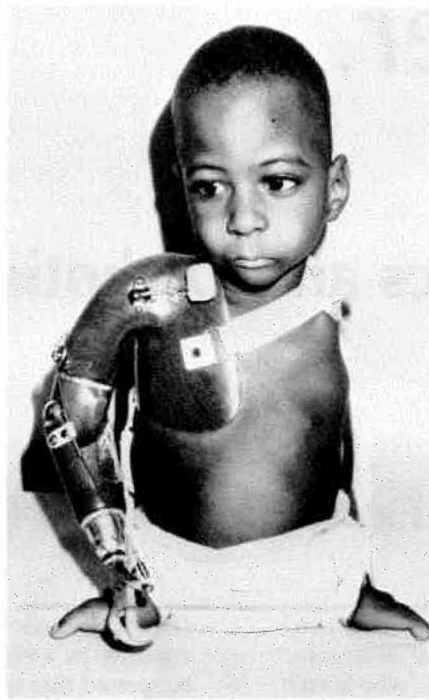


Fig. 1. This male was born with bilateral upper amelia and lower complete phocomelia. After acquisition of sitting balance, he was fitted with a shoulder disarticulation type prosthesis with nudge control for elbow lock and unlock and with terminal device and forearm lift control by chest expansion. At age five, a Michigan Feeder Arm was applied, and his feeding time and ease of eating were enhanced.

to supply children with severe limb deficiencies with externally powered devices. When they are supplied, there are mechanical problems, electrical problems, and frequent repairs are necessary. The "down time" is considerable. For this reason, many clinicians and patients have been discouraged and have abandoned use of these devices.

It is ironic that the greatest development has been made for the patient with the below elbow deficiency. The Otto Bock System is available in a number of sizes and

provides excellent cosmesis and function. Our experience has been satisfactory with this device. The cost, however, is considerable and this may be one reason that this prosthesis has not been applied extensively in this Country, in spite of the fact that there are large numbers of children with below-elbow level deficiencies. It is also a fact that below-elbow patients function quite well with body powered equipment. In either case, American industry has not been at the forefront. The majority of commercially available

devices today have been developed in Europe or Canada.

I recently had the opportunity visit Doctor Rolf Sorbye, in Orebro, Sweden, who in collaboration with Systemteknik has developed an excellent below-elbow self-contained self-suspended prosthesis, using myoelectric control. This device has been fitted to a number of children as young as 18 months and the results are extremely promising. Two prostheses are fabricated for each patient so that there is no "down time" when one prosthesis becomes inoperative and needs bench repairs. The cost per patient, therefore, is approximately \$6,000 for the pair of arms. There is under development, at the present time, in Sweden, another multi-functional hand (also for the below-elbow level), which will provide powered function for grasp, release, dorsiflexion and palmar flexion of the wrist, and supination and pronation of the forearm. The project is funded by a joint effort on the part of the Swedish Government and private industry. It is unfortunate that we have not been able to have a similar effort in this Country. Dr. Dudley Childress, at Northwestern University has developed an excellent self-contained, self-suspended below-elbow system, using myoelectric control. The fact of the matter is that this and similar devices, developed in this Country, have not found a manufacturing outlet for disbursement. It is, therefore, a financial matter that in the face of limited demand the manufacturers cannot produce these items at a cost that will make it profitable. It seems to me, therefore, that this is an area, where the Government should intervene and subsidize this effort. There are numerous precedents throughout industry in this regard. The railroads, the airlines, and the shipbuilders have been subsidized. The renal dialysis program is one health area where Government is presently providing a subsidy. The precedent is there. There also needs to be an effective lobbying effort mounted, not only by the profession, but by the affected individuals, that is, patients and their parents. I believe that this is the essence of the problem. The technical "know how" is available but what is lacking is sufficient funding to make these devices in sufficient numbers so that they can become available to patients. It is fortunate that there are not a large number of patients. Ironically, were there large numbers of patients and a large demand, then the cost, of course, would be reduced. In the absence of this unfavorable manufac-

turing circumstance, subsidies must be given to industry so that the necessary devices can be produced and made available at reasonable cost.

Another aspect of the problem, which is paradoxical, is that there has been so much effort put into the below-elbow level, where the need, as I see it, is not nearly as great as it is in the above-elbow and the shoulder-disarticulation levels. The patients with more proximal limb deficiencies are greatly in need of externally powered devices. Yet the powered devices that are available for the proximal cases, are not the most efficient. The available commercial items, even at great cost, are not representative of the best technology available in this country, today. This can be partially explained by the fact that the numbers of patients affected at the higher level are substantially less than those at the below-elbow level. It is also natural to work on problems where success is more readily obtained. The challenge is there at the shoulder-disarticulation level and the above-elbow level, where these patients desperately need more function. There is need in this country for a concerted effort to develop and provide powered arms for patients with the more proximal limb deficiencies. It is a blight on our record as a nation, with such sophisticated technology and industrial and productive capacity, that this area of human need has been so long unfulfilled.

by

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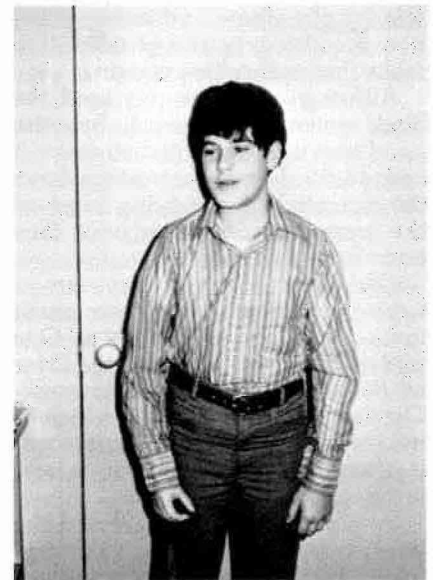
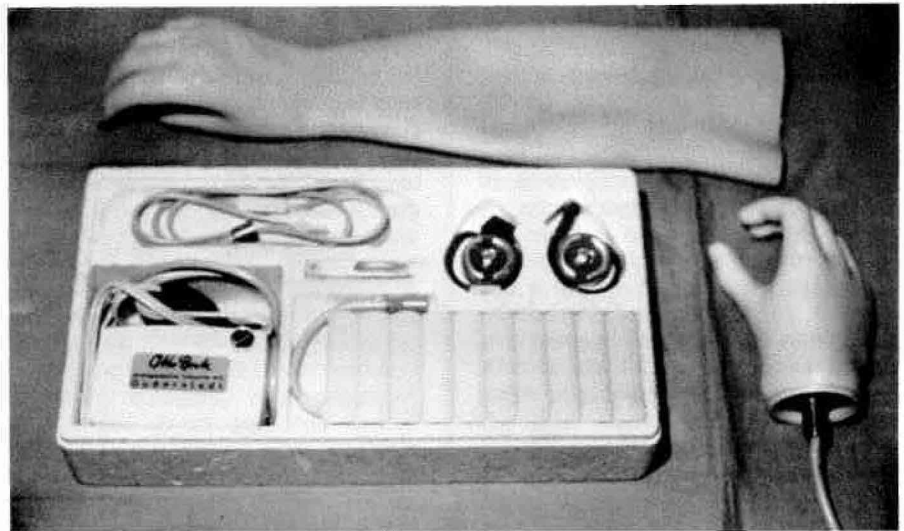


Fig. 2. A fourteen-year-old with partial transverse hemimelia fitted with a Otto Bock Myoelectric hand that is available in a kit as shown. The battery pack can be attached to the belt. The shirt covers the wire and the socket resulting in excellent cosmesis.

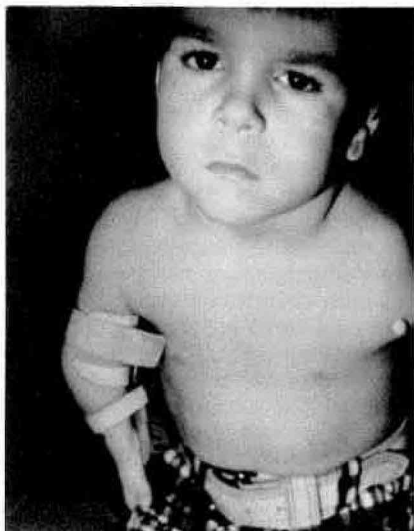


FIG. 3. This youngster with right upper phocomelia and left amelia was given an opposition post early. A standard left shoulder-disarticulation prosthesis provided little function. A hybrid system utilizing an OCCO electric elbow and a Michigan Electric Hook, provides greater function. Both units are powered by one battery pack.