PRELIMINARY EVALUATION OF THE SWEDICH MYOELECTRIC HAND PROSTHESIS FOR PRE-SCHOOL CHILDREN AS USED IN THE NETHERLANDS

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Summary

Myoelectric hand prosthesis for adults have been issued in the Netherlands for a number of years. Opinions about the extend of acceptance and the practical application potential of this prosthesis vary greatly. Certainly the last word has not been said about this. According to dr. Sörbye, head of the neurophysiological department of the Örebro regional hospital of Sweden, the application of the myoelectric prosthesis for very young children would lead to higher grade of acceptance than is currently the case with adults (1).

We started issuing and supervising the Swedish myoelectric shildren's hand in the Netherlands in 1979 (2). It seems useful to us, occupational therapists of the two treatment-teams, to give you an impression of the potentials and practical results of this prosthesis. We followed the children closely during the occupationa therapy training sessions; as a consequence of our close contact with the parents we have also been able to incorporate parential experiences in this study.

It is an established fact that children with a peromelia on one side, without a prosthesis, can do almost anything that bimanual children can do but at leter age. They are completely orientated towards one-handedness and use their other extremities to support their actions. Nevertheless they experience problems with those manual skills which require complex and co-ordinated bimanual actions.

In our opinion it is important to observe whether children who have been supplied with a prosthesis at a young age are capable of the practical skills which are to be expected of normal children of the same age. Also we are interested in observing at what age and to what extent they can successfully integrate the prosthesis in such a way that it becomes part of their body-image.

Introduction

After the knowledge of the existence of the Swedish myoelectric prosthesis for pre-school children (have after called m.p.p.) spread into the Netherlands, through press reports and medical congresses, parents requested that their child be supplied with an m.p.p. To some extent the application of prosthesis on very young children in the Netherlands started due to the pressure from these parents.

It was decided, in the light of the small number of children that had applied for an m.p.p., to keep the treatment centrally located. Consequently the acquired specialist knowledge and experience remain centralised.

At the moment there are two centres at which we have started treatment-team; namely the Rehabilitation Center "Hoogstraat" in

Leersum and the Rehabilitation Department of the University Hospital in Leiden. The two occupational therapists of these treatment-teams, together with the doctor and the prosthetist, visited the promoter of the m.p.p. (i.e. dr. Sörbye in Sweden), in September 1979.
The task of the two occupational therapists was to gather first-hand information regarding methods of approach used in the application of the hand in dr. Sörbye's hospital. Until now six children in the Netherlands have been supplied with a prosthesis according to the clinical discussion with dr. Sörbye and based on his advice and experience..

Interim clinical evaluation

All six children, who have a fore -arm peromelia, are now supplied with a myoelectric prosthesis. Three children received the prosthesis in Leersum and three in Leiden. Five children were three years old and one child was four and a half when they got the prosthesis. The latter patient received an Otto Bock six and three quarters hand because the Swedish hand was already too small for her. We deliberately chose to start at the age of three years because the child is then more likely to be ready for a second graspfunction in play and playmaterials.

At a very young age the children received a patch hand. This obviously had a positive influence on the training; namely that they already became used to the support and object-immobilising function of the prosthesis. Lead beads were inserted in the patch hand in order to get used to the weight of the future Swedish myoelectric children's hand, there were no problems in this procedure. Each child came to the orthopaedic workshop accompanied by a parent. It was not difficult to find the muscle action-potentials for activating the hand nor was it difficult to make the socket.
The different kinds of reactions displayed by children of the same age became apparent during experiments with the loose hand in which the electrodes were placed on the stump with tubigrip. One child showed a great deal of interest and understanding by starting to play enthousiastically while another child did not see the relation between the action of the loose hand and his own stump at all.

A fairly intensive but short period of training follows the issuing of the m.m.p.; this training is done by the occupational therapist. She looks for possible ways to approach the child and tries to offer playmaterials which interest the child and whish necessitate the use of the prosthesis hand. The parents are encouraged to become involved in this.

During the first period of training some children found the m.p.p. heavy however, after a few days, they became used to it and it apparently ceased to be a problem. For four children the m.p.p. was immediately a substitute for the patch hand but the other two preferred a more gradual change.
After accepting the prosthesis the children were quite soon able to open and close the hand. Sometimes they managed to pick up an object in this period. However it was not possible to keep the hand open in a certain position. As soon as the child started doing something with the other hand or even paying attention to something else, the prosthesis opened or closed due to an unexpected movement of the stamp.

The child still had insufficient control over the operation of the hand, therefore the full function of the hand was not exploited. Even the adjustment of the opening electrode from number six to number four failed to bring any change. In order to secure objects, they were pressed against a supporting surface such as the table, floor or the child's own knee, or held between arm and body.

It is not possible for a small child to understand how the prosthesis works, why an object falls or what the shild has to do to prevent this. Only by frequent playing with the prosthesis correct use will develop spontaneously. The passive rotation potentional of the wrist was not used as yet. The children seemed not to be disturbed by the sound produced by the prosthesis motor.

After about foru months the child had an appointment for a check-up, this was sometimes followed by a second period of training in the department of occupational therapy. The intensity of this second period was also dependent upon the results achived by the child,the distance away from home and the degree of fatigue shown.

Now the children used their prosthesis steering the handle-bars of a bicycle and pushing a trolley or a doll's pram. The cylinder grip, which is required for this, demands less co-ordination than picking up and moving small objects. However there were some shildren who could move an object without it falling. Play activities which require incorporation of the prosthesis hand were then possible, for instance with construction materials. Some children needed encouragement to keep using the hand.

In the third period of training, about six months later, it appeared that the children were capable of more complex and co-ordinated actions, such as tearing paper. The feel for correct adjustment of the prosthesis started to grow now. Also involuntary opening and closing of the hand was less. The oldest child, who was old enough for the A.D.L.-training, was able to dress herself almost completely after this training-period. Small buttons and shoe-laces ceased to be a problem for her. At school she was able and had the courage to follow almost all physical training classes. But putting on the prosthesis herself was clearly still too difficult for her.

The full function of the prosthesis was now used more by the children. Also the passive roation of the wrist became more integrated in normal actions. Although in the course of time, we could see similarities in the possible uses of the prosthesis being employed, all children individually showed big differences in understanding the action of the hand and also differences in the speed at which they acquired skills.

Provisional conclusions

In 1979 the first Swedish myoelectric prosthesis for pre-school children was issued in the Netherlands. Now, in 1981 the number of children for whom the prosthesis is suitable, according to the parents as well as the treatment-team, is growing steadily. The period that we are looking back upon now seems too short to enable us to draw reliable conclusions.

We do wish to express the opinion that it is essential to give the parents realistic and accurate information regarding the potentials and limitations of the prosthesis. The treatment-team cannot completely control all the information received by the parents.

Press reports and other forms of publicity often create high expectations in parents and this also has an influence on the child. For a number of parents the cosmetic aspect of the prosthesis plays an important role, in the sense that this has a psychological function for parents (3).
We have experienced that giving instruction to the parents about the way in shich they can stimulate the child at home is of the utmost importance. The situation at home influences the child strongly.

It is too early to say that a child has more functional benefit from the m.p.p. than the conventional hook. The m.p.p., however, gives a more natural movement pattern and offers a better pincergrip in some activities, this more true pincergrip disappears as soon as a bigger hand is used.

During the non-specific use of the prosthesis the hand should remain closed, however, in spite of adjusting the opening-electrode the hand continued opening and closing, especially during the first period of training. Switching off the action of the prosthesis with the swithch did not seem a real solution because this would interfere with a rapid integration of the hand. The child would not be able to understand why the hand sometimes does and sometimes doeas not work and will also become less interested if the hand does not open at the moment he wants to do something with it. At a later stage it also became apparent that the switch under the glove unexpectedly turned off. It was then decided to remove the switch. The disadvantage of this is that the batteries become flat more quickly by the continual opening and closing of the hand. Also the chance of accidents such as unexpectedly gripping the other arm or the legs is bigger, due to the fact that the child is not yet completely used to the situation.

The biggest problem is the glove. It braks very quickly, usually in the same place, namely the nail of the index finger. The result is that parents have to purchase a new glove, on avarage each month, which is rather expensive. Apart from this we have had few technical problems with the m.p.p.

The results of our experience which I have summarised, and the development in the field of prosthesis application, indicate that work in this area should be continued.

References

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