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# Early Mobility Aid for Non-walking Children

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## INTRODUCTION

The early establishment of mobility in children born with multiple congenital amputations and limb deficiencies is of paramount importance. The child's inability to manipulate objects, explore the environment, and function independently in an upright position can result in limited cognitive development. Prompt intervention is necessary to prevent this degenerative cycle from compounding the child's disabilities. A dominant concept in the field of cognitive development is Piaget's theory which emphasizes the importance of object manipulation for successful, early concept formation.[3] Although children with multiple congenital amputations cannot manipulate objects or move about using their own limbs, they can develop early concept formation by observing the actions and words of people around them. However, because the child's exposure to these activities is often limited by the amount of time that an adult is willing to donate, it is not surprising that some of these children have not developed normal cognitive functions.

Currently, devices used to provide mobility to most children with multiple limb deficiencies fall into three categories:

1. A socket fitted to a base with small wheels or casters (Figure 1).[2]
2. A pylon-type swivel walker (Figure 2).[4]
3. An electrically powered cart (Figure 3).[5]

All three of these options present problems that often cannot be overcome. The socket on casters[2] requires upper limbs or prostheses for propulsion. The swivel walker[4] (which was popular in Australia and Canada during the late 60's and early 70's, but was not widely used in the United States) requires great energy expenditure. Also, as the child grows and the center of gravity is raised, the walker may become dangerous. The electric cart[5] has provided the best opportunity for mobility to this group, but it is not widely used because each cart must be custom fabricated at a specialized center with most adjustments and repairs made at that center. Initial costs, as well as the costs of returning it to the center, often are prohibitive.

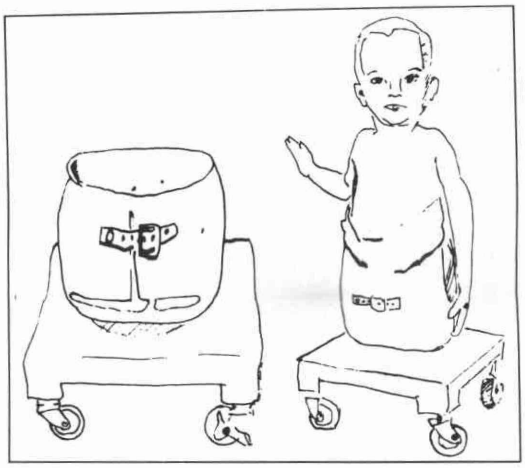

**Figure 1. Socket mounted on caster base.**

## EVALUATION

The Rehabilitation Engineering Lab (REL) at The University of Texas Health Science Center at San Antonio recently was asked to help evaluate a two-year-old congenital amputee with bilateral upper limb amelia, hip disarticulation on the right, and proximal femoral focal deficiency (PFFD) with hemimelia on the left.

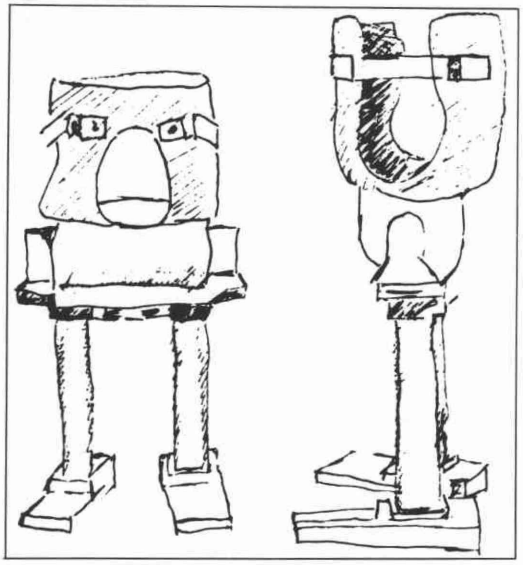

**Figure 2. Swivel Walker.**

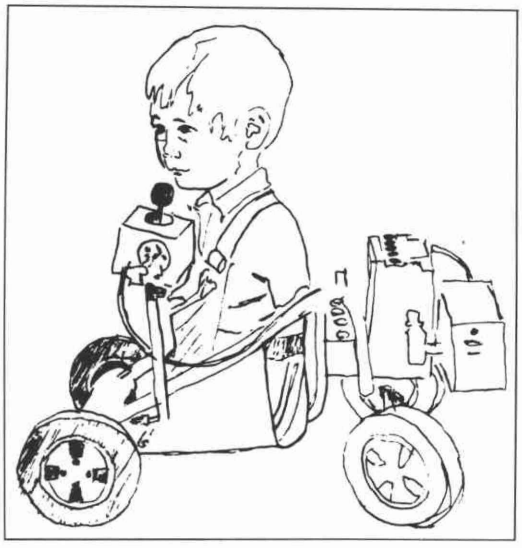

**Figure 3. Electrically powered cart, custom fabricated.**

The child could move by log rolling. Toys could be manipulated to some extent by head, neck and trunk movements, but most toys had to be placed in position. The child could pick up objects with the mouth and with the toes. The child seemed to have appropriate cognitive development skills and was very curious about the environment. The referring orthopedist was not in favor of prosthetic fittings at this time.

After the initial interview with the child and family, the rehabilitation team considered the available mobility devices. The limitations discussed above and the 120 mile distance of the family's home from the center made it necessary to examine alternative options. To solve the immediate mobility problems, we considered relatively inexpensive, commercially available electrically powered toy cars.

## DESIGN PROCEDURES

The rehabilitation team wanted a commercially available system that could be delivered to the family the first visit with minimal customizing required. It was decided that a "joystick" system for total operation of the vehicle was the most appropriate way to proceed.

We decided that a vehicle produced by Hedstrom, Inc,[1] The Probe VI, had the most features suitable to our needs. These included size, weight, simple drive mechanism, and an electrical system. Also, it appeared that this vehicle would require minimal modification. This toy vehicle is a battery powered six wheel vehicle with a molded body. The vehicle comes complete with two six volt gel batteries, which power two six volt electric motors. The six wheel design provides good stability (Figure 4).

The joystick allows forward, reverse, right, and left turns. An additional advantage of the Hedstrom vehicle is the small turning radius made possible by the steering system. This system cuts power to the drive wheel on the side of the direction of the turn. When the joystick is in the forward or reverse position, equal power is applied to drive wheels on each side of the vehicle.

## DISCUSSION

The child came to the REL for an introduction to the modified vehicle. The joystick was adapted so that the vehicle could be moved without the operator sitting in it. A safety strap and foam pad were added to aid in sitting balance. The child was able to operate the cart by remote control while sitting in the mother's lap. After a few minutes, the child was placed in the vehicle and soon was operating it (Figure 5).

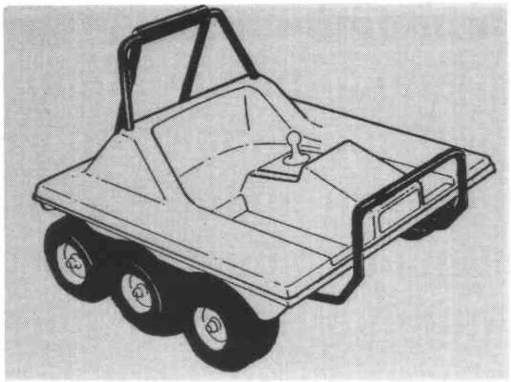

**Figure 4. Probe VI.**

The family was instructed in the vehicle's operation and sent home to practice. The total retail cost of the cart was $170.00. This vehicle should be sufficient as a mobility aid for several years with proper training and supervision. A vehicle of this type can be used as a mobility aid for children aged 18 months to seven years.[6]

Early mobility has been provided to a child with multiple limb deficiencies by minimal modification of a relatively inexpensive toy, an electrically-powered vehicle. The device was readily acceptable to both the patient and family. Such devices can give small children with similar disabilities a new dimension of mobility and represent an easily affordable adjunct to their rehabilitation.

## ACKNOWLEDGMENTS

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**Figure 5. Child in modified Probe VI.**

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