THE GOBOT:
A TRANSITIONAL POWERED MOBILITY AID FOR YOUNG CHILDREN WITH PHYSICAL DISABILITIES

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ABSTRACT

The following paper describes a new and innovative mobility aid, the GoBot, designed for children under the age of six years who have a physical disability, which limits their ability to achieve self-initiated mobility. The GoBot was developed at the Rehabilitation Engineering Center, Lucile Packard Children's Hospital at Stanford from 1991 to 1995 through a grant (Grant H189P00018-91) from the U.S. Department of Education, Office of Special Education Programs. The original team included an Occupational Therapist, Rehabilitation Engineer and Design Engineer. The GoBot is now being manufactured and distributed by Innovative Products Incorporated.

INTRODUCTION

During the first three years of life, children become mobile, learn to talk, play with toys, interact with peers and explore the environment. Infants transition through several stages of mobility during the first year from belly crawling to rolling, creeping, crawling and finally to an upright posture for ambulating (Bly, 1994). Young children are typically observed being in a state of perpetual motion, reaching out to their environment. In contrast, children who have physical limitations, such as those who are unable to stand and ambulate independently, are typically limited in their ability to reach out to interact with their environment. They are often restricted to static positions such as on the floor, in a stroller or positioned in therapeutic equipment such as a standing frame. They have few opportunities to act upon the environment rather the environment has to be brought to them.

Until recently, there were very few options for a child with severe physical disabilities, such as cerebral palsy, to achieve self-initiated mobility to interact with the environment. If the child could not use a manual walker, the only alternatives were to use a powered wheelchair or an adapted toy vehicle (Wright, 1997). Adapted toy vehicles are noisy and cannot be used indoors, where young children spend a majority of their time. A power wheelchair can be costly, ($15,000-$20,000) particularly if the child requires a custom seating system and alternative controls such as switch input rather than a joystick. Health care professionals are often reluctant to recommend a power wheelchair for a

young child and do so only if the child can demonstrate excellent driving skills. Could a new type of mobility device be designed that would provide young children with the ability to explore the environment by allowing children to move close enough to reach and touch people and objects around them? Could the device provide a transitional means of mobility for the child to experience the sensory and perceptual aspects of mobility: vestibular, proprioceptive, visual perceptual, spatial relations and problem solving? Could this device be made available for a cost more equal to custom orthotic mobility aids ($4,000-$5,000) rather than the cost of a power wheelchair ($10,000-$15,000)? The GoBot, originally designed as the Transitional Powered Mobility Aid (TPMA), is such a mobility device (Wright, 1998). It is specifically designed to provide children as young as 12 months of age with the ability to achieve developmentally appropriate mobility for the purpose of exploring, while standing upright. The GoBot enables these children to explore the environment while assisting in transitioning them to other methods of mobility such as a walker, manual or power wheelchair.

PRODUCT DESCRIPTION

The GoBot (Figure 1) consists of an adjustable positioning frame attached to a battery- powered base, which can be driven with a joystick or up to four switches. The frame is easily adjusted without the need for tools to accommodate children from 12 months to 6 years of age. It has been designed to accommodate children with various positioning needs such as those with low muscle tone or weakness and children with spasticity or reflexive posturing. Children can be positioned in standing, semi-standing or in a seated position by adjusting the positioning frame's height in relation to the height of the footplate. Features of the positioning frame include a seat which slides backwards between the vertical backpost to allow for hip extension for positioning children in standing. The seat can be also be adjusted forwards for children requiring more support under the pelvis and thighs as when sitting or semi-standing. The vertical backpost unlatches and swings down to easily

Figure 1: Photo of the GoBot

transfer the child in and out of the GoBot by one adult. The anterior trunk pad's vertical post is mounted to an adjustable sprocket joint to adjust the pitch of the child's trunk, either forwards or backwards. There is one strap around the backside of the anterior trunk pad, which fastens behind the child's back. The GoBot was purposely designed to be restraint free for the child. This encourages the child to use movements and weight shifting when reaching and exploring objects. Kneepads are available to provide support to the knees during standing or semi-standing. The pads are curved longer on one side than the other to provide lateral support at the knees to reduce abduction of the hips. The pads can be removed from the posts and rotated to provide medial support at the knees to reduce adduction of the legs. However, it is preferable to not use the kneepads so the child has the ability to move the legs freely.

The base of the GoBot houses the electronics, driving mechanisms and the 12-volt battery. It can drive about 8 miles before needing to be charged. Speed is variable up to 4 miles per hour. It is operated by a joystick or up to 4 switches. A multi-adjustable, five-sided tray allows for placement of switches in any location so the child can maneuver the GoBot by using movements of the hands, head or feet. Most children who use switches to maneuver the GoBot prefer using their hands, because they are able to see the switches. A timed latch mode is available which allows the child to travel a distance without maintaining contact on the switch. A remote joystick is available for controlling power on the GoBot from a distance.

ENVIRONMENTAL CONSIDERATIONS

The GoBot is best used in an environment designed to facilitate exploratory experiences, such as Mobility Technology Day Camp (Wright, 1997). Such an environment encourages successful exploration and problem solving experiences. The children use the GoBot in a large room where they can get close to the walls, shelves, cabinets and doors, reaching and touching objects they have never had an opportunity to get near. Developmentally appropriate activities are introduced at each session such as pushing and pulling toys, knocking down blocks, looking into large boxes, kicking balls, watching themselves in a wall mirror while moving around the room and playing hide and seek with peers. The children often experience for the first time new sensations such as vestibular from moving fast and in circles; propioceptive sensations from bumping into walls (which is referred to as "finding" the wall) and visual perceptual experiences while watching people and objects while moving themselves through space.

SUMMARY

The GoBot is both an educational and therapeutic tool intended to provide a means for children with physical disabilities to explore the environment

using upright, self-initiated mobility to experience a course of development more equal to their able bodied peers. It is intended for young children who would otherwise spend their developmental years sitting passively in a stroller or manually dependent wheelchair. The GoBot may facilitate development in the areas of language, socialization, self-esteem, visual-motor and upper extremity function. It is not intended to replace the need for a power wheelchair. Rather, it is a tool for providing children with exploratory or transitional mobility experiences, which may lead to functional mobility (Wright, Egilson, 1996).

ACKNOWLEDGEMENTS

The following people are recognized for their contribution to this project: The project team contributors, Margaret Barker and John Wadsworth; parents and children of subjects included in the project; therapists and teachers who participated in interviews and trials; volunteers Snaefridur Egilson and Marilynn Jennings; RJ Cooper, Jim Steinke; Phil Disalvo and the staff at the Rehabilitation Engineering Center, Lucile Packard Children's Hospital at Stanford, now known as the Rehabilitation, Technology and Therapy Center.

The GoBot has been licensed to Innovative Products Incorporated, 830 South 48th Street, Grand Forks, ND 58201, the sole manufacturer and distributor of the GoBot.

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