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ABSTRACT

Mobility provides young children with the opportunity for many developmental experiences. Children with spina bifida have physical limitations which hinder these developmental experiences. This paper describes two assistive devices designed to provide age-appropriate independent mobility, the Caster Cart and Crutchless Standing Orthosis.

INTRODUCTION

Children with physical limitations are denied many normal experiences, usually taken for granted, that enhance social and psychological development. A wide variety of assistive devices are available to provide some of these experiences in an age-appropriate manner. This paper presents two devices developed and fabricated at Gillette Children's Hospital in St. Paul, Minnesota.

A large number of the clients served at Gillette are children and young adults with Myelomeningocele or Spina Bifida. The majority of these young children have significantly limited muscle function of their lower extremities. Normal children are becoming very mobile on the floor before one year of age, yet this mobility is physically difficult or impossible for infants with Spina Bifida. These devices provided here provide important mobility and hands-free standing as a means to more normal, enjoyable and useful activities for the child.

Preliminary designs of these devices were adapted in the early 1970's from a general use in a child paraplegic program developed by Walt McClich and others at the Oregon Crippled Children's Caster. The devices currently fabricated at Gillette have several differences, described below in design features, that have increased their usefulness for our clients.

CASTER CART

Condition of Need

Children use a remarkable amount of mobility in discovering their environment and building their self-image. Limitations to a child's independent mobility naturally increase opportunity for many early developmental experiences, such as altering one's environment, discovering cause-affect relationships, or interaction with one's peers. The castor cart fabricated at Gillette, described below, is simple in its design, but has been used to provide independent mobility to a large number of our young clients with Spina Bifida.

The very close proximity to the floor (about 1-1/2") allows independent transferring to the child, and it's use simulates sitting and playing on the floor. There is also extra room on the cart to carry toys and pets while keeping hands free to propel the cart's wheels. The castor cart's design allows free rolling and is highly maneuverable. Sitting support is provided as needed.

Design Features

1. The castor cart is positioned 1-1/2 inches above the floor. For independent access and peer-level interaction.

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We have used to different shell designs, both light in weight. Design drawings for an aluminum shell are available and may be easier to fabricate in certain facilities. The shell of the cart we currently provide is vacuum-formed from ABS plastic. The contoured edge and two vane-mounted aluminum bars contribute to the shell's rigidity.

Sitting support is provided by a contoured seat, as shown, which is made of polypropylene. Minimal support is supplied to give required trunk stabilization with maximum upper body freedom.

There are two large wheels and one caster attached to the center cart. The two large wheels are located on one side for propagation and the cart is located beneath the front center portion of the cart. Aluminum plate inserts are vacuum-formed into the side of the shell to strengthen the axle mounting. An important feature of this cart is the high-quality wheels, which maximize the cart's maneuverability and minimize the energy required for propulsion.

The overall design differs from the G.C.L.C. cart in that the car is smaller and located forward. The wheel design also incorporates one more wheel, the back of the cart which gives better lateral access to the floor.

CRUTCHLESS STANDING ORTHOSIS (CSO)

Discussion of Need

Standing is a position that has physical, developmental, and psychological benefits. The Gillette type Crutchless Standing Orthosis (CSO) has developed over the past 11 years and is presently custom fabricated for many of our Spina Bifida clients from ages of one year to six years. Some users choose to continue use of their CSO up to age nine or ten. The CSO is designed to accommodate growth with simple modifications. Positioning and dressing is easy and quickly accomplished which helps the CSO be well accepted by both children and parents.

The minimal weight of the orthosis is very important, particularly for use with the small child. Gillette recognizes the quality of other standing orthosis designs but we have chosen our own design to decrease weight.

There are several physical benefits of the CSO. Daily weight-bearing sessions on lower limbs will maintain joint strength and decrease tendency toward osteoporosis and recurrent fractures. The upright position is reported to also improve overall urologic function in addition to general improvement in circulation and respiration. Standing will also provide additional stretch to assist non-progression of muscle contractures, particularly about the hip and knee.

The social benefits of the standing experience can be dramatic. As peers begin to walk, effective interaction is enhanced when eye-level positioning is provided. Interaction is also enhanced when mobility is provided to move freely and play with peers. With a small amount of upper limb strength, the child can move to begin to move about with a walker. Many of our children with good balance and coordination learn to "walk" with their hands free, through a rhythmic thoracic rotation. Upright positioning and walking toward locomotion will exercise residual muscle strength. Playing ball, pushing a baby buggy, brushing teeth and helping with household chores are some examples of activities of our clients using a CSO.

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Concluding Statements

The mobility devices described in this paper have been used widely by our client population. Some mothers feel the caster cart has been the single most useful tool for their child.

Efforts are being made to explore the feasibility of commercial production of these devices. Custom fabrication can easily be accomplished for small quantity applications and specification drawings are available at Gillette.

Technical support for the fabrication of these devices has been provided by David Lawros, Rick Weber and others of the Orthotic and Prosthetic Lab at Gillette. Please direct any questions regarding the fabrication and usefulness of these mobility devices to the authors at:

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