

CONSIDERATIONS IN THE DESIGN OF A SAFE AND EFFECTIVE GAIT TRAINING ORTHOSIS

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INTRODUCTION

For the child with cerebral palsy, being able to walk with a conventional type of walker is often not possible due to spastic upper extremity involvement, low tone trunk, poor balance, weak upper extremities or lack of lower limb control. Ambulation for these children may only be possible through the use of a hands-free gait training device that provides weight bearing regulation, trunk support and lower limb guidance.

With an increase in the number of devices on the market and the various anecdotal claims, it is important that one carefully ask a number of key questions concerning the design of a device prior to recommending it for a child. It is essential that device designs be developed based on scientific fact and with input from consumers. Safety must also not be compromised.

This paper outlines the key features needed to provide a safe and effective gait training orthosis.

FUNCTION

Directional Control – during initial use, the child may need directional guidance, which can help them concentrate on the task of walking. Later the steering control can be reduced or taken away as needed. Having unilateral control of steering is even more beneficial since some users tend to veer in one direction due to limb dominance.

Pelvic Rotation – this is an important consideration since this is one of the determinants of gait. Providing adjustable rotation at the pelvis allows for improved step length and more natural ambulation. Not accounting for this important issue also means the hip rotation will be translated to excessive wobble of the front wheels and horizontal translation of the frame.

Center of Gravity – allowing for proper tracking of the center of gravity while providing consistent lift support throughout the stride length is important.

Limb Guidance – very important when there is scissoring and excessive internal rotation of the lower limbs. Device must reduce undesired forces in order to provide proper alignment and allow clearance of the limbs during the swing phase.

EASE OF USE

Tool-Free – not needing tools to connect/adjust the device makes for a caregiver-friendly device. Having to use a hex key to connect the shoes for example would slow down the donning/doffing process.

Adjustability – making the device easily adjustable can make it much easier for caregivers and therapists to make minor changes.

Growth Adjustment – growth allowance is important but must be made *without compromising safety* or the mechanical integrity of the device.

Quick Release Buckles - a quick connect/release fastening system is needed to allow parents/caregivers to put the child in and out of the body component quickly and easily. It also allows the device to be donned consistently with the right amount of strap tension each time. This is very important in settings where various caregivers may be placing the child in the device.

SAFETY

Brakes – important for safety and function. Braking system can be used to position a child at a desk to perform hands-free activities. Brakes can also prevent roll back during stepping and on inclines. Assist with transport.

Component Integrity – device needs to provide adequate lift support for a wide range of children. Additionally adequate strength of materials is needed, such as in the leg uprights to reduce scissoring.

Steering – selectable control initially to maintain desired direction of travel.

Frame Configuration/Dynamic Stability – having an adequate base of support for a user's height & weight is critical. Frames with a narrower base of support can have a 20 to 63% greater chance of tipping (depending on design) than a square frame. The frame configuration is also very important to allow unimpeded movement of the limbs.

ACCEPTANCE

Aesthetics/Colour Choices – providing colour choices in the straps and frame of the device helps lead to greater acceptance of the product. Feedback from consumers should be an essential part in the design of such a device.

Comfort – the use of resilient high density padding in key areas, wide bands and straps should be provided.

Portability – device needs to be collapsible or break down into component parts to easily fit in the family vehicle.

Low Maintenance – a low maintenance device helps reduce service costs for the family later.

CONCLUSIONS

Choosing the appropriate type of gait training device for each child is essential for a successful functional outcome so that all the benefits of upright mobility and posture can be realized. A team approach is often the best way to determine suitability.

An inappropriate prescription could lead to incongruency between the individual's needs and the device's capabilities to the point where safety may be compromised. However, for the suitable candidate, the benefits of a safe and effective gait training device can make a big difference to the child's physical and emotional well being.

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