



A Case Study On The Use Of Theratogs® With Conventional Physiotherapy On A Child With Cerebral Palsy, GMFCS Level V

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Abstract.

Children with Cerebral Palsy (CP) exhibit postural malalignment due to muscle imbalance and spasticity. Studies have shown that orthotic garments can help improve posture in such children by reducing fluctuations in tone and contracture of muscles. Orthotic garments have also been shown to improve spinal geometry in children with CP. The aim of this study aims to determine the effect of orthotic garments (TheraTogs® WUNZI) on a child with CP and GMFCS levels V along with conventional physiotherapy. In this study, the child received physiotherapy five times a week and wore the TheraTogs® for 6 hours daily. The outcome measure used in the study were GMFM, posture evaluation with images and patient satisfaction. The results of the study showed that the TheraTogs® has a positive influence on posture, and it also helped in improving gross motor function. Further randomised controlled trials are needed on children with GMFCS level 5 to validate our findings.

Keywords: TheraTogs®, Cerebral Palsy, Posture, Motor Function.

1 Introduction

Children with cerebral palsy (CP) often exhibit postural malalignment due to muscle imbalance, spasticity, and misaligned joints (Abd El-Nabie and Saleh, 2019). Several studies have shown that orthotic garments can provide the structural correction that can help improve posture and functional abilities in children with CP (Flanagan et al., 2009).

Orthotic garments produce interface pressure that holds the patient's limbs while in a static or dynamic posture (Shaari et al., 2020). The garments reduce fluctuations in tone and contracture of the muscles to improve postural alignment and stability (Bahramizadeh et al., 2015). As the garments are close-fitting and elastic, they are thought to provide additional proximal segment stability in children with CP (Abd El-Kafy, 2014).

Most orthotic garments studies have been done in children with Gross Motor Function Classification System (GMFCS) levels I to III, focusing on spatiotemporal gait parameters (Almeida et al., 2017). Fewer studies have been done on children with GMFCS level IV or V.

The lack of seated postural control in children with GMFCS levels III to V leads to reduced functional activities. The children have difficulties carrying out their activities of daily living (ADLs). They have impaired reaching, eating, swallowing, and speaking due to a lack of trunk and head control (Dalvand et al., 2012; "Self-Reported Health Status and Quality of Life in Youth With Cerebral Palsy and Typically Developing Youth - PMC," n.d.).

Orthotic garments have been shown to provide extra-proprioceptive information, enhancing body awareness and improving posture in children with CP (Attard and Rithalia, 2004). However, more studies are needed to effectively evaluate the impact of orthotic garments on postural control in children with CP, especially GMFCS levels IV and V.

This study was undertaken to evaluate the effect of orthotic garments (TheraTogs® WUNZI) in combination with conventional therapy in improving the posture and function in a child with CP, GMFCS level V.

2. Patient information

A 17-month-old child with a clinical diagnosis of CP (Mixed spastic and dystonic quadriplegia with epilepsy), height, and weight received the diagnosis at eight months. Clinical evaluation showed spasticity with the topographical setting of quadriplegia.

3. Examination findings

The subject showed a gross motor level of V on the Gross Motor Function Classification System (GMFCS) (Rosenbaum et al., 2008). In the assessment of the motor system, the following patterns were observed:

In the supine position -the child had difficulty moving the hands symmetrically with the neck; the child has difficulty in transitioning from supine to prone and needs maximum assistance; she is unable to cross the midline with the upper limbs; the child keeps her hands to the sides with the elbow flexed and hands fist; When placed in prone position child can lift her head for less than 5 seconds; a child cannot clear the chest; unable to go prone on elbows; supported sitting requires maximum support at upper trunk; sacrum sitting; sitting with kyphosis; with the hip flexed and knees off of the plinth; a child cannot hold her neck in midline holds the neck in the midline for 1 second; poor righting and equilibrium reactions in supine, prone and sitting. The child has persistent tonic reflexes absent parachute and landaus reactions. The subject presents with rounded shoulders, flexed elbows and fists, and flexed and abducted hip and feet plantarflexed.

The child has received regular occupational therapy early intervention since she was eight

months old for 30 minutes, five days a week. She started receiving physiotherapy intervention at 12 months of age, five times a week, each session of 30 minutes. She was advised to start chair-supported sitting on a modified chair.

The Datta Meghe College of Physiotherapy ethics committee approved the study. The parents signed informed consent. This study used the TheraTogs® WUNZI system, consisting of the vest and the child receiving conventional physiotherapy treatment five days a week, each session lasting 30 minutes. The TheraTogs® system WUNZI was used to improve trunk extension, reduce protraction and provide proprioceptive inputs to the child for maintaining the posture.

3. Intervention

After the initial week of adaptation, the child wore the orthosis for 4hrs to 6 hours each day. During the initial week, the child wore the orthosis for about an hour or two hours, which gradually increased to 6 hours as per the child's tolerance. The caregivers were trained and given a step-by-step guide to putting on the TheraTogs® WUNZI.

The Gross Motor Functional Measure (GMFM) scale was used to assess the progress of the child pre and post-use of Theratogs® ("Comparison of Reliability and Validity Between GMFM-88 and GMFM-66 in Children With Cerebral Palsy -Physical Therapy Korea," n.d.). The child received three months of intervention. It included physiotherapy treatment for 30 minutes with TheraTogs®, and the child continued using TheraTogs® WUNZI for 4 to 6 hours during her daily activities.

4. Outcomes

4.1 Gross Motor Function Measure-88

The Gross Motor Function Measure-88 (GMFM-88) is a valid and reliable clinical evaluation tool that measures the change in motor skills in children with CP (Ko and Kim, 2013). It consists of 88 items organized into five dimensions: (1) lying and rolling; (2) sitting; (3) crawling and kneeling; (4) standing; and (5) walking, running, and jumping. Item scores range from 0 to 3 (0 = does not initiate to 3 = completes).

The GMFM-88 scale was used as an assessment tool in this study. GMFM score was measured before the start of the intervention and at the end of 3 months. GMFM scores for lying and sitting dimensions were recorded both at the start and end of the intervention. GMFM-88 is a valid and reliable outcome measure to assess a child with CP15. GMFM score at the start of the intervention for Lying dimension A was 15 %, and for the sitting dimension B was 2%. The total score was 3.4 %. The child showed improvement in both dimensions of the GMFM score.

Post-intervention at the end of three months, the Lying score increased to 29 %, and the sitting score improved to 13%. The sitting dimensions markedly improved post-intervention.

4.2 Posture assessment

The floor sitting was assessed in frontal and right-sided view. The child needed support at her trunk to maintain the tripod sitting posture. The child could not hold her neck in the midline for more than a second.

Observational analysis was done using the images. The child improved trunk extension and neck holding immediately after wearing the TheraTogs®. The images were taken just before donning the TheraTogs® in the first session and immediately after wearing the TheraTogs®. The pre-intervention and post-intervention images are as follows.

The images were taken in the post TheraTogs® intervention at three months. The pre TheraTogs® images were compared with the post-intervention images. The child showed improved sitting in pictures taken after the TheraTogs® intervention (Figures 1 and 2). The neck position improved in the post-intervention images. The child could sit in a tripod sitting position without support for about 10 seconds or more. On occasion, she could sit for about 45 seconds before falling.

4.3 Patient satisfaction

Patient satisfaction was assessed using interview questions (“Wearables for Pediatric Rehabilitation: How to Optimally Design and Use Products to Meet the Needs of Users | Physical Therapy | Oxford Academic,” n.d.). The questions were nonstandardized. The questions regarding the time duration of the

Thera Togs® usage during the day, the ease of donning, the time required to put the Thera Togs® on, and if they see any changes in their child or not were asked in the questionnaire.

According to the parents, they found that the Thera Togs® wearing made a positive difference in their child. They were using Thera Togs® each day for about 6 hours. It took 10 minutes for them to put it on. The child did not mind wearing the orthotic garment. Although the cost of the Thera Togs® was a concern, the parents indicated that they would purchase the orthotic garment again.

5. Discussion

The child showed improvement in the GMFM lying dimensions. The improved neck extension in prone lying. The child could complete the range and be able to hold the neck in extension. The child was able to initiate rolling on both sides, although the child still could not complete the roll. The child's supine lying items on GMFM did not show any change after the TheraTogs® intervention.

The sitting dimensions GMFM score also improved. The child started sitting on the mat with support from the therapist. The neck control improved, and the child could hold her neck in the midline for more than 10 seconds. The child started to sit propped up on their arms for more than ten seconds with the support. The GMFM total score improved from 15 percent to 31 percent. The markedly improved score in sittings dimensions could be attributed to wearing TheraTogs® during the therapy and during the ADLs of the patient.

The study by Shamekh Mohamed El-Shamy showed that spinal geometry is improved in children with CP receiving a combination of conventional therapy and TheraTogs®. The TheraTogs® system helps with alignment during the therapy session. The improved alignment assists the muscle action and improves the joint positions. This further improves movement patterns and corrects abnormal body positions by correcting the imbalance of nonstructural elements (El Kafy and El-Shamy, 2021; “The Immediate Effects of a Dynamic Orthosis on Gait Patterns in Children With Unilateral Spastic Cerebral Palsy: A Kinematic Analysis - PMC,” n.d.; “Treatment of cerebral palsy and motor delay,” 1983).

Wearing TheraTogs® with a strapping system creates a sense of compression for the child. This vertical stiffness to the spine, upper body, and trunk reinforce the child's core stability. The studies have also shown that soft orthotics help enhance trunk stiffness and proximal stability, improving the spatial orientation of the body and thus positively influencing postural control.

On posture evaluation, the child showed improvement in the kyphotic posture and sitting balance at the end of 3 months. Many studies have proposed that TheraTogs® improves proprioception and tactile inputs. It helps correct the alignment, thus providing optimal muscle length, also improving muscle firing. It enhances static and dynamic balance. The tripod sitting posture improved. The external hip rotation improved post-intervention. This is in consensus with the study of Shamekh Mohamed El-Shamy et al. According to the study TheraTogs® when used for an extended period of time, might act as a reflex-inhibiting pattern for the limb, which is spastic, adducted, and externally rotated. The continuous inhibiting inputs provided may dampen the overexcited group of muscles.

The limitations of this study are that we could not use postural analysis due to limited resources. The study evaluated the combined effect of the TheraTogs® system and conventional therapy but did not evaluate the effects of both interventions independently.

6. Conclusion

Combined with conventional therapy, the TheraTogs® WUNZI system improved posture and gross motor function in the child with CP, GMFCS level V when worn for three months, six hours a day. The patient's caregiver did not report any compliance issues during the intervention. Further studies are required to see if a similar improvement can be seen in a larger population of children with CP, GMFCS level IV, and V. Also, the effect of orthotic garment intervention on posture and postural control in children with CP needs to be studied.

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Figure 1: Immediate effect of TheraTogs® on sitting posture frontal view. A. Before TheraTogs®, B. After TheraTogs®



Figure 2: Immediate effect of TheraTogs® on sitting posture, side-view. A. Before TheraTogs®, B. After TheraTogs®



Figure 3: Post-intervention images at three months A. Frontal view, B. Side-view