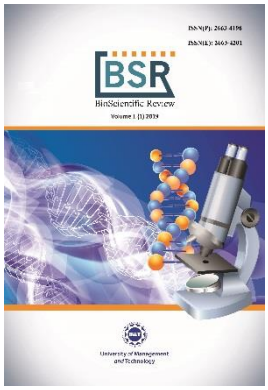

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Case Report

Immediate Effect of Vertibrace Dynamic Orthosis on Gross Motor Function in a Child with Spastic Cerebral Palsy: A Case Study

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Abstract

Children with spastic cerebral palsy usually display a decline in their gross motor functional abilities as compared to their peers of the same chronological age. Orthosis has been used widely to manage spasticity, prevent contractures, maintain the range of motion and improve motor function. The purpose of the study was to see the immediate effect of Vertibrace Dynamic Ankle Foot Orthosis on gross motor function abilities of a child with spastic cerebral palsy. A child with spastic cerebral palsy level I on gross motor function classification system was selected to wear the Vertibrace Dynamic Ankle Foot Orthosis. Gross motor abilities were assessed before and after wearing the orthosis using the gross motor function measure. Vertibrace Dynamic Ankle Foot Orthosis showed an immediate improvement in the gross motor abilities by 3% in the child with spastic cerebral palsy with regard to kneeling, walking, running and jumping. Hence, Vertibrace Dynamic Orthosis can be prescribed for enhancement of gross motor abilities in children with spastic cerebral palsy. Further randomized control research about the effects of Vertibrace Dynamic Ankle Foot Orthosis is recommended by assessing a larger number of subjects and evaluating different variables.

Keywords: Vertibrace Dynamic Ankle Foot Orthosis, gross motor function, Cerebral Palsy (CP)

1. Introduction

Cerebral Palsy (CP) is a group of permanent movement and posture disorders which results from a non-progressive lesion or abnormality in the immature brain that leads to the impairment of motor function (1). CP is a well-recognized neurodevelopmental condition that persists throughout life (2).

The symptoms of CP in children are often complex and wide ranged including spasticity and impaired motor function such as deficits in sitting, standing, locomotion and daily living skills in addition to cognitive, social and emotional impairments that some children may experience (3). Gross motor abilities are essential for participation in physical activities in all children. Children with spastic CP experience lack gross motor functions due to spasticity, lack of the precise spatial and temporal activities (4).

Ankle Foot Orthoses (AFOs) or the orthotic management in children affected with CP aims to generate normal gait pattern through proper positioning of peripheral joints or by blocking pathological movement of the joints (5).

A wide range of different types of AFOs is used in clinical practice; each is characterized by its unique design and constituent material that enable different levels of stiffness and ankle control.

The most frequently prescribed orthosis are Solid Ankle Foot Orthosis (SAFO), Dynamic Ankle Foot Orthosis (DAFO) and Floor Reaction Orthosis, also known as Ground Reaction Foot Orthosis (FRO), Posterior Leaf Spring (PLS), or Hinged Ankle Foot Orthosis (HAFO) with a plantarflexion limitation facility. AFOs in general are designed to improve the efficiency of the

gait of children with CP by affecting positively on gait kinetics and kinematics, decrease the energy expenditure during walking and enhance the attainment of functional skills (6).

The Vertibrace Dynamic AFO is a new design of dynamic AFOs which provide the stability and dynamism that help in improving the motor functional abilities and gait functions in children with CP.

Immediate effect means to see the closer response of the modality used and asses its effects.

The aim of this case study is to discover the immediate effect of the use of Vertibrace Dynamic AFO on the gross motor abilities in a child with spastic CP.

It was hypothesized that there is no immediate effect of Vertibrace Dynamic AFO on gross motor abilities in a child with spastic CP.

2. Patient Profile

A 7 year old female with spastic CP was assessed via modified Ashwar Scale for spasticity and she was graded 1 which indicates mild spasticity.

The child was on level I in GMFCS which indicates that the child was independent in walking.

2.1. Materials

Vertibrace is a novel and dynamic AFO provided by Performance Laboratories.

It consists of two parts including a smaller outer rigid part that cups the ankle (Figure 1) and a larger inner flexible part that extends from the mid-calf muscle to the tip of toes (Figure 2).

Figure 1. Outer Rigid Part of Vertibrace Dynamic Foot Orthosis

Figure 2. Inner Flexible Part of Vertibrace Dynamic Foot Orthosis

The rigid part provides stability and the flexible part provides dynamism. The two parts are worn together while attached with each other (Figure 3 and Figure 4).

Figure 3. Vertibrace Dynamic Foot orthosis (Two parts attached) – Anterior View

Figure 4. Vertibrace Dynamic Foot orthosis (Two parts attached) – Lateral View

This unique design gives the child the stability which enhances balance and motor activities and also provides the dynamic ability which improves the gait and function.

2.2. Management and Outcome Results

The Vertibrace Dynamic Orthosis was chosen for the child in order to enhance functional motor abilities.

The child was assessed for gross motor functional abilities by GMFM-88.

Before the Vertibrace AFO application, all dimensions of GMFM-88 were assessed.

In Dimension A (lying and rolling), the child achieved 100%. In Dimension B (sitting), she achieved 93.3%. In Dimension C (crawling and kneeling), she achieved 97%. In Dimension D, (standing) 87% and finally in Dimension E (walking, running and jumping), she achieved 75%. With total score unaided, which means that no orthosis or aids were used during the assessment, she achieved 90.46%.

Immediately after wearing the Vertibrace AFO (Figure 5), and just a few seconds before the orthosis application, we assessed again the child's gross motor functional abilities using GMFM-88.

Figure 5: The child wearing the Vertibrace Dynamic Foot Orthosis

The percentage of achievements was still the same after the application of Vertibrace AFO in Dimension A (lying and rolling) and Dimension B (sitting) with 100% and 93.3%, respectively. On the other hand, the percentage of achievement increased after the application of Vertibrace AFO in Dimension C (crawling and kneeling) with 100% score, in Dimension D (standing) with 87% score and finally in Dimension E (walking, running and jumping) with 86% score. The total score achieved using Vertibrace Dynamic AFO was 93.26%. The improvements occured in dimensions that cover kneeling, crawling, walking, running, and jumping (Table 1).

Table 1. The Percentage of Gross Motor Function Using the GMFM-88.

Variable	Dimension A	Dimension B	Dimension C	Dimension D	Dimension E	Total Score
Without the Vertibrace dynamic AFO	100%	93.3%	97%	87%	75%	90.46%
With the Vertibrace Dynamic AFO	100%	93.3%	100%	87%	86%	93.26%

The previous results indicate 3% improvement in the gross motor abilities in a child with spastic CP immediately after using the Vertibrace Dynamic AFO.

3. Discussion

It was concluded previously that there was no immediate effect of Vertibrace Dynamic AFO on gross motor abilities in a child with spastic CP, however, this case study rejects the hypothesis and proves that Vertibrace Dynamic AFO improves the gross motor abilities of a child with spastic CP immediately after application.

This study chooses to classify the patient according to GMFCS because it was proved to be a valid tool in CP classification that proved to be successful for research purposes (7). Also, it is encouraged here to use GMFCS as a framework to identify treatment goals for orthotic management in children with CP (8).

The current study chose GMFM as the method of evaluation due to its high reliability and validity (9) which was confirmed by Ko and Kim (10) who found that GMFM has reasonable reliability and responsiveness. They applied it on eighty four children and they assessed both the interrater and intrarater reliability and it was found both were excellent.

CP declines the motor functional abilities in children (11). So, the main concern of all rehabilitation teams is to improve the gross motor abilities by using any successful evidence based measures that include physical therapy and exercises (12), Kinesiotaping, therapeutic suits like the Pedia Suit, the Thera Suit, the Penguin Suit, the Adeli Suit (13), and also different types of orthosis (13).

Orthotic management has always been vital in the rehabilitation process of children with CP. The main aim of lower limb orthosis, as declared by the International Society of Prosthetics and Orthotics, is correcting or preventing deformity, providing a base of support, facilitating skill

training and ultimately improving gait efficiency. Different types of AFOs are used for CP management as mentioned earlier. The dynamic AFOs are widely used for allowing and enhancing the dynamic functions in the ankle and simulating a normal gait pattern (14, 15).

Several studies have shown normal ankle kinematics, improved energy efficiency of gait, and normal push-off power at pre-swing following dynamic AFOs (16).

The dynamic AFOs used regularly were found to increase the gross motor function of children with spastic CP. Twenty three ambulatory children with spastic CP showed significant improvement in crawling, kneeling, standing, walking, running and jumping skills as measured by GMFM (17). This confirms our case study result as Vertibrace Dynamic AFO is considered as the new modification of the standard dynamic AFO.

Another study mentioned that dynamic AFO allow rapid acquisition of postural control and functional abilities and encourage its use in active therapy programs (15).

On the contrary, the dynamic AFO wasn't encouraged to be used in children with spastic CP as it was stated that dynamic AFOs increase the energy expenditure due to excessive dorsiflexion and it also caused an excessive increase in peak knee extensor moment (18).

Vertibrace Dynamic AFO is a new entry in the world of dynamic orthoses. It is suggested for patients with excessive plantarflexion, toe walking, hyperextension at the knee, mild to severe ankle instability, and mild to severe drop foot. Its unique design allows both stability and dynamic action that has been proven to increase the functional abilities in the child with spastic CP.

The results of our case study suggest aims and benefits of Vertibrace Dynamic AFO as the child showed an immediate increase in the gross motor abilities by 3% assessed using the GMFM.

4. Conclusion

The Vertibrace Dynamic AFO is proven to cause an immediate enhancement of gross motor abilities in a child with spastic CP especially with regard to kneeling, walking, running, and jumping. Further randomized control trials should be designed in order to prove the effects of the Vertibrace Dynamic AFO on different variables and subjects because a single case study is not enough.

Competing interest

None.

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