



Effect of Biological Functional Postural Training in an Adolescent with Cerebral Palsy – A Case Report

Prof Dr. CK Senthil Kumar^{1}, Prof. Ranjeeta Behera²*

¹Director, North East Christian University, Centre for Medical Education and Research, Nagaland. INDIA.

²Centre for Medical Education and Research, North East Christian University, Dimapur Nagaland, INDIA.

ABSTRACT

So much focus is being given to impairment-based physiotherapy intervention for cerebral palsy by the contemporary physiotherapist. When theoretically based interventions like Bobath's NDT emphasize tone-based interventions, literature-based interventions always support functional-based rehabilitation. We have treated a patient on a functional basis and presented it in this report. The purpose of this study is to evaluate the effectiveness of exercise interventions that may improve postural control in an adolescent with cerebral palsy (CP). The patient has performed a functional evaluation with pre and post-treatment with a follow-up of about 3 months. We found that the patient with adolescent cerebral palsy was found to be improving significantly when functional postural training was provided and it enhance the lower limb ROM, muscle power & strength, coordination, and functional performance of their daily living.

KEYWORDS: cerebral palsy, motor relearning, gait rehabilitation, muscle strength, functional performance.

INTRODUCTION:

Cerebral palsy (CP)—is the most common chronic non progressive and infantile encephalopathy that affects the development and results in disabilities due to abnormal motor control(1). Structural and mechanical changes in body alignment, as well as musculoskeletal changes, are developed therefore compensatory mechanisms are overcome by gravity and recruit new muscle groups to maintain stability. This lead to muscle imbalance, increased hypertonia, and deformities which affect postural balance and develop complex motor skills and impacts functional activities, thus limiting participation in different activities (2). Development of automatic postural reactions, including straightening, balance, and protection and also be delayed or undeveloped (3). Independent walking plays an important role in activities of daily living, improves bone density and cardiopulmonary endurance, reduces obesity, etc. Therefore, it is an important goal of clinical and community-based rehabilitation for many children with cerebral palsy(1). Children with spastic CP present with muscle weakness, spasticity, and limited selective voluntary control, resulting in gait and balance impairments (4). These gait abnormalities reduce gait speed and affect daily activities, sports and leisure, quality of life, and social interactions(5). Although most children with Unilateral spastic CP can walk without assistance, motor skill impairments should be addressed to improve gross motor function in everyday life. The LE intensive functional training (LIFT) protocol - integrated the principles of motor learning, such as intensive and structured practice, active participation, and skill/exercise progression.

CASE REPORT:

A 6year-old boy was diagnosed with spastic diplegia cerebral palsy who came to the Rehabilitation department. The boy was 130 cm in height and 27 kg in body weight. The child was able to ambulate by himself with an assistive device (anterior rolling walker) and ankle-foot orthoses. On examination, we observed muscle weakness (Kendal scale) and spasticity (Ashworth scale) predominantly in lower limb and trunk; decreased range of motion and deficits in postural control, especially in sitting posture and impairments in functional performance, especially decreased gait velocity, poor alignment during functional tasks, difficulties in sitting unsupported and to perform lateral walk. Now the patient is assigned for physiotherapy treatment to enhance their muscle power, range of motion, coordination to improve functional mobility.

CLINICAL DESCRIPTIVE:

Initially, the patient was assessed by a physiotherapist twice before intervention i.e pre and post-intervention sessions and at a 3-month follow-up. Then, brief information about the Physiotherapy given to the children's parents/guardians with the consent form. The primary outcome measure was the 1-minute walk test (2MWT). This measure was selected based on the age of participants which causes decreased attention to task and ability to comprehend pacing required for 6 minutes. Secondary outcome measures were the 10-Meter Walk Test (self-selected and fast gait speed), 30-s chair rise(22 (strength), single-leg stance on the affected side(balance), and range of motion of all lower limb-joint has taken with a universal goniometer. The tone of all lower limb muscles is checked by Modified Ashworth Scale, Gross Motor Function Measure (GMFM-88) and Timed Up & Go (TUG) evaluation were

conducted. GMFM is a valid, reliable and sensitive test, specially developed for children with CP. Here GMFM and GMFS-88 are also evaluated. It measures gross motor function improvements over time or as a result of the intervention. TUG is a practical and quick test that has been widely used to verify ambulatory mobility.

CLINICAL FINDINGS:

Reduced ROM in the bilateral lower limb, muscle power, impaired functional mobility.

THERAPEUTIC INTERVENTION:

At the first session(0-4 weeks), General range of motion exercises are taught without resistance. Once the exercise technique was mastered, the training load will be determined. The training load was adjusted by adding free weights around body segments. Stretching also enhance to prevent joint stiffness and promote flexibility in each joint. The children were evaluated every week to adjust the training load. All exercises should be performed in three sets of ten repetitions, with a 90-second interval between sets. For 4-8 weeks: Resistance training was started with the low-resistance bands. (yellow, red, green) As the strength is increased in children resistance band colour was also changed with a high resistance band. The strengthening exercises were given to the lower limb muscles like hip flexors-extensors, abductors adductors, knee flexors-extensors and ankle dorsiflexors plantar flexors. 2MWT is enhanced to improve the functional capacity of the individual. The strengthening domain primarily involved LE exercises using body weight as resistance that targeted functional activities (eg, sit to stand, step-ups, vertical jumping, stair climbing). They performed sit-to-stand movement with support and walked with assistive devices (anterior roller walker). Time in seconds was recorded from the “go” cue to when the child sat down on the bench was encouraged to improve their dynamic control. For 8-12 weeks: Skill progression was used to make LIFT challenging and intensive enough to elicit changes in motor skills and function. Exercises targeting specific muscle groups important for gait were also included to a lesser extent with muscle-specific exercises (eg, bridges, clamshells, heel raises). The balance

activities such as tandem walking, one-leg standing, and balancing on unstable surfaces and balance beams. The coordination domain involved activities such as ball kicking, jumping jacks, hopping through squares (hopscootch), and galloping/skipping. Gross motor function was tested with GMFM domains like standing, walking, running, and jumping was evaluated before and after sessions.

FOLLOW UP & OUTCOME:

Initially from day 1 we started with normal range of motion exercises in bilateral lower limb along with this stretching is enhanced particularly for calf muscles hamstring adductor or butterfly stretch. Each exercise is performed with 3 sets of x10 reps. Each set of exercises with an interval of 90sec And the above program is followed for about 4 weeks. From 4 week onwards we will be encouraging resistance training, targeted exercises to the bilateral lower limb. This resistance training is given to hip flexors - extensors, hip abductor - adductor, knee flexor - extensor, dorsi flexors and plantar flexors using thera bands or we may use weight cuffs also. Targeted exercises are mainly encouraged to improve functional performance and also to improve the muscle strength of the individual. Here targeted exercises like sit to stand, single-leg stance, leg presses, vertical jump, stair climbings and this exercise are also performed with 3 sets x 10 repetitions. Along with this 2 Minute walk test is also enhanced to determine the functional capacity of the individual and it can be calculated by using a stopwatch, paper n pen to enrol the distance and time taken to complete the cycle. For each cycle of 2-minute walk test pre & post heart rate value, distance and time take to complete the cycle are compared and contrasted to determine the efficacy or effectiveness of 2 MWT in CP. Initially, GMFCS(level 3) is noted which show moderate categories with the GMFS -88 scoring. The above programs are followed up till 8 weeks and the scoring are noted to determine the efficacy of the Functional performance in an individual. After 8 weeks we will start with balance and coordination exercises, Specific targeted muscle group performance to enhance the gait pattern. Therefore, single-leg stance, tandem walking, leg presses, Hopping with different shapes are encouraged to promote balance and to improve agility. On comparing the GMFS -88 with the above session it has been improved and also the GMFCS level changes(level 2) based on the improvement with the above rehabilitation protocol, so we concluded that the functional postural training has a benefit on adolescent cerebral palsy.

DISCUSSION:

In this study, functional postural training in adolescent cerebral palsy has shown a positive effect of structured exercises protocol about 3 months follow-up. There is an improvement in increase ROM in the bilateral lower limb, muscle strength, balance, functional performance. Distance ambulated during a 1MWT represents a potentially cost-effective and user-friendly method of assessing gait capacity in a clinical setting. This was corroborated by an increase in fast gait speed at both time points that approached significance in CP. 30seconds chair rise test revealed a larger increase in functional strength in terms of lower limb functional training. Task-oriented practice. It shows greater improvements in activities performance since it enables the refinement of neural control commands besides increases in strength(6). There are also improvements in GMFM scores, with major increases in dimensions D and E, which represent “standing” and “walking, running and jumping” items. These items are related to the exercises proposed during the intervention, such as sit-to-stand movement and stair-climbing. TUG test requires sophisticated postural control and dynamic balance since it requires a process of planning, initiation and execution of complex activities such as rising from a chair, walking, changing direction and sitting. Increases in muscle strength are accompanied by decreases in TUG time. If the decrease in TUG time means that child improved in agility and postural control since that minor time in the TUG test is associated with low risk and high gait speed [7]. Task-oriented weight-bearing (closed chain) strength training for children with cerebral palsy can be effective in improving functional performance.

PATIENT PERSPECTIVE:

Initially I was not able to fulfil my daily routine even though I walk with an assistive device, I need some external support to do them. After taking the functional type of physio, I see a lot of tasks performed with less energy expenditure.

REFERENCE:

1. Cho C, Hwang W, Hwang S, Chung Y. Treadmill Training with Virtual Reality Improves Gait, Balance, and Muscle Strength in Children with Cerebral Palsy. *Tohoku J Exp Med*. 2016 Mar;238(3):213-8. doi: 10.1620/tjem.238.213. PMID: 26947315.
2. Bax M, Goldstein M, Rosenbaum P, Leviton A, Paneth N, Dan B, Jacobsson B, Damiano D; Executive Committee for the Definition of Cerebral Palsy. Proposed definition and classification of cerebral palsy, April 2005. *Dev Med Child Neurol*. 2005 Aug;47(8):571-6. doi: 10.1017/s001216220500112x. PMID
3. Ferdjallah M, Harris GF, Smith P, Wertsch JJ. Analysis of postural control synergies during quiet standing in healthy children and children with cerebral palsy. *Clin Biomech (Bristol, Avon)*. 2002 Mar;17(3):203-10. doi: 10.1016/s0268-0033(01)00121-8. PMID: 11937258.
4. Østensjø S, Carlberg EB, Vøllestad NK. Motor impairments in young children with cerebral palsy: relationship to gross motor function and everyday activities. *Dev Med Child Neurol*. 2004;46:580-589
5. Beckung E, Hagberg G. Neuroimpairments, activity limitations, and participation restrictions in children with cerebral palsy. *Dev Med Child Neurol*. 2002;44:309-316.
6. Carr JH, Shepherd RB. *Neurological rehabilitation –Optimizing motor performance*. Oxford: ButterworthHeinemann; 1998.
7. Williams EN, Carroll S, Reddihough DS, Phillips BA, Galea MP. Investigation of the timed “up and go” test in children. *Developmental Medicine and Child Neurology* 2005;47:518–524.