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Use of Treadmill Training to Improve Gait Parameters after Tendoachilies Tendon Lengthening in Paediatric Cerebral Palsy: A Case Report

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Abstract

Introduction-Cerebral palsy is the most common form of neurological disorder in pediatric age group. Tightness is most commonly seen in patient with cerebral palsy which causes decreased range of motion and limited gait function. In present study, a 6 year old male patient with hemiplegic cerebral palsy who has been operated for Tendoachillies lengthening by z plasty was having difficulty in walking and reduced weight bearing on the left lower limb and affected balance.

Purpose-The purpose of the case report is to describe the use of treadmill training to improve gait parameters in child with cerebral palsy operated for z plasty procedure of Tendoachillies lengthening.

Methodology-Treadmill training was given to increase walking speed and to improve gait parameters. After training, conventional physiotherapy treatment was also given. The outcome measures were step length, stride length, cadence and foot prints.

Conclusion-After comparison of pre and post treatment outcome measures, it was found that treadmill training is safe and feasible for child with cerebral palsy and indicates that there are positive benefits in walking speed and improvement in gait parameters.

Key words: Cerebral palsy, Treadmill training, Tendoachilles lengthening, Z plasty.

Introduction

Cerebral palsy has a variety of causes, all of which result in brain damage that affects mobility, posture, and balance. Two or three out of every 1,000 live births are affected. Cerebral palsy is also linked to spasticity, dyskinesia, ataxia, and mixed/other coordination disorders. Spasticity, which affects about 80% of children with cerebral palsy, is the most common movement disorder.

Movement disorders caused by cerebral palsy can result in secondary issues such as hip pain or dislocation, balance problems, hand dysfunction, and equinus deformity.[4] It is estimated that 10% of the global population is disabled, with 3.8 percent of the Indian population suffering from some form of disability. Cerebral Palsy affects approximately 15-20% of physically disabled children.The topographic classifications for CP are monoplegic, hemiplegic, diplegic, and quadriplegic; monoplegic and triplegic are uncommon. Diplegia is the most common type, accounting for 30% to 40% of cases, followed by hemiplegia 20% to 30%, and quadriplegia accounts for 10%to15% .[3]Cerebral palsy patients also have foot and ankle deformities.Equinus in the ankle is caused by contraction of the gastronemius and soleus muscles. The inability to dorsiflex the foot and Equinovarus deformity are the most common foot deformities in cerebral palsy patients. The surgical treatment is Tendon Achilles lenthening via z plasty. The majority of children with cerebral palsy have impaired gait control due to involuntary muscle spasms and muscle weakness.[1]

According to the World Health Organization's International Classification of Functioning, Disability, and Health model, the new intervention goal is to focus on not only physical structure but also daily activities and social involvement, in which gait function plays a critical role.[2]Inreality, children with cerebral palsy have limitations in their gait structure as well as movement. As a result, improving all of these factors is the primary therapeutic goal of therapy for children with cerebral palsy. A variety of equipment is used in the clinical setting as an alternative to traditional therapy to help children with cerebral palsy develop their gait capacity.The treadmill has long been used in the rehabilitation of patients suffering from central nervous system disorders. The treadmill effectively improves gait efficiency by applying repeated weight loading to an individual's lower limbs. Several systematic studies have found that repeated task-oriented training on the treadmill improves motor learning in subjects.[1] The goal of this

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study was to look into the effect of a treadmill on specific aspects of gait in children with cerebral palsy, such as cadence, stride length, step length, and step width.

Clinical description-A 6 year old male diagnosed with left hemiplegic cerebral palsy, with previous ankle equinovarus foot deformity corrected by Z plasty TA lengthening, presented to pediatric physiotherapy department with complaints of pain while walking and he was not bearing weight on affected extremity. He presented with tightness of hamstrings, Tendoachilies, and Piriformis on left side. He had been operated on 10 weeks prior, but he was still not bearing full weight on his left lower extremity. He had pain at the scar site and adhesions in the scar. He needed assistance while walking and his speed was slow. He was also afraid of falling, so he was hesitant to walk. He was dragging his left lower extremity while walking. The child was limping while walking.Prior to treadmill training, the patient was a taking small step with his heel not touching the ground. Treadmill training was combined with traditional physiotherapy to improve the child's gait.

Material(S) and Methods

The patient and his parents were explained in detail about the procedure and a written informed consent was taken from his parents to include him in the study.

Then the following outcome measures were recorded

1. Step length
2. Stride length
3. Step width
4. Degree of toe out
5. Cadence

The child was given conventional physiotherapy with below mentioned treadmill training protocol. The treatment was given for ten consecutive days daily for 10-15 minutes. The treatment was progressed based on patient's pain tolerance and endurance. After completion of the treatment, the outcome measures were recorded and compared.

The treatment was given daily for 10 consecutive days starting at 0.08 speed for 10 -15 minutes. Forward walking and lateral walking was also given and speed and time was increased as per the tolerance of the child.

Table 1:- Treatment given to the child

Sr. No.	Intervention	FITT	GOALS
1	Treadmill training	F -10 consecutive days I – 4-6 on Borg scale T- 10-15 minutes T – gait training	To improve gait parameters and pattern of walking
2	Conventional physiotherapy programme	F-10 consecutive days I-challenging by the end of set T-15-20 minutes T-trunk control and balance Bridging Abdominal curls Weight shift on tilt board along with reach outs Stretching of TA, Hamstrings and Piriformis.	Improve trunk control and balance Improve core muscle strength.

Results

Table 2: Comparison of pre-treatment and post-treatment outcome measures

Outcome measures	**Pre treatment value**	**Post treatment value**
step length	21cm	23cm
stride length	32.5cm	36cm

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step width	7.5cm	17.5cm
degree of toe out	30 degree	30 degree
cadence	22steps/minutes	44steps/min

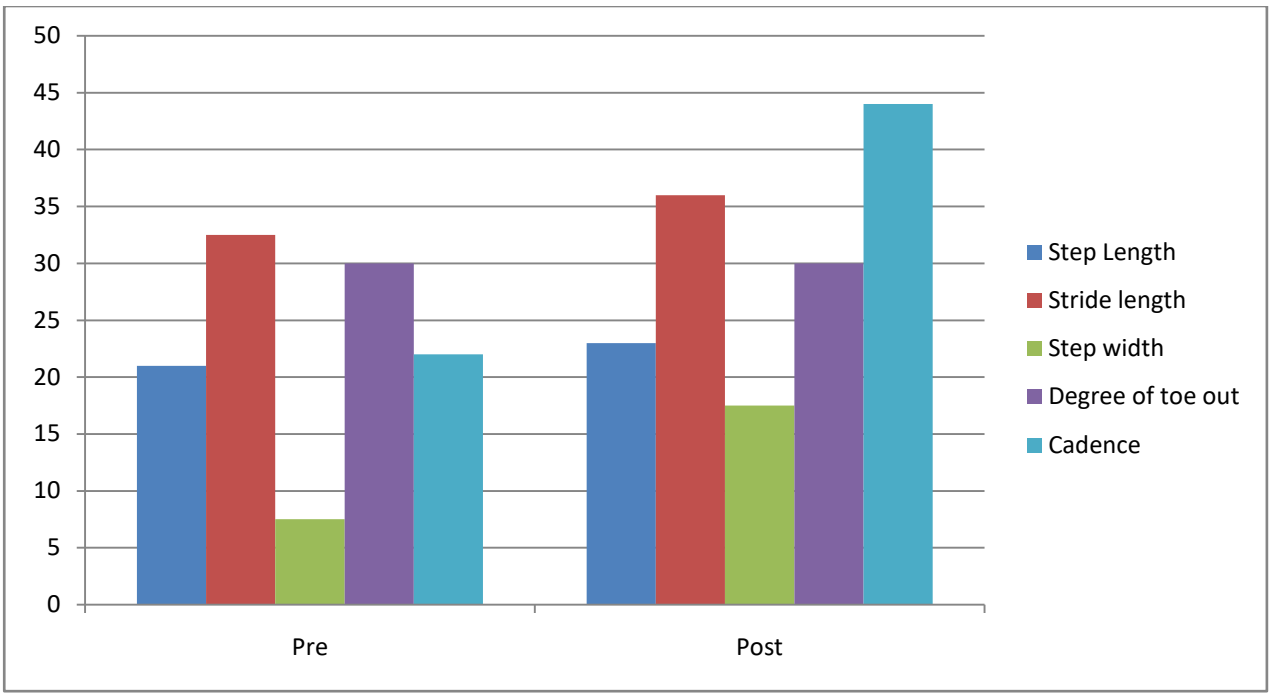

Figure1 shows the variation between the pre and post gait parameters.

Treadmill training was effective for gait parameters and walking speed Therefore there is difference of step length, stride length and cadence There is difference in step length by 3cm, stride length by 3.5cm and increase in cadence by 22 steps /minutes.

Discussion

Gait parameters changed significantly. Step length increased by 3cms, stride length increased by 4.5cms, and cadence increased by 22 steps per minute. The patient had increased weight bearing on the affected side during treadmill exercise, and his heel was hitting the ground. As a result of the current research, treadmill training will enhance gait parameters and walking speed. Previous research found that treadmill exercise increased weight shift on the affected side and improved balance Lower-extremity muscle strength, endurance, and bone mineral density can all be improved with weight-bearing exercise. Normal joint movement during treadmill exercise often helps to relieve spasticity by stretching dynamic muscles and strengthening dorsiflexors. The gluteus maximus, rectus femoris, vastus medialis, and gastrocnemius all displayed increased activity during ramp ascension. Increased walking speed decreases a child's fear of falling in addition to enhancing ambulation and social interaction.The trunk and lower limb muscles were stimulated for balance using treadmill gait exercise. This is possibly why treadmill exercise has a clinically significant effect on gait parameters in cerebral palsy children. Co contraction of proximal and distal muscles as a consequence of abnormal muscle tone has been related to the use of an inefficient kinetic system in cerebral palsy children. Repetitive gait training on a treadmill, on the other hand, increases control of agonist-antagonist muscles in the lower extremities and facilitates automatic and rhythmic gait in children with cerebral palsy by triggering the central pattern generators of the spinal cord. Central pattern generators are neural activations capable of forming motor patterns that lead to rhythmic, automatic strides, enabling biomechanical components involved in various phases of gait, postural function, and balance to be trained.[1]

Conclusion

The present case study has shown improvement in gait parameters of child with cerebral palsy operated for Tendoachilies lengthening .It can be concluded that treadmill training after Tendoachilies lengthening in children with cerebral palsy may be beneficial to improve gait parameters and in turn may be helpful for functional improvement in gait. Further studies with large sample size are needed to confirm the findings of the present study.

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