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Effect of frenkel exercises on ataxic cerebral palsy: A case report on a child with ataxic CP

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Abstract

Objective: To know the effectiveness of frenkel exercises on hypotonia, balance & in-coordination in ataxic CP.

Methods: The patient underwent Frenkel exercises in various different positions like lying, sitting, and standing position.

Result: Post intervention significant improvement was seen in all the outcome parameters (GMFM score, BEST score, GAIT parameter, MMT score). As the result of intervention affected upper and lower limb improved in terms of muscle tone, coordination, intentional tremors, sitting & standing balance.

Conclusion: Frenkel exercises seem to be a promising intervention for improving coordination, muscle tone, sitting & standing balance respectively for both upper and lower limb movements in children with ataxic CP. Further investigations are certainly needed to assess.

Keywords: cerebral palsy, in-coordination, ataxic, balance, gait pattern, frenkel exercise

Introduction

Dr. John Little identify "Cerebral Palsy" [1]. It is a non-progressive disorder of developing fetal brain affecting majorly movement and posture [2], ultimately causing activity limitation. According to the part of CNS involved group Evans form proposed an expanded classification of the muscle tone and derived different from like hypotonia (decreased tone), hypertonia (increased tone presenting with stiffness), spasticity, rigidity, dyskinesia & ataxia [3]. On the basis of abnormalities Cerebral Palsy(CP) is differentiated into 5 different group: a) spastic, quadriparesis (double hemiplegia); (b) dystonia, chores, ballismus, tremor; (c) rigid; (d) ataxic (e) mixed [3].

Ataxic cerebral palsy being the most common one [4] results in abnormal movement patterns due to impairments seen in Cerebellum. Main function of cerebellum is to coordinate voluntary movement, postural control, along with that in some aspect of motor learning process [5]. Along with this increased time duration for activation of muscle, its magnitude and scaling of produced force was also altered during voluntary contraction [4].When there is any lesion seen in archicerebellum (there is a reduction in muscle tone, hypotonia and failure to maintain posture and equilibrium), paleocerebellum (hypotonia and disturbance in posture), neocerebellum (disturbance in coordination of muscular activities) [1]. Damage to the cerebellum has been associated with a range of movement disorders including in-coordination, reduce manual dexterity [5].

It is stated that Exercise therapy decreases the amount of functional abnormalities seen in musculoskeletal and neurological disorder patients. Movement patterns in ataxic cerebral palsy may be due to impairments in the timing and duration of muscle activation. Cerebellar dysfunction cause hypotonia, disturbance of balance, in coordination, Intention tremors, Dysarthria, unsteady gait, dysmetria, excessive flexibility end gaze evoked nystagmus. In cerebellar ataxia, the gait pattern is also disturbed due to balance deficits. These deficits lead to unsteady gait. Although it was not very easy to restore normal movement as individuals with cerebellar disease also presents with deficits in motor learning [6].

Balance exercises include exercise in supine position, exercise in sitting position, Exercise in standing position. We also investigated about age influence, severity of ataxic symptoms, exercise duration and balance challenge level for training which is required for inducing changes in speed of walking [7]. The aim of present study is to evaluate the effectiveness of Frenkel exercise on ataxic cerebral palsy patient.

Patient information

Patient was 10 years old ataxic male CP child undergoing regular physiotherapy intervention from last 3 years. He was having complaint of frequent falls, difficulty in walking, long time standing, going up & down stairs, eating or drinking, wearing and removing clothes independently. He was able to speak without any difficulty with his caregivers. His primary concern was to be able to walk independently and have good balance to avoid more number of falls. Patient was not taking any medication from long but undergoing vocational rehabilitation. Pre diagnosed case of Ataxic cerebral palsy by paediatrician.

Clinical Findings

The important clinical findings were showed in Table no 1. Poor standing balance, reduced muscle tone, unsteady gait with disturbed stride and step length was seen. Not able to eat and drink without spilling the content. Handwriting was not clearly understood due to tremors while writing.

Table 1: Parameter recorded during assessment

	Left	Right
Muscle Tone		
Hip Adductors	Grade 1	Grade 1
Hamstrings	Grade 1	Grade 1
Calf Muscles	Grade 1	Grade 1
REFLEXES		
Knee Reflex	+	+
Ankle Reflex	+	++

Diagnostic assessment

Motor function was assessed by GMFM (Gross Motor Functional Scale) to check the independence level of the child, Balance was assessed by BEST (Balance Evaluation System Test), Muscle strength was assessed by MMT (Manual Muscle Testing), Muscle tone was assessed by PROM, Trunk control was checked by TCMS (Trunk Control Measurement Scale).

Therapeutic intervention

In starting of intervention session, main focus is on normalizing the reduced muscle tone. It took duration of 2 month to normalize completely. Intervention was given for 40 minutes per day for 6 days a week for continuous 5 months. Intervention session includes frenkel exercises for both lower and upper limbs one after another.

Exercises were progressed gradually from lying to sitting and than in standing position. Exercise sequence according to the position and progression for Upper Limb & Lower Limb was given in Table no 2 & 3 respectively. Treatment was given 40 minutes a day, for 6 days a week for 20 weeks. Follow up reassessment was done after each 15 days to see the effect of treatment.

Outcome measures were recorded before and after completing treatment at day 1 and week 20 respectively. Treatment protocol was same throughout, only dosage and position was progressed. Not even on a single day treatment session was missed. After 2 months of intervention during follow up reassessment it was found that treatment was effective. Pre and Post scores of all the outcome measures are given in Table No 4.

Table 2: Frenkel exercises for Lower Limb

Lying	Sitting	Standing
Ankle toe pumps simultaneously on both the legs.	Patient is ask to stretch his one leg to extend from sitting to touch different object or marks indicated on the floor.	Patient is ask to stand with feet shoulder width apart and weight is shifted on both the legs simultaneously.
Alternate heel slides in supine lying.	The lift both the legs alternately to place heel on the marked joint of the other leg.	Walking on a straight line by keeping one foot in such a manner that heel of one foot touches toes of another.
Bilateral heel sliding in supine lying.	From sitting with feet's shoulder length apart patient is asked to sit & stand.	Walk along a winding strip.
In supine lying taking both the legs alternatively to the side ways.	Rise and sit with knees together. Sit & stand with keeping knees together	Walk between two parallel lines.
Bending and extending one leg while moving the other leg sideways.	Sitting hip abduction and adduction	Side-ways walking on the marked points.
Slide down the heel of one leg on the opposite leg shin.		Walk & turn around.
Place the heel of one leg on the opposite knee, Or sliding down crest of tibia to ankle.		Walk and change direction to avoid obstacles, Ladder walking.

Table 3: Frenkel exercises for Upper Limb

Touching nose with Finger.
Touching different object kept in front of table with both the hands one by one.
Bilateral tapping of alternate hands on thighs as fast as possible.
Additional activities like building blocks, drawing on big boards, buttoning& unbuttoning clothes, combing hair, writing & typing, playing with clay, putty and dough, separating different beans will also improves co-ordination.

Table 4: Showing Pre and Post scores of outcome measures

	Pre scores	Post scores
GMFM-88(Gross motor Functional measurement)	1(depicts that the patient tries to initiates the task in less than 10% of the activities of daily living)	2 (depicts that the patient partially finishes the given task in 10 to 99% of the activities of daily living)
BEST (Balance Evaluation system test)	Grade 1	Grade 2
MMT (Manual muscle Testing)	Grade 3	Grade 5
TCMS (Trunk control measurement scale)	15/23	20/23

Discussion

This case report established the effectiveness of Frenkel exercises for improving in-coordination and balance, reduced muscle tone on ataxic CP child. By far this is the first case reported to state the effect of frenkle exercise on in-coordination &balance. Although other evidences are stated in past done studies which suggest Frenkel's exercises performed on people having ischemic stroke

patient with impaired proprioception proved to be highly beneficial in terms of improving sensory and balance recovery [8]. In 2016 a study was done to see the comparison between Frenkel exercise and balancing exercise in patient with cerebellar dysfunctions as a result of this study it was concluded that Frenkel's exercise regime was effective in treating patients with cerebellar ataxic gait abnormality [9]. Significant improvement is seen in GMFM-88(Gross motor Functional measurement), BEST (Balance Evaluation system test) MMT (Manual muscle Testing) TCMS (Trunk control measurement scale) when compared pre and post treatment, all this is due to regular movement with precision during frenkel exercise improves the amount of motor learning. Significant improved was seen in gait parameters and number of falls reduced. It was concluded that the treatment is effective and helping him to progress day by day. Though till now we have not achieved independent walking completely, although the achievements we have got in this child motivated us to follow the similar protocol in other children too.

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Conflict of Interest
None

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