International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Exercises and Activities for Gross Motor and Fine Motor Development in Developmental Coordination Disorder: A Case Study

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ABSTRACT
Developmental coordination disorder also known as developmental dyspraxia, is used to refer the difficulty in movement skills, that children have which is not primarily due to general intellectual, primary sensory or motor neurological impairments. The patient with 6 years of age having DCD, presented with difficulty in walking and unsupported standing along with gripping difficulties as well as mild cognitive impairment. A certain set of treatment protocol was followed for about 5 weeks considering the complaints of the patient, which included activities promoting gross motor as well as fine motor functions. After following the protocol patient was able to attain unsupported standing and supported walking along with marked improvement in gross motor and fine motor functions. Different scales like, Modified Ashworth Scale, Pediatric Balance Scale were used to assess the patient as per suspected problems and if there was any associated condition. To confirm the diagnosis of the condition, criteria under diagnostic and statistical manual of mental disorders 5 (DSM5) were verified.

KEYWORDS - Developmental coordination disorder **(**DCD), attention deficit hyperactivity disorder (ADHD), low birth weight (LBW), autism spectrum disorder (ASD), Diagnostic and statistical manual of mental disorder (DSM).

INTRODUCTION

Developmental Coordination Disorder is the terminology which mainly describe difficulties in the development of movement skills that not just interferes with child's activities of daily living and academic achievement.[1] Another term used in reference of DCD is clumsy child syndrome. It becomes apparent at an early age as a difficulty in carrying out activities that require motor coordination or learning. The cause of DCD is unknown. However, the difficulty arises when the body is unable to process the information provided by brain, which affects the child's ability to carry out activities effectively. DCD often co-occurs with other conditions, such as attention deficit hyperactivity disorder (ADHD), specific language impairment (SLI), and learning disabilities (LDs), hence it has a heterogenous presentation. Diagnosis of DCD by a physician requires conducting an interview and clinical assessment. Physical therapists may play an important role in the diagnosis of DCD.
There is limited data regarding the prevalence of DCD in India, but the studies indicated that the condition is more common in school going children, however accurate figures are not determined. As per studies- prevalence of suspected DCD in children with age 5–7 years is (21.5%), between 8–9

years is (23.9%) and is more common in 10–11 years i.e. (30.6%). Preterm infants are at higher risk of having DCD, data is as follows- (preterm: 29.54%, term: 23.10%). Infants with LBW (low birth weight) have a higher prevalence of DCD as well i.e. (30.15%) and among normal birth weight the prevalence was (21.43%). Children having both preterm and low birth weight history, the prevalence of suspected developmental dyspraxia turned out to be 51.72%[2].

METHODOLOGY-

The study was carried out on a patient with the diagnosis of developmental coordination disorder in physiotherapy OPD, at Jyotirao Phule Subharti college of Physiotherapy SVSU Meerut. The time duration of the study was set to be 5 weeks for the child with 6 years of age, having a weight of 17kg whose mother reported a significant history of complications during antenatal, perinatal and postnatal period. Although the child was oriented but sometimes appeared to be irritable. Pediatric balance scale was used to assess the balance of the child, whose score was 25.

PURPOSE OF THE STUDY –

The purpose of the study is to determine the effect of a certain set of treatment protocol which involves activities to promote gross motor, fine motor and cognitive development.

TABLE 1. SUBJECTIVE DATA OF PATIENT

CHARACTERSTIC	VALUE
1) Gender	Male
2) Age	6 years
3) Birth weight	3.5 kg
4) Head circumference	35 cm
5) Chest circumference	32 cm

The history was taken from the mother of the patient. Rest of the data like birth weight, head and chest circumference was collected by the documents and reports present at the time of birth.

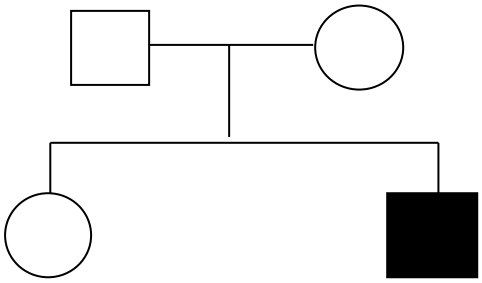
KEY ELEMENTS IN HISTORY OF PATIENT

The antenatal history obtained from the mother comprises of gestational hypertension, history of fall was noted twice during the last trimester, though the mother experienced fetal movements at normal time interval of expectancy. Apart from that supplements were taken for the calcium, folic acid and iron. The perinatal history involved on and off pain so the labor was induced which lasted for 7-8 hours. The delivery was normal (vaginal), full term and the birth presentation was cephalic. Postnatal history showed that the birth cry was delayed by a minute, also there was occurrence of seizures during 1st month after birth.

Point of concern noted in developmental history of the patient under gross motor development comprises delayed head control by 3 months, sitting with and without support was delayed by 3 months along with walking without support delayed by 6 months. About fine motor development, as per observation made, there was a significant delay in pincer grasp of the child by 6 months. In respect to personal development there was delay in the social smile of the child by about 4 months but presently the child

does not exhibit any difficulty in social interaction or any other symptom that might indicate co-occurrence of ASD (Autism spectrum disorder). Also, the communication of the child was normal.
A relevant point was noted in the family history, the father experienced difficulty in walking after having an episode of fever at the age of 3 years. There was no history of mother's abortion or miscarriage. Patient has a sibling (female) 7 years.

PEDIGREE CHART



In the pedigree chart mentioned above
Unaffected male is represented by –  and affected male is represented by - 

Unaffected female is represented by - 

OBSERVATION OF THE PATIENT-

On observation certain points were seen which were- body built, which appeared to be ectomorphic, child was easily irritable, facial appearance was normal along with mode of ambulation which was support by mother. On observing the patient in supine position, head was positioned in mid line also the visual tracking was normal. In prone position the child was able to lift head but not efficiently, also the child was able to do transitions but he was unable to attain standing from sitting and supine.

TABLE 2. EXAMINATION OF THE PATIENT –

Key points assessed during the patient's examination were

1. HIGHER CORTICAL FUNCTIONS- The child was alert and he was able to recognize his family. Apart from this the child was fully oriented.
2. SENSORY EXAMINATION- The sensory examination was normal which was checked using tuning fork, blunt needle and hot and cold water.
3. NEUROMUSCULAR EXAMINATION – The muscle tone was noted as – (grade 0) as per Modified Ashworth Scale, Superficial reflexes as well as deep tendon reflexes were present.
4. MUSCULOSKELETAL EXAMINATION – Active range of motion as per assessment was complete for bilateral Upper limb as well

	as lower limb, MMT assessed was grade 5 for bilateral upper limb while for lower limb it was grade 3 bilaterally, no deformity or contracture was seen during the assessment.
5.	CARDIO AND OROMOTOR ASSESSMENT – The cardio and Oro motor assessments were normal.
6.	BALANCE AND GAIT ASSESSMENT – The assessment was done using Pediatric balance scale and the patient had a total scoring of - 25

TREATMENT MEATHOD USED

A certain set of exercises were involved in the treatment protocol addressing the needs of the child which were followed up to 5 weeks, the main aim of exercises and activities involved in this protocol was to resolve the problems associated with activities of daily living along with academic performance.

Activities were added by every week as per the prognosis of the patient, while some activities remained same in which child was not fluent. Total 45-50 minutes were given to the patient daily for the activities involved in the protocol, and the session was attended by the patient for whole 7 days for a total duration of 5 weeks. Ergonomic advice was also provided to the parents and activities were explained and advised to be practiced at home which can be done with the sources available at the moment.

The sequence of activities, repetitions along with time and sets are described in the table no. 3 mentioned below, in which activities are divided by weeks.

TABLE NO: 3

Days/weeks	Treatment/activity	Repetition/sets and time	Description
Week 1	**For gross motor functions**		
	a) ROM Exercises (depending upon patient's ability to perform, for both UL and LL.	10 Reps. (2 sets.)	Patient position – lying
	b) Stretching (B/L) for lower limb.	5 reps. with10 sec. Hold then relax. (2 sets)	Patient position – lying (muscle group- hamstrings, calf, quadriceps.)
	c) Leg dangling exercise.	10-15 reps.	Patient position – sitting
	d) Knee rolling.	10 Reps.	Patient position – lying (stabilize the pelvis.)

	e) Butterfly pose.	Maintain for 30-60 sec.	Patient position – sitting (support the back, with wall)
	For fine motor functions		
	a) Clay modeling activities.	5-10 minutes.	
	b) Throwing activities including toys like ball.	5-10 minutes.	
	c) Coloring or drawing.	10-15 minutes.	
Week 2	**For gross motor functions**		
	a) Quadriceps drill. (with minimum resistance). (B/L). b) Swiss ball exercises (back extension, balancing, superman pose).	10 Reps. 10-15 minutes.	Patient position – sitting (resistance applied manually). Patient position – prone on Swiss ball. (Reaching out activities were also added.
	c) Bridging.	Minimum 10 reps. (2 sets.)	Patient position – supine with knees flexed.
	d) Joint approximation. (for both UL and LL).	10 reps.	
	For fine motor functions		
	a) Peg board activities.	5-10 minutes.	Variations were made depending upon shape, size and colour for both exercises.

	b) Thread bead activity.	5-10 minutes.	
Week 3	**For gross motor functions**		
	a) Encourage transitions between each body position, step by step.	Maintain each position for 1 min.	Transition was as follows- (Supine → prone→ seated→ tall knee→ half knee→ standing).
	b) Seating and standing supported.	Maintain each position for 2-5 minutes.	
	For fine motor functions		
	a) Placing coins in piggy bank.	5 minutes.	
	b) Peeling and placing stickers.	5-10 minutes.	
Week 4	**For gross motor functions**		
	a) Walking along with parallel bar	5-10 minutes	Bean bags were used to provide uneven surface.
	b) Walking on uneven surface with assistance.	5 minutes	Smiley ball was used.
	c) Playing catch (with assistance).	2-5 minutes.	
	d) Hopscotch game (with assistance).	2 reps. (3 sets)	The activity was done under continuous supervision. (single as well as double leg hop).
	For fine motor functions		
	a) Games like Jenga	5-10 minutes	
	b) Origami (paper folding)	5-10 minutes	

Week 5	**For gross motor functions**		
	a) Independent walking.	5-10 minutes.	
	b) Supported stair climbing and descending.	2-5 minutes.	
	c) Frankel's exercise	10-15 minutes.	While lying – heel to shin While sitting – lift thigh with knee flexed and firmly return the foot to the ground. While walking – walking sideways, backward and back to initial position & walking in zig-zag pattern.
	For fine motor functions		
	a) Threading and lacing activities.	3-5 minutes.	Ribbons or shoe laces can be used.

RESULT:

After the intervention of 5 weeks there was a marked improvement in child's motor ability as well in cognitive functioning. The ability to lift head in prone position efficiently improved. The changes were also seen in MMT of the patient's lower limb bilaterally, which was grade 3 prior to the intervention and later improved to grade 4. The child was able to attain sitting to standing transition but still needed slight assistance, lastly there was changes seen in the scoring of paediatric balance scale which turned out to be 32 after the intervention.

CONCLUSION:

The significance of gross motor, fine motor activities in condition such as developmental coordination disorder was shown in the study, and how they are beneficial in achieving activities of daily living with efficacy for such children.

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