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ABSTRACT

This case report describes the application of two treatment intervention theories for Developmental Coordination Disorder (DCD) to physical therapy practice. The patient was an 8-year-old girl with hypotonicity, generalized weakness, balance, coordination deficits, and poor cardiovascular endurance. Parent concerns related to frequent episodes of tripping and falling. DCD treatment intervention theories of the bottom up (process or deficit oriented) and top down (functional skill approach) methods were used to guide and direct the physical therapy treatment. After 8 months of treatment, the child improved in balance, coordination, gross motor development, cardiovascular endurance, and self esteem. The case report demonstrates a method to apply the current knowledge of DCD treatment theory in a way can be integrated into clinical practice. Applying a strategic combination of each theory in this case has led to the development of clinical questions for future research.

INTRODUCTION

Background Information
Developmental Coordination Disorder (DCD) affects nearly 6% of children in the United States, aged 5 to 11 (Kaufman & Schilling, 2007), with 5% of full term birth compared to 16% of preterm birth (Roberts, Anderson, & Davis, 2011). According to the *Diagnostic and Statistical Manual of Mental Disorders*, DCD presents with developmental coordination impairment, which can significantly restrict activities of daily living and academics of a child. The impairments cannot be related to any other medical condition or another developmental disorder in order to be diagnosed as DCD (Kaufman & Schilling, 2007). Physical therapy has been found to be the most effective treatment for this diagnosis. Within physical therapy, there are many types of treatment approaches that have been researched although no consensus has been reached on which type of approach is the most effective. This case report describes the application of two treatment intervention theories of the bottom up (process or deficit oriented) and top down (functional skill approach).

Case Description
The case patient is an 8-year-old girl who was referred to physical therapy by her pediatrician. She was born prematurely at 24 weeks gestation with a birth weight of 1lb 7oz. She has a medical diagnosis of hypotonia (781.3) and treatment diagnosis of lack of coordination (781.3) and strength and balance deficits (781.99). At the time of evaluation demonstrated hypotonicity, poor cardiovascular endurance, significant generalized weakness, delayed gross motor skills, balance and coordination deficits. She also displayed shortening of her hamstrings, gastrocnemius, and soleus muscles bilaterally leading to toe walking and running on her toes without trunk rotation. She demonstrated delayed equilibrium reactions in standing and sitting with single limb balance of 2-3 seconds with poor control. Poor control in hopping always leading with left lower extremity and unable to land symmetrically. She displays poor body awareness requiring verbal and visual cuing for activities and decreased strength with inability to perform modified push up, able to complete one sit up, and unable to crab walk or wheelbarrow walk. Parental concerns of clumsiness, falling frequently at school and reports the patient doesn't enjoy gym class and often is picked on at school. After the assessment goals were formed to improve function and safety in her environment. The patient was recommended to receive outpatient physical therapy two times per week for 60-minute sessions.

METHODS and RESULTS

Over the course of 8 months with 60-minute sessions once a week the patient was treated using a strategic combination of the Developmental Coordination Disorder treatment theories of bottom up and top down methods. The bottom up method (deficit oriented) involves treating an underlying dysfunction or motor control (Hillier, McIntyre, & Plummer, 2010) and top down involves gaining new skills and cognitive problem solving (Branhart et al., 2003). Each session began with a bottom up theory activity then progressed to a top down activity. In early sessions the patient was trained in a normalized gait pattern and cardiovascular endurance in treadmill walking. With practice the patient was able to progress to treadmill running with improved gait pattern and reduced anxiety. With every new activity the patient displayed anxiety and expressed that she was unable to complete the activity. After attempting the activity and practicing the patient was able to gain confidence in her motor skills and understanding that she was able to complete the activities. Other bottom up activities included jumping on the mini trampoline focusing on symmetrical jumping, tilt board, swing progressing to quadruped position, scooter board supine and prone, stretching, modified push ups and sit ups. By beginning with a bottom up activity the patient was able to become more aware of her body and increase confidence in her motor skill abilities to prepare for top down activities. The patient found increased difficulty in completing top down activities if the bottom up activities were not performed first. Top down activities require motor planning integration along with gross motor skills, coordination, balance, and strength. The patient was able to progress in galloping and backward walking with increased speed and proficiency in starting with either foot. Bear walking with decreased knee extension and increased endurance to the activity. Improved balance beam with ability to complete 3 feet of tandem walking without falling. In the beginning of treatment the patient was unable to complete the rock-climbing wall. She required verbal and tactile cues for foot and hand placement. By the end she was able to self-talk herself through the activity for hand and foot placement to be able to reach the top of the wall using the cognitive theory of this top down activity as well as her gains in motor skills.

Bottom Up

- Activities that use proprioceptive, vestibular, and tactile input- not mastery of the specific activity
 - Vestibular
 - Rolling on floor, down inclines
 - Rolling chairs
 - Tilt boards
 - Mini trampolines
 - Running, fast walking
 - Bolster swings
 - Scooter boards
 - Proprioceptive
 - Shaking out hands and arms
 - Pressure on top of head/ shoulders
 - Weighted vest
 - Chewing

Top Down

- (Functional Skill Approach)
 - Uses motor learning principles and emphasizes direct teaching of a task specific activity
 - Changes can be made in
 - Sequence
 - Size or shape of the tool
 - Position of the tool
 - Speed, length, or repetition of the trial
 - Required strength
 - Need to be taught as a specific skill, break down the skill into a number of parts, include problem solving activities to encourage the child to search for solutions
 - Galloping
 - Throwing a ball
 - Mirroring activities
 - Strengthening
 - Rock wall climbing
 - Ladder activities
- Cognitive motor
 - Emphasize the planning and execution of movement
 - Child is able to choose goals and be guided through the learning activity and problem solving
 - Comparative Discussion
 - How can you make this better? Comparing two ways
 - Self rating
 - What type of grade would you give yourself
 - General question and answer
 - Did that work for you?
 - Therapist evaluation
 - You are throwing the ball well and hitting the target- reinforcing positivity
 - Dynamic Systems
 - Promote participation and change the environment or task to challenge
 - Practice!

Theory Activities	11/18/13	12/16/13	1/6/14	1/13/14	1/27/14	2/3/14	2/10/14	2/17/14
Bottom Up								
Walking	X	X	X	X				
Running					X	X	X	X
Mini Trampoline						X		
Tilt board				X	X			
Swing (Prone and Quadruped)						X	X	X
Scooter Board						X		
Stretching (Gastronemius, Soleus, and Hamstring)	X	X	X	X	X		X	X
Modified push ups						X		X
Sit ups						X		X
Top Down								
Skipping								
Gallop	X	X	X	X	X	X	X	X
Backwards walking	X	X	X	X	X	X	X	X
Crab Walking					X	X	X	X
Bear Walking	X	X	X	X	X	X	X	X
Balance beam	X	X		X		X	X	
Prone activities						X	X	X
Mirroring Activities								
Throwing			X	X				
Rock Wall Climb				X			X	X
Ladder				X	X	X		
Single Leg Stance				X				X
Hoops (Jumping)						X	X	X

DISCUSSION

Through the use of both treatment theories the patient demonstrated gains in strength, balance, coordination, gross motor development, cardiovascular endurance, and self esteem. One of the most significant gains was in self-efficacy and the belief that she was able to complete many of the activities her peers are completing. She was able to decrease the amount of self-doubt throughout the sessions and became more open to trying new activities. She learned how to complete more difficult tasks by integrating the steps of the less difficult tasks such as prone swinging to reach for objects. By the end of the session she was able to think through the steps to be able to swing far enough to reach for the objects to complete the task. With improvements motor skills and self-efficacy this patient will see improvements in the school and home environments. With the gains found in applying this strategic combination of theories has led to more clinical questions and the need for future research.

Characteristics

- No increase or decrease of deep tendon reflexes
- Low tone
- Abnormal posture
 - Forward head
 - Winging of scapula
 - Increased lordotic curve
 - Hyperextension of elbows
 - Genu recurvatum
- Problems not associated with physical strength, vision, hearing, or deformity



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