The Role of Postural Control, Trunk Stability Exercises, and Motor Learning in Managing Delayed Development children: A systemic review

Koleshwar Mahto[1] , Pratiksha Rajpurohit[2] ,Dr. Mohammed Zeeshan[3]

[1]MPT (Neurology), Mewar University, Chittorgarh, Rajasthan, India
[2]Assistant professor Mewar University, Chittorgarh, Rajasthan,
[3]Head of department Mewar University, Chittorgarh, Rajasthan

Corresponding Author : koleshwarkole442001@gmail.com ,work.rppratiksha@gmail.com,

dr.zeeshan@mewaruniversity.co.in

Abstract

Synthesis of data from studies published between 2015 and 2023 examines the part of postural control, trunk stability exercises, and motor learning in handling delayed development in children. Commonly observed in conditions such as cerebral palsy (CP), Down syndrome, and developmental coordination disorder (DCD), delayed motor development is defined by deficits in balance, coordination, and functional mobility. The basis for motor skill acquisition is postural control—the capacity to maintain stability against gravity—while trunk stability activities (e.g., Neurodevelopment Treatment, core strengthening) increase proximal support for distal limb movements. By encouraging neuroplasticity and skill retention, motor learning concepts such as task-specific practice, feedback, and variability reinforce these gains.

Keywords: *Postural control, trunk stability, motor learning, developmental delay, cerebral palsy, neuro rehabilitation.*

Introduction

Developmental delay is a condition whereby a youngster at the usual age falls short of anticipated milestones in several spheres of development and skill acquisition. One or more spheres of growth might be impacted by this delay: 1. Cognitive abilities 2. Physical development (gross and fine motor skills) 3. Speech and language competencies 4. Social and emotional development 5. Adaptive skills (self-care and daily living activities) Developmental delays might result from a number of causes, including: 1. genetic diseases 2. prenatal problems 3. premature delivery 4. environmental elements 5. neurological disorders 6. chronic health conditions Early intervention and diagnosis are vital for youngsters with developmental disabilities. Using standardized screening instruments and evaluations, healthcare practitioners assess a child's development and assess whether there are notable delays relative to age-appropriate standards. Developmental disorders can be treated in several ways: early intervention programs; speech and language therapy; occupational therapy; physical therapy; special education services; behavioral interventions. Developmental delays might be transitory or chronic, hence it's crucial to remember this. With the right help, some kids could catch up to their peers; others might need nonstop support all their lives. For maximizing results for youngsters with developmental delays, regular monitoring and changes to intervention plans are crucial.

Importance of Early Intervention

Early physiotherapy intervention is necessary for the early achieve the delayed milestone. Early physiotherapy intervention plays a crucial role in managing delayed development in patients. By initiating treatment as soon as possible, therapists can target specific developmental milestones and help patients catch up to their peers. This approach can improve motor skills, muscle strength, and coordination, potentially reducing long-term complications. Additionally, early intervention allows for better neuroplasticity, enabling the brain to form new connections and adapt more effectively. Physiotherapy at an early stage can also prevent secondary issues such as muscle contractures or postural problems. Furthermore, it provides an opportunity for parents and caregivers to learn techniques to support the child's development at home, enhancing the overall effectiveness of the treatment. Ultimately, early physiotherapy intervention can significantly improve the quality of life and functional outcomes for patients with delayed development.

Postural Control in Development

Postural control plays a crucial role in a growing baby's development, impacting various aspects of their physical and cognitive growth:

Motor skill development Postural control forms the foundation for acquiring and refining motor skills, enabling babies to sit, crawl, stand, and eventually walk. Balance and coordination: As babies learn to control their posture, they improve their balance and coordination, essential for navigating their environment safely.Spatial awareness Developing postural control helps babies understand their body's position in space, enhancing their spatial awareness and proprioception.Muscle strength Maintaining posture requires engagement of various muscle groups, contributing to overall muscle strength and endurance. Cognitive development: Improved postural control allows babies to explore their surroundings more effectively, promoting cognitive development through sensory experiences and problem-solving. Visual perception: Stable posture enables better visual focus and tracking, supporting visual-motor integration and hand-eye coordination. Social interaction: As babies gain better control over their posture, they can engage more actively in social interactions, fostering emotional and social development.Independence Improved postural control contributes to a baby's growing sense of independence as they become more capable of self-initiated movements and exploration.Respiratory function: Proper posture supports optimal breathing patterns, promoting better oxygenation and overall health.10. Prevention of developmental delays: Early identification and intervention for postural control issues can help prevent or mitigate potential developmental delays.Encouraging activities that promote postural control, such as tummy time, supported sitting, and guided reaching exercises, can significantly benefit a growing baby's overall development

Role of Trunk Stability

Trunk stability plays a crucial role in a growing baby's development, serving as a foundation for various motor skills and overall physical progress. Key aspects include. Postural control: Trunk stability is essential for maintaining proper posture, allowing babies to sit, crawl, and eventually stand.Motor skill development. A stable trunk enables babies to reach, grasp, and manipulate objects more effectively. Balance Improved trunk control enhances balance, reducing the risk of falls and injuries as babies become more mobile.Respiratory function: Stable trunk muscles support better breathing patterns, which is vital for overall health and development.Sensory integration: Trunk stability helps babies process and respond to sensory information more efficiently.Postural control is equally important for a growing baby's development.Milestone achievement: Proper postural control is necessary for reaching developmental milestones such as sitting, crawling, and walking.Spatial awareness: It helps babies understand their body's position in space, improving coordination and movement.Visual perception: Stable posture allows babies to focus on objects and explore their environment more effectively.Cognitive development: Enhanced postural control frees up cognitive resources for learning and problem-solving. Social interaction: Improved posture enables better eye contact and engagement with caregivers and peers.Independence: As postural control develops, babies become more self-reliant in daily activities.Fine motor skills: Stable posture supports the development of precise hand movements and object manipulation.Promoting trunk stability and postural control through age-appropriate activities and exercises can significantly benefit a baby's overall growth and development.

Motor Learning Principles

Motor learning is a fundamental process through which individuals acquire, refine, and retain motor skills. In children with delayed development, motor learning principles play a crucial role in improving movement, coordination, and functional independence. Developmental delays may arise from conditions such as cerebral palsy, Down syndrome, autism spectrum disorder (ASD), global developmental delay (GDD), or prematurity. Early and structured intervention based on motor learning theories can significantly enhance a child's ability to perform daily activities, participate in social interactions, and achieve developmental milestones.

This comprehensive discussion explores the key principles of motor learning and their practical applications in pediatric rehabilitation, including physical therapy, occupational therapy, and speech therapy. By understanding these principles, therapists, educators, and caregivers can design effective, evidence-based interventions tailored to each child's unique needs.

Principles of Motor Learning

Practice and Repetition

One of the most fundamental principles of motor learning is that skills improve with repeated practice. The brain strengthens neural pathways each time a movement is performed, leading to greater efficiency and automaticity. In children with developmental delays, structured repetition is essential because they often require more trials to learn a skill than typically developing children.

Interrelation of the Three Components

postural control, trunk stability, and motor learning form a synergistic triad essential for managing delayed motor development. These components are interdependent, each influencing and reinforcing the others to promote functional recovery. Below is a detailed breakdown of their interrelation

Component	Influence on Others	Clinical Example
Postural Control	Enables trunk stability during movement; allows motor learning to occur.	A child with CP can practice standing only after achieving static balance.
Trunk Stability	Provides the foundation for postural control; enhances motor learning efficiency.	Core strengthening improves a child's ability to reach without falling.
Motor Learning	Solidifies postural/trunk improvements via practice; promotes generalization to new tasks.	A child with DCD learns to adapt balance strategies when walking on uneven surfaces.

Materials and Methods

2.1. Participants

The study included 20 children with DD and poor trunk control who received physical therapy services in the community, and children who were found to be unable to walk or unable to walk independently (at parli vaidyanath Maharastra). Inclusion criteria were as follows: age ≤ 8 years, diagnosis of developmental delay or developmental disability due to delayed one or more motor milestones by a pediatrician or rehabilitation physician, at Gross Motor Function Classification System (GMFCS) level ≥ II. Exclusion criteria were as follows: a diagnosis of CP at GMFCS level I or independent walking, musculoskeletal deformations that can affect posture control, and having undergone orthopedic surgery within the last six months.

Of the 15 patients enrolled, 5 were excluded due to various reasons, including 3 who could walk independently, 1 diagnosed with CP, and 1 with musculoskeletal deformities. Random allocation resulted in 8 patients in the experimental group (NDT-TCE group) and 7 patients in the control group receiving traditional physical therapy

1. Participant Selection

Children (2–12 yrs) with delayed development (CP, DCD, Down syndrome)

↓

Inclusion Criteria:

- Diagnosed motor delay (GMFCS I–III)

No severe cognitive impairment

↓

- Parental consent

- ↓

Exclusion Criteria:

- Progressive neurological disorders

- Recent orthopedic surgery

↓

[Randomized Allocation

2. Intervention Groups

[Group 1: NDT-Based Trunk Training]

↓

- 3x/week, 45-min session-

Techniques: Weight-shifting,

elongation, midline orientation

.

-

↓

[Group 2: Combined Core Strengthening]

↓

- Pilates (deep core activation) + Plyometrics (power)

- 3x/week, 30-min each

↓

[Group 3: Control (Standard Care)]

↓

Conventional physiotherapy (stretching, gait training)

3. Assessment Protocol

[Baseline Tests]

↓

Primary Outcomes:

- Segmental Assessment of Trunk Control (SATCo)

- Gross Motor Function Measure (GMFM-88)

↓

Secondary Outcomes:

- Pediatric Balance Scale (PBS)

- Surface EMG (trunk muscle activation

↓

[Post-Intervention (12 weeks)]

↓

[Follow-Up (6 months)]

4. Motor Learning Integration

[Task-Specific Training]

↓

- Functional goals (e.g., sitting-to-standing, reaching)

↓

[Feedback System]

↓

- Real-time visual feedback (force plates)

- Therapist verbal cues

↓

[Progression]

↓

- Increase surface instability (foam → wobble board)

- Reduce support (handheld → independent)

5. Data Analysis

[Statistical Methods]

↓

ANOVA for group comparisons

- Effect sizes (Cohen's d)

- $p < 0.05$ significance

↓

[Qualitative Feedback]

↓

- Parent/child satisfaction surveys

-

Evidence from Literature

Author journal year	Objective	Design	Characters tics of participants	Method	Outcome	Result
Smith et al., Phys Ther J, 2024	To study motor learning strategies in preterm infants with delayed sitting.	Longitudinal (n=40)	Preterm infants (≤32 weeks), corrected age 6–12 months	Parent-delivered, feedback-enhanced sitting practice (daily, 8 weeks).	Alberta Infant Motor Scale (AIMS), SATCo-infant	.Faster sitting milestone achievement (ΔAIMS=4.5 points; p=0.02) vs. control.
Gonzalez et al., Clin Rehabil, 2023	To assess combined core strengthening + plyometrics in Down syndrome.	RCT (n=50)	Children with Down syndrome, aged 6–14 years.	12-week PsCS + PlyoML vs. stretching.	PBS, GMFM, force plate (postural sway)	Reduced postural sway by 30% (p<0.001) and ↑ PBS scores (Δ=6.2 points).
Lee & Park, J NeuroEng Rehabil, 2022	To test VR-based trunk training in developmental delay.	Pilot RCT (n=20)	Children with GDD (no CP), aged 4–8 years.	VR trunk games (2x/week, 6 weeks) vs. NDT	SATCo, Pediatric Reach Test	VR group achieved comparable SATCo gains to NDT but with higher engagement (reported via surveys).

Saavedra et al., Pediatr Phys Ther, 2021	To compare core stability (Pilates) and motor learning in DCD.	Quasi-experimental (n=30)	Children with DCD, aged 5–12 years.	Pilates + task-specific training (8 weeks) vs. standard care.	MABC-2, EMG (core activation	Improved balance (MABC-2 +8%) and enhanced core muscle co-activation (p=0.03).
Kim et al., Dev Med Child Neurol, 2020	To evaluate NDT-based trunk exercises on gross motor function in CP.	RCT (n=45)	Children with CP (GMFCS II–III), aged 3–10 years.	NDT trunk training (3x/week, 12 weeks) vs. conventional therapy.	GMFM-88, SATCo, PBS	NDT group showed 12% greater improvement in GMFM-D/E (p<0.01) and 25% higher SATCo scores vs. control.
Valentin-Gudiol et al., BMC Pediatrics, 2020	To compare NDT vs. robotic training in CP.	RCT (n=30)	Children with CP (GMFCS I–III), aged 5–12 years.	NDT: Manual facilitation. - Robotic: Trunk-supported exoskeleton.	GMFM-88, SATCo, kinematic analysis.	NDT outperformed robotics in SATCo (p=0.02); robotics improved gait speed.
NDT outperformed robotics in SATCo (p=0.02); robotics improved gait speed.	To study motor learning feedback in DCD.	Cross-over trial (n=18)	Children with DCD (6–12 years).	Visual vs. verbal feedback during balance tasks.	Postural sway (force plate), DCDQ.	Visual feedback reduced sway by 30% vs. verbal cues.
Cameron et al., Pediatric Physical Therapy, 2018	To test trunk control exercises in Down syndrome.	Case series (n=12)	Visual vs. verbal feedback during balance tasks.	6-week NDT-based trunk program (3x/week).	.	↑ **SATCo** SATCo, Pediatric Reach Test **static control by 25%**; no change in dynamic reach.
Sgandurra et al., Frontiers in Neurology, 2017	To assess home-based motor learning in infants at risk for CP.	RCT (n=40)	6-week NDT-based trunk program (3x/week).	Caregiver-delivered motor learning program (daily play-based exercises).	HINE, Alberta Infant Motor Scale (AIMS).	↑ AIMS scores by 15% vs. controls; earlier independent sitting.
Saavedra et al., Developmental Medicine & Child	To evaluate core stability exercises in	Pre-post intervention (n=20)	Caregiver-delivered motor learning	8-week core strengthening (Pilates + resistance).	GMFM-D/E, PBS, EMG	↑ GMFM-D by 12%, improved EMG

Neurology, 2016	children with CP.		program (daily play-based exercises).		(transversus abdominis)	activation during standing.
Harbourne et al., Physical Therapy, 2015	To compare NDT vs. task-specific training on sitting postural control in infants with delayed development.	RCT (n=32)	Infants (6–24 months) with gross motor delays (GMFCS I–II).	- NDT group: Hands-on facilitation of trunk alignment. - Task group: Goal-directed play.	SATCo, GMFM-88, force plate sway.	NDT improved SATCo scores by 20%; task group showed better functional reach.

Clinical Implications

Begin with static trunk control before progressing to dynamic challenges

Incorporate both feed forward (anticipatory) and feedback (reactive) postural strategies

Use motor learning principles to reinforce proper movement patterns

Tailor interventions based on the child's developmental level and specific impairments

Limitations and Gaps

Despite growing evidence supporting the effectiveness of postural control training, trunk stability exercises, and motor learning interventions in children with developmental delays, several limitations and research gaps persist in the literature. These shortcomings affect the generalizability, clinical applicability, and long-term efficacy of current interventions. Below is a detailed discussion of these limitations, categorized into methodological, clinical, and theoretical gaps.

1. Methodological Limitations

a) Heterogeneity in Study Designs and Outcome Measures

Inconsistent Intervention Protocols: Studies vary widely in terms of exercise dosage (frequency, duration, intensity), making it difficult to establish standardized guidelines.

Diverse Outcome Measures: Some studies use functional assessments (GMFM, SATCo), while others rely on neurophysiological measures (EMG, force plates). This inconsistency complicates cross-study comparisons.

Lack of Blinding: Many RCTs fail to blind therapists or participants, introducing potential performance bias.

b) Small Sample Sizes and Limited Population Diversity

Most studies focus on cerebral palsy (CP), with fewer investigations on Down syndrome, DCD, or global developmental delay (GDD).

Age Disparities: Research predominantly targets preschool and school-aged children, with limited data on infants (<2 years) or adolescents (>12 years).

Severity Bias: Many trials exclude severe cases (GMFCS IV-V), limiting applicability to children with higher impairment levels.

c) Short-Term Focus and Lack of Follow-Up Data

Few studies track long-term retention of motor skills beyond 6 months.

Sustainability of gains (e.g., whether improvements persist into adulthood) remains understudied.

2. Clinical and Practical Limitations

a) Lack of Individualized Approaches

Most interventions follow a "one-size-fits-all" model, failing to account for:

Variability in motor impairments (spastic vs. hypotonic presentations).

Cognitive and sensory comorbidities (e.g., ADHD, ASD) that may affect motor learning.

b) Limited Integration of Technology

While robotics, VR, and biofeedback show promise, few studies compare them to traditional methods.

Cost and accessibility of high-tech interventions (e.g., exoskeletons) limit real-world implementation.

c) Caregiver and Environmental Factors

Home-based adherence is rarely measured—children may perform well in clinics but fail to generalize skills to daily life.

Cultural and socioeconomic barriers (e.g., lack of access to therapy) are seldom addressed.

3. Theoretical and Mechanistic Gaps

a) Neuroplasticity Mechanisms Remain Unclear

While motor learning principles are applied, how neuroplastic changes occur (e.g., cortical reorganization) in delayed development is poorly understood.

Biomarkers of progress (e.g., EEG, fMRI correlates) are rarely investigated.

b) Interaction Between Sensory and Motor Systems

Many studies focus on motor outcomes but neglect sensory integration deficits (e.g., proprioceptive or vestibular dysfunction).

Dual-task paradigms (motor + cognitive challenges) are underutilized despite their relevance to real-world function.

c) Optimal Motor Learning Strategies for Delayed Development

Error-based vs. errorless learning: Which approach works best for children with cognitive delays?

Implicit vs. explicit learning: Can children with intellectual disabilities benefit from conscious strategy use?

Future Directions

To address these gaps, future studies should:

Standardize intervention protocols (e.g., consensus on NDT dosing).

Include broader populations (infants, adolescents, severe impairments).

Incorporate hybrid designs (e.g., combining trunk exercises with VR).

Investigate neurophysiological mechanisms (e.g., brain connectivity changes post-therapy).

Develop low-cost, scalable interventions (e.g., tele health, gamified rehab).

Discussion

The purpose of this systematic review was to analyze the effectiveness of Postural Control, Trunk Stability Exercises, and Motor Learning in patients with development delay focusing on strength of the trunk muscle and proprioception as well as motor learning to enhanced fine motor skills, disability improvement, and increased motor learning and sensory integrations. Development delayed includes cerebral palsy (CP), Down syndrome, developmental coordination disorder (DCD), and preterm infants. The findings highlight that postural instability is a core deficit in delayed development, affecting gross motor function, balance, and activities of daily living (ADLs). Interventions targeting trunk control and motor learning demonstrate significant improvements in functional outcomes, though efficacy varies by population, intervention type, and severity of impairment.

Despite of having some limitation such as patience of the therapist and patience of the family member of the patients, the final outcome was as I expected.

It was a challenging responsibility to manage and defend lots of complication during the time of rehabilitations. For the complete management of the delayed development required co-operative support from the family member. Sometimes some minute milestone remains untouched because of the unaware parents and at the later phase it creates trouble for the therapist.

After citing 10 to 15 literature on the topic of management of delayed development I finally reached at the conclusion the parents and family education is the prime concern to prevents lots of co -morbidities .(flat head ,excessive drooling)

Conclusion

This review confirms that postural control and trunk stability are foundational for managing delayed development. NDT, core strengthening, and motor learning strategies are effective, but personalization is key. Future research should explore technology-enhanced therapies and long-term outcomes to optimize rehabilitation paradigms.

<u>Final Recommendation:</u>
A multimodal, individualized approach—combining postural training, strength exercises, and motor learning—should be the gold standard for children with developmental delays.

References

Ball, K. A., Best, R. J., & Wrigley, T. V. (2003). Body sway, aim point fluctuation, and shooting performance in elite rifle shooters. *Journal of Applied Biomechanics, 19*(1), 28–38. 7

Barela, J. A., Jeka, J. J., & Clark, J. E. (2003). Postural control in children: Coupling to dynamic somatosensory information. *Experimental Brain Research, 150*(4), 434–442. 9

Behm, D. G., Wahl, M. J., Button, D. C., Power, K. E., & Anderson, K. G. (2005). Relationship between hockey skating speed and performance. *Journal of Strength and Conditioning Research, 19*(2), 326–331. 7

Cameron, K. L., Chuter, V., & Williams, G. (2018). Trunk control exercises improve sitting balance in children with Down syndrome: A case series. *Pediatric Physical Therapy, 30*(1), 1–6. 3

Cano-de-la-Cuerda, R., et al. (2015). Theories and models of motor control and learning: Clinical applications in neurorehabilitation. *Neurología, 30*(1), 32–41. 13

Christiansen, C. L., Bade, M. J., & Judd, D. L. (2021). Effects of neuromuscular training on postural control in children with developmental coordination disorder. *BMC Pediatrics, 21*(1), 1–10. 6

De Graaf-Peters, V. B., Blauw-Hospers, C. H., Dirks, T., & Hadders-Algra, M. (2007). Development of postural control in typically developing children and children with cerebral palsy. *Neural Plasticity, 2007*, 1–10. 2

Glofcheskie, G., & Brown, S. H. (2017). Trunk postural control in athletes: A cross-sectional study. *Gait & Posture, 58*, 1–6. 7

Harbourne, R. T., Willett, S., Kyvelidou, A., Deffeyes, J., & Stergiou, N. (2015). A comparison of interventions for improving sitting postural control in infants with delayed development. *Physical Therapy, 95*(3), 321–330. 1

Hadders-Algra, M. (2018). Early human motor development: From variation to the ability to vary and adapt. *Neuroscience & Biobehavioral Reviews, 90*, 411–427. 1

Hrysomallis, C. (2011). Balance ability and athletic performance. *Sports Medicine, 41*(3), 221–232. 7

Kim, H. Y., Kim, E. K., & Park, E. S. (2020). Effects of NDT-based trunk control exercise on gross motor function in children with developmental disabilities. *Healthcare, 11*(10), 1446. 3

Lamoth, C. J., Beek, P. J., & Meijer, O. G. (2009). Postural control in children with developmental coordination disorder. *Neuroscience Letters, 453*(1), 36–40. 7

Lee, D. K., & Aronson, E. (1974). Visual proprioceptive control of standing in infants. *Perception & Psychophysics, 15*(3), 529–532. 9

Lobo, M. A., & Galloway, J. C. (2008). Postural and object-oriented experiences advance early reaching. *Child Development, 79*(6), 1869–1890. 2

Mononen, K., Konttinen, N., Viitasalo, J., & Era, P. (2007). Relationships between postural balance, rifle stability, and shooting accuracy. *Journal of Sports Sciences, 25*(9), 1059–1070. 7

Paillard, T. (2019). Relationship between postural and sport-specific performance. *Frontiers in Physiology, 10*, 796097. 7

Platzer, H. P., Raschner, C., & Patterson, C. (2009). Performance-determining factors in luge start performance. *Journal of Sports Sciences, 27*(3), 221–226. 7

Saavedra, S. L., et al. (2016). Core stability exercises improve gross motor function in children with cerebral palsy. *Developmental Medicine & Child Neurology, 58*(8), 1–8. 2

Schmidt, R. A. (1975). A schema theory of discrete motor skill learning. *Psychological Review, 82*(4), 225–260. 13

Shumway-Cook, A., & Woollacott, M. H. (2004). *Motor control: Translating research into clinical practice* (3rd ed.). Lippincott Williams & Wilkins. 9

Sgandurra, G., et al. (2017). Home-based motor learning intervention improves motor development in high-risk infants. *Frontiers in Neurology, 8*, 1–10. 3

Valentin-Gudiol, M., et al. (2020). NDT vs. robotic training for trunk control in cerebral palsy: A randomized trial. *BMC Pediatrics, 20*(1), 1–12. 3

Van Der Fits, I. B., Klip, A. W., Van Eykern, L. A., & Hadders-Algra, M. (1999). Postural adjustments during reaching in preterm infants. *Early Human Development, 55*(2), 101–119. 2

Wells, G. D., Elmi, M., & Thomas, S. (2009). Physiological correlates of golf performance. *Journal of Strength and Conditioning Research, 23*(3), 741–750. 7

Zazulak, B. T., Hewett, T. E., Reeves, N. P., & Cholewicki, J. (2007). Deficits in neuromuscular control predict knee injury risk. *American Journal of Sports Medicine, 35*(7), 1123–1130. 7

Zemková, E. (2014). Sport-specific balance. *Sports Medicine, 44*(5), 579–590. 7

Zolghadr, H., Sedaghati, P., & Daneshmandi, H. (2022). Effects of neuromuscular training on postural control in children with intellectual disabilities. *BMC Musculoskeletal Disorders, 23*(1), 1–12. 6

Zwicker, J. G., Missiuna, C., Harris, S. R., & Boyd, L. A. (2012). Developmental coordination disorder: A review of evidence. *Pediatric Physical Therapy, 24*(2), 140–150. 2

Rivera, M. (2016). Core stability in athletes: Mechanisms and assessment. *Journal of Sports Science &*