INSIGHTS-JOURNAL OF
HEALTH AND REHABILITATION

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

REFRAMING NEUROMUSCULAR REHABILITATION: BEYOND BOBATH AND TOWARD DYNAMIC MOVEMENT INTERVENTION

Original Research

Atiqa Niamat[1]*, Shoaib Waqas[2], Marian Gabriel[3], Irum Shahzad[3], Mariam Haider[4]
[1]Physical Therapist, Lahore University of Biological and Applied Sciences, Lahore, Pakistan.
[2]Professor and Dean, Lahore University of Biological and Applied Sciences, Lahore, Pakistan.
[3]Rehabilitation House Officer, Ghurki Trust Teaching Hospital, Lahore, Pakistan.
[4]Telemedicine Incharge Orthopedic and Spine center at GTTH
Corresponding Author: Atiqa Niamat, Physical Therapist, Lahore University of Biological and Applied Sciences, Lahore, Pakistan, atiqa.niamat@ubas.edu.pk
Acknowledgement: The author acknowledges the contributions of researchers and clinicians whose evidence-based work in pediatric neurorehabilitation informed the perspectives discussed in this article.

Conflict of Interest: None

Grant Support & Financial Support: None

INSIGHTS-JOURNAL OF
HEALTH AND REHABILITATION

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

INTRODUCTION

The rehabilitation of children with spastic cerebral palsy (CP) stands at a critical juncture. For decades, clinical practice has been shaped by traditional paradigms, most notably the Bobath concept or Neurodevelopmental Treatment (NDT), which was developed with the intent of normalizing muscle tone and facilitating typical movement patterns. Its widespread adoption has made it a cornerstone of pediatric neurorehabilitation worldwide (1,2). However, advances in neuroscience, motor learning, and rehabilitation science have altered the expectations of what therapeutic interventions should achieve. In an era increasingly defined by evidence-based practice, it has become essential to reassess whether long-standing approaches continue to meet the functional needs of children with CP and their families. The central concern lies in the growing disconnect between traditional therapeutic philosophies and contemporary evidence. Systematic reviews and comparative studies have repeatedly questioned the clinical effectiveness of the Bobath approach, reporting limited or inconsistent functional gains when compared with more task-oriented, activity-based interventions (3-5). Despite this, Bobath therapy remains deeply embedded in routine practice, often driven by historical precedent rather than robust outcome data. This persistence highlights an unmet need within clinical rehabilitation: the translation of evolving scientific evidence into everyday therapeutic decision-making for children with spastic CP. Spastic CP, particularly the diplegic and quadriplegic subtypes, is characterized by impaired trunk control, abnormal postural alignment, and delayed acquisition of gross motor milestones (6,7). Trunk stability forms the biomechanical and neurophysiological foundation for balance, coordinated limb movement, and functional mobility. Deficits at this proximal level cascade into broader limitations in sitting, standing, walking, and participation in daily activities (8). Beyond the physical impairments, these limitations impose considerable emotional, social, and economic burdens on caregivers and families, underscoring the urgency of interventions that translate impairment-level changes into meaningful functional improvements (9).

Against this backdrop, Dynamic Movement Intervention (DMI) has emerged as a compelling alternative that aligns more closely with contemporary rehabilitation principles. Unlike traditional methods that emphasize inhibition of abnormal tone and facilitation of "normal" movement patterns, DMI prioritizes active, task-specific engagement within progressively challenging environments (10). By employing dynamic surfaces such as therapy balls, wobble boards, and unstable bases of support, DMI integrates vestibular, proprioceptive, and visual inputs to provoke automatic postural responses and enhance motor learning (11,12). This approach reflects current understanding of neuroplasticity, which emphasizes repetition, task specificity, and salience as drivers of activity-dependent cortical reorganization and sustained functional change (9).

Emerging evidence lends support to this shift in therapeutic emphasis. Studies by Reddy and Balaji et al. have demonstrated significant improvements in trunk stability and gross motor function among children with spastic CP following dynamic surface training, outperforming outcomes achieved with conventional physiotherapy approaches (3). Similarly, Talgeri et al. reported that trunk-focused, dynamic interventions produced superior functional gains compared to static postural techniques, advocating their integration into standard rehabilitation programs (8). These findings resonate with the International Classification of Functioning, Disability and Health (ICF) framework, which prioritizes activity, participation, and contextual relevance over isolated impairment reduction (13,14).

DMI also represents a broader philosophical evolution in pediatric rehabilitation—from normalization toward functional empowerment. Rather than attempting to suppress atypical movement patterns, it encourages children to actively solve motor challenges through developmentally appropriate tasks. Functional activities such as rolling on unstable surfaces to promote segmental trunk control, sitting with perturbations and reaching tasks, crawling over uneven terrain to enhance coordination, kneeling on dynamic bases to build proximal stability, and standing or walking on compliant surfaces to refine balance and gait are systematically progressed based on endurance and motor capacity. This emphasis on purposeful movement aligns closely with goals of independence, participation, and quality of life, which increasingly define successful rehabilitation outcomes (15-17).

Despite its promise, DMI remains underutilized in clinical practice. Limited clinician awareness, scarcity of structured training opportunities, and entrenched reliance on traditional methods present substantial barriers to widespread adoption (18). Additionally, the relative lack of large-scale randomized controlled trials has contributed to hesitation among practitioners and policymakers. The ongoing randomized controlled trial at the authors' institution, directly comparing DMI and Bobath therapy using validated outcome measures such as the Gross Motor Function Measure-88, Trunk Impairment Scale, and Shoaib Sensorimotor Development Tool, represents a

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

critical step toward addressing this evidence gap (19,20). Such research is essential to establish standardized protocols and identify which subgroups of children may benefit most from this approach.

The future of pediatric neurorehabilitation depends on the willingness of clinicians, educators, and researchers to critically appraise legacy practices and embrace interventions grounded in contemporary evidence. While DMI may not be universally applicable or a replacement for all existing therapies, it offers a functionally oriented, neuroplasticity-driven framework that aligns with current scientific understanding and clinical priorities. Rehabilitation professionals must actively engage with emerging data, seek advanced training, and advocate for research-informed guidelines that prioritize meaningful functional outcomes. Only through such collective action can pediatric rehabilitation evolve toward more effective, child-centered care that truly reflects the dynamic potential of the developing brain.

CONCLUSION

Rehabilitation practice for children with cerebral palsy must reflect contemporary scientific understanding rather than rely on historical convention. The present work highlights the limitations of traditional, tone-centered approaches and reinforces the value of functionally driven, task-specific interventions. Dynamic Movement Intervention emerges as a clinically meaningful alternative, emphasizing active participation, trunk control, and motor learning within real-world contexts. By aligning rehabilitation goals with neuroplastic principles and functional outcomes, this approach offers practical implications for improving independence and participation in daily life. The findings underscore the need for clinicians to adopt evidence-informed strategies that prioritize meaningful movement and long-term functional gains in children with neuromotor impairments.

AUTHORS' CONTRIBUTION:
Atiqa Niamat: Main conceptualization, wrote original draft and reviewed. Shoaib Waqas: Finalized & reviewed.
Marian Gabriel: Reviewed and edited. Irum Shazad: Reviewed. Marium Haider: Reviewed

Conflict Of Interest:
None

REFERENCES

1. Kim C. Comprehensive physiotherapy approaches for children with cerebral palsy: Overview and contemporary trends. Physical Therapy Korea. 2023;30(4):253–60.

2. Paul S, Nahar A, Bhagawati M, Kunwar AJ. A review on recent advances of cerebral palsy. Oxidative Medicine and Cellular Longevity. 2022;2022(1):2622310.

3. Reddy S, Balaji GK. Dynamic surface exercise training in improving trunk control and gross motor functions among children with quadriplegic cerebral palsy: A single center, randomized controlled trial. J Pediatr Neurosci. 2020;15(3):214–9

4. Waqas S, Ahmad A, Goulardins JB, Hanif A, Tariq M, Niamat A. Efficacy of Transcranial Direct Current Stimulation and Mirror Therapy for Rehabilitation of Spastic Quadriplegic Cerebral Palsy-A pilot Study. Annals of King Edward Medical University. 2024 Sep 30;30(3):295-301.

5. Plotas P, Papadopoulos A, Apostolelli EM, Vlachou E, Gazou F, Zogopoulou I, et al. Effects of hippotherapy on motor function of children with cerebral palsy: a systematic review study. Ital J Pediatr. 2024;50(1):188.

6. Chaovalit S, Dodd KJ, Taylor NF. Sit-to-stand training for self-care and mobility in children with cerebral palsy: a randomized controlled trial. Dev Med Child Neurol. 2021;63(12):1476-82.

7. Szturm T, Parmar ST, Mehta K, Shetty DR, Kanitkar A, Eskicioglu R, et al. Game-Based Dual-Task Exercise Program for Children with Cerebral Palsy: Blending Balance, Visuomotor and Cognitive Training: Feasibility Randomized Control Trial. Sensors (Basel). 2022;22(3).

8. Talgeri AJ, Nayak A, Karnad SD, et al. Effect of trunk-targeted interventions on functional outcomes in children with cerebral palsy—a systematic review. Dev Neurorehabil. 2023;26(3):193–205.

9. Kaya Y, Saka S, Tuncer D. Effect of hippotherapy on balance, functional mobility, and functional independence in children with Down syndrome: randomized controlled trial. Eur J Pediatr. 2023;182(7):3147-55.

10. Xiang A, Fu Y, Wang C, Huang D, Qi J, Zhao R, et al. Aquatic therapy for spastic cerebral palsy: a scoping review. Eur J Med Res. 2024;29(1):569.

11. Araneda R, Ebner-Karestinos D, Paradis J, Klöcker A, Saussez G, Demas J, et al. Changes Induced by Early Hand-Arm Bimanual Intensive Therapy Including Lower Extremities in Young Children With Unilateral Cerebral Palsy: A Randomized Clinical Trial. JAMA Pediatr. 2024;178(1):19-28.

12. Rapson R, Latour JM, Marsden J, Hughes H, Carter B. Defining usual physiotherapy care in ambulant children with cerebral palsy in the United Kingdom: A mixed methods consensus study. Child Care Health Dev. 2022;48(5):708-23.

13. Al-Nemr A, Kora AN. Effect of core stabilization versus rebound therapy on balance in children with cerebral palsy. Acta Neurol Belg. 2024;124(3):843-51.

14. Merino-Andrés J, García de Mateos-López A, Damiano DL, Sánchez-Sierra A. Effect of muscle strength training in children and adolescents with spastic cerebral palsy: A systematic review and meta-analysis. Clin Rehabil. 2022;36(1):4-14.

15. Tapia C, Constanzo J, González V, Barría RM. The Effectiveness of Aquatic Therapy Based on the Halliwick Concept in Children with Cerebral Palsy: A Systematic Review. Dev Neurorehabil. 2023;26(6-7):371-6.

16. Uysal İ, Özden F, Tümtürk İ, İmerci A. The effectiveness of dual task exercise training on balance, mobility, physical performance, and quality of life in children with cerebral palsy: a single-blind randomized controlled trial. Ir J Med Sci. 2024;193(2):813-21.

17. Ziab H, Saleh S, Talebian S, Olyaei G, Mazbouh R, Sarraj AR, et al. Effectiveness of virtual reality training compared to balance-specific training and conventional training on balance and gross motor functions of children with cerebral palsy: A double blinded randomized controlled trial. J Pediatr Rehabil Med. 2024;17(3):353-68.

18. Elshafey MA, Abdrabo MS, Elnaggar RK. Effects of a core stability exercise program on balance and coordination in children with cerebellar ataxic cerebral palsy. J Musculoskelet Neuronal Interact. 2022;22(2):172-8.

19. Yoo M, Ahn JH, Park ES. The Effects of Over-Ground Robot-Assisted Gait Training for Children with Ataxic Cerebral Palsy: A Case Report. Sensors (Basel). 2021;21(23).

20. Lepoura A, Lampropoulou S, Galanos A, Papadopoulou M, Sakellari V. Study protocol of a randomised controlled trial for the effectiveness of a functional partial body weight support treadmill training (FPBWSTT) on motor and functional skills of children with ataxia. BMJ Open. 2022;12(3):e056943.

