European Journal of Physiotherapy and Rehabilitation Studies
ISSN: 2668-9928
ISSN-L:2668-9928
Available on-line at: www.oapub.org/hlt

DOI: 10.46827/ejprs.v5i1.235

Volume 5 | Issue 1 | 2025

IMPACT OF NEURODEVELOPMENTAL TREATMENT ON GROSS MOTOR FUNCTION AND SPASTICITY IN CHILDREN WITH SPASTIC CEREBRAL PALSY: A REGIONAL STUDY FROM PUNJAB, INDIA[i]

Lalit Arora[1],
Gurmeet Kaur Sethi[2],
Reena Arora[3ii]
[1]Associate Professor,
University College of Physiotherapy,
Baba Farid University of Health Sciences,
Faridkot, Punjab,
India
[2]Professor & Ex-Principal,
GGS Medical College & Hospital,
Baba Farid University of Health Sciences,
Faridkot, Punjab,
India
[3]Associate Professor,
University College of Physiotherapy,
Baba Farid University of Health Sciences,
Faridkot, Punjab,
India

Abstract:
Background: Cerebral palsy (CP) is a non-progressive neurological disorder leading to motor impairment and spasticity in children. Among its subtypes, spastic diplegia is the most common and causes significant limitations in posture and mobility. Although both Conventional Physiotherapy (CPT) and Neurodevelopmental Treatment (NDT) are widely practiced interventions, evidence regarding their comparative effectiveness remains inconsistent. **Objective:** This study aimed to evaluate the impact of Neurodevelopmental Treatment (NDT) combined with Conventional Physiotherapy (CPT) compared to CPT alone on gross motor function and spasticity in children with spastic cerebral palsy. **Methods:** A randomized controlled trial was conducted among 100 children (aged 4–12 years) with spastic diplegic CP, classified as GMFCS Level III–IV. Group A received NDT combined with CPT, while Group B received CPT alone, for

[i] न्यूरोडेवलपमेंटल ट्रीटमेंट का स्पास्टिक सेरेब्रल पाल्सी वाले बच्चों में ग्रॉस मोटर फंक्शन और स्पास्टिसिटी पर प्रभाव: पंजाब, भारत से एक क्षेत्रीय अध्ययन

[ii]Correspondence: email lalitarora1635@gmail.com,reenalalit@gmail.com

90 minutes per session, three times weekly, over 12 months. Gross Motor Function Measure (GMFM-88) and Modified Ashworth Scale (MAS) were used as outcome measures, assessed at baseline, 4, 8, and 12 months. **Results:** Group A showed significantly greater improvement in GMFM-88 scores compared to Group B at 4, 8, and 12 months ($p<0.001$). Similarly, a significant reduction in MAS scores was observed in Group A at all post-treatment intervals ($p<0.001$). These findings indicate superior gains in gross motor abilities and reduction in spasticity with combined NDT and CPT. **Conclusion:** Neurodevelopmental Treatment, when integrated with Conventional Physiotherapy, produces better improvements in motor function and reduction in spasticity than Conventional Physiotherapy alone. The results support incorporating NDT principles in pediatric neurorehabilitation programs for children with spastic cerebral palsy.

Keywords: Neurodevelopmental Treatment (NDT); cerebral palsy; spasticity; gross motor function; physiotherapy; GMFM-88; rehabilitation

1. Introduction

Cerebral palsy (CP) is a group of permanent disorders of movement and posture causing activity limitation, attributed to non-progressive disturbances in the developing fetal or infant brain[1]. These disorders are frequently accompanied by disturbances of sensation, perception, cognition, communication, and behavior, as well as by secondary musculoskeletal problems. The global prevalence of CP is estimated to range between 1.6 and 3.4 per 1000 live births[2]. Despite advances in perinatal care, the incidence remains relatively stable, making CP one of the most common causes of physical disability in childhood [3].

Among the various clinical types of CP, spastic cerebral palsy is the most prevalent, accounting for nearly 70–75% of cases[4]. Spastic diplegia, a subtype of spastic CP, primarily affects the lower limbs more than the upper limbs, leading to gait difficulties, postural instability, and delayed gross motor development[5]. Children with spastic diplegia frequently present with increased muscle tone, weakness, reduced selective motor control, and abnormal movement patterns, which collectively impair mobility and functional independence[6]. The severity of functional limitation is often categorized using the Gross Motor Function Classification System (GMFCS), a reliable tool for classifying motor abilities in children with CP[7].

Conventional physiotherapy (CPT) has traditionally focused on muscle stretching, strengthening, and task-specific training to improve range of motion, muscle performance, and endurance. However, these approaches often target individual impairments rather than addressing integrated movement control[8]. In contrast, the Neurodevelopmental Treatment (NDT), also known as the Bobath concept, emphasizes improving postural control, facilitating normal movement patterns, and inhibiting abnormal reflex activity[9].

Despite its widespread clinical use, the evidence supporting NDT remains equivocal. Systematic reviews have reported mixed findings regarding its effectiveness compared to other therapeutic approaches such as strength training, task-specific therapy, or constraint-induced movement therapy[9,10]. Some studies have demonstrated improvements in gross motor function and postural control following NDT-based interventions[11,12] while others have found no significant difference between NDT and other physiotherapy modalities[13]. Therefore, rigorous clinical research is needed to determine the true efficacy of NDT, particularly when combined with conventional physiotherapy approaches.

The Gross Motor Function Measure (GMFM-88) is a standardized, validated, and widely used tool for assessing gross motor function in children with CP (Russell *et al.*, 2000). It evaluates changes across dimensions such as lying, sitting, crawling, standing, and walking, providing a sensitive measure of functional progress over time. Assessing the effects of NDT using GMFM-88 offers an objective way to evaluate therapeutic outcomes.

Given the continuing debate regarding the efficacy of NDT, there is a need to investigate its long-term effects, particularly when used in conjunction with conventional physiotherapy. Combining NDT's facilitation-based approach with CPT's strengthening and stretching exercises may offer complementary benefits, addressing both postural control and muscle performance. However, empirical evidence supporting this integrative approach remains limited.

This study, therefore, aims to evaluate the long-term effects of Neurodevelopmental Treatment (NDT) combined with Conventional Physiotherapy (CPT) compared to CPT alone in children with spastic cerebral palsy. The Gross Motor Function Measure (GMFM-88) and MAS were used as the primary outcome measure at baseline, 4, 8, and 12 months to assess improvement in motor function. The findings of this study are expected to contribute to evidence-based clinical decision-making and help optimize rehabilitation strategies for children with spastic CP.

2. Materials and Methods

2.1 Study Design and Setting

This study was a randomized controlled trial conducted to evaluate the comparative effects of Neurodevelopmental Therapy (NDT) combined with Conventional Physiotherapy (CPT) versus Conventional Physiotherapy alone on gross motor function and spasticity in children with spastic diplegic cerebral palsy. The study employed a parallel-group design with equal allocation to each group. The intervention period extended over twelve months, with assessments conducted at baseline, 4 months, 8 months, and 12 months. The study was carried out at the Outpatient Department (OPD) of the University College of Physiotherapy and the Department of Paediatrics, Guru Gobind Singh Medical College & Hospital, Faridkot, Punjab.

2.2 Ethical Approval

Prior to the initiation of the study, approval was obtained from the Institutional Ethics Committee (IEC) of University College of Physiotherapy, Baba Farid University of Health Sciences, Faridkot. Parents or legal guardians of all participating children provided written informed consent after being informed of the purpose, procedures, benefits, and potential risks of participation. Confidentiality and anonymity of participants were maintained throughout the study, and all data were used exclusively for research purposes.

2.3 Participants

470 children were enrolled in the study and 120 children who met the inclusion and exclusion criteria were selected. 20 children dropped out from study, 10-10 from each group. In group A, two children were lost to follow up despite several telephonic reminders, while eight discontinued treatments. In group B, five children were lost to follow up while five discontinued treatments. Various reasons were relocation to other rehabilitation facilities, change of residence, transportation issues from distant rural areas, scheduling conflicts with school hours or caregiver's availability/other family responsibilities.

Participants were aged between 4 and 12 years, of both sexes, and demonstrated the cognitive ability to follow simple verbal instructions. All children were classified as Level III or IV according to the Gross Motor Function Classification System (GMFCS), indicating moderate to severe limitations in gross motor function but the potential for improvement with intensive physiotherapeutic intervention.

2.4 Inclusion and Exclusion Criteria

Children were eligible for inclusion if they had a confirmed diagnosis of spastic diplegic cerebral palsy, were within the specified age range, and were medically stable to participate in physical therapy. Exclusion criteria included children with mixed or ataxic types of cerebral palsy, those who had undergone orthopedic surgery or received botulinum toxin injections within six months prior to study enrollment, and children with uncontrolled epilepsy, severe cognitive deficits, or significant visual or auditory impairments that could interfere with participation in therapy sessions.

2.5 Sample Size and Randomization

This study adopted a parallel group randomized controlled design. After screening and consent, eligible participants were randomly assigned to either Group A (experimental) or Group B (control) using a sealed opaque envelope method to ensure allocation concealment. A research assistant not involved in the assessment or intervention process performed the randomization to reduce potential bias.

2.6 Blinding Procedure

Due to the nature of the interventions, therapist blinding was not feasible. However, the outcome assessors were blinded to group allocation to minimize observer bias. The same two physiotherapists, each having more than five years of clinical experience in pediatric neurorehabilitation, conducted all outcome assessments. Parents and caregivers were advised not to reveal the type of therapy their child received to the assessors during the study period.

2.7 Intervention Protocol

Neurodevelopmental Therapy Combined with Conventional Physiotherapy (Group A)
Participants in Group A received an intervention program combining the principles of NDT with conventional physiotherapy techniques. NDT sessions emphasized facilitation of normal postural control, inhibition of abnormal tone and reflex activity, and promotion of efficient movement patterns. Treatment activities included rolling, sitting balance, kneeling, half-kneeling, standing, and walking exercises using task-oriented and functional approaches. Specific handling and positioning techniques were employed to facilitate active participation and postural transitions. Sensory-motor integration, proprioceptive training, and feedback-based correction were integral to each session. Therapy sessions were conducted three days a week for 90 minutes each, over a period of 12 months.

2.8 Conventional Physiotherapy Only (Group B)

Children in Group B received conventional physiotherapy focusing on stretching of spastic muscle groups such as the hip adductors, hamstrings, and gastrocnemius, and strengthening of weak antagonist muscles. The sessions also included range-of-motion exercises, functional mobility drills, and gait re-education using assistive devices as required. Balance and coordination training were performed through static and dynamic postural control exercises. The therapy frequency and duration were identical to those of Group A to ensure treatment exposure equivalence. Caregivers were educated and encouraged to continue home exercise programs emphasizing stretching, strengthening, and mobility activities.

2.9 Outcome Measures

The primary outcome measure was the Gross Motor Function Measure-88 (GMFM-88), a standardized observational assessment tool designed to evaluate changes in gross motor function in children with cerebral palsy. It comprises 88 items distributed across five dimensions: lying and rolling, sitting, crawling and kneeling, standing, and walking/running/jumping. Each item is scored on a four-point scale, with higher scores indicating greater functional ability. The total percentage score and domain-wise scores were calculated for each participant.

The Modified Ashworth Scale (MAS) served as the secondary outcome measure to quantify muscle tone and spasticity. Specific muscle groups assessed included the hip adductors, hamstrings, and calf muscles. All assessments were carried out by the blinded assessors under standardized conditions using identical measurement procedures.

2.10 Assessment Schedule

All participants underwent baseline assessment prior to the commencement of therapy, followed by evaluations at 4, 8, and 12 months. Each assessment session was scheduled at the same time of day to minimize diurnal variability. Standardized protocols and environmental settings were maintained to ensure consistency across all evaluations. Any adverse events, deviations from the intervention protocol, or interruptions in therapy attendance were documented and monitored.

2.11 Data Collection and Statistical Analysis

All data were recorded on pre-structured case report forms and entered into a secured electronic database for analysis. Descriptive statistics such as mean, standard deviation, and frequency distribution were calculated for demographic variables and baseline characteristics. Within-group comparisons of GMFM-88 scores across time points were performed using paired t-tests, while between-group comparisons were analyzed using unpaired t-tests. A p-value of less than 0.05 was considered statistically significant.

Figure 1: Unpaired t-test for comparison at 0th month, 4th month, 8th month and 12th month score measurements of GMFM-88 between Group A and Group B

Unpaired t-test	**Comparison**							
	GMFM-88							
	0thmonth		**4thmonth**		**8thmonth**		**12Thmonth**	
	Group-A	**Group-B**	**Group-A**	**Group-B**	**GroupA**	**Group-B**	**Group-A**	**Group-B**
Mean	40.67	38.504	49.822	42.560	58.808	46.770	67.870	50.770
S.D.	7.899	9.412	8.038	9.312	8.366	9.437	8.033	9.553
Number	50	50	50	50	50	50	50	50
df	98		98		98		98	
Mean Difference	2.166		7.262		12.038		17.100	
Unpaired t-test	1.246		4.174		6.749		9.687	
P-value	0.216		<0.001*		<0.001*		<0.001	
Result	**Non-Significant**		**Significant**		**Significant**		**Significant**	

p>0.05 non-Significant, p<0.05 Significant

At baseline, GMFM-88 (Mean±SD) of Group-A was 40.67±7.899 and that of Group-B was 38.504±9.412 (t= 1.246, p>0.05), showing no significant difference. After 4 months, GMFM-88 (Mean±SD) of Group-A was 49.822±8.038 and Group-B was 42.560±9.312 (t= 4.174, p>0.05) indicating significant difference in Group-A. After 8 months, GMFM-88 (Mean±SD) of Group-A was 58.808±8.366 and Group-B was 46.77±9.43(t= 6.749, p>0.05) indicating significant difference in Group-A. After 12 months, GMFM-88 (Mean±SD) of Group-A was 67.87±8.03 and Group-B was 50.77±9.55 (t= 9.687, p>0.05) indicating significant difference in Group-A.

Figure 2: Unpaired t-test for comparison at 0th month, 4th month, 8th month and 12th month score measurements of MAS between Group A and Group B

Unpaired t-test	Comparison							
	MAS							
	0thmonth		4thmonth		8thmonth		12Thmonth	
	Group-A	Group-B	Group-A	Group-B	GroupA	Group-B	Group-A	Group-B
Mean	1.73	1.70	1.50	1.70	1.27	1.50	1.07	1.34
S.D.	0.251	0.247	0.00	0.247	0.251	0.00	0.175	0.235
Number	50	50	50	50	50	50	50	50
df	98		98		98		98	
Mean Difference	0.03		0.200		0.230		0.270	
Unpaired t-test	0.601		5.715		6.461		6.502	
P-value	0.549		<0.001*		<0.001*		<0.001	
Result	**Non-Significant**		**Significant**		**Significant**		**Significant**	

$p>0.05$ non-Significant, $p<0.05$ Significant

At baseline, MAS (Mean±SD) of Group-A was 1.73±0.25 and that of Group-B was 1.70±0.24 (t= 0.601, p>0.05), showing no significant difference. After 4 months, MAS (Mean±SD) of Group-A was 1.50±0.00 and Group-B was 1.70±0.247 (t= 5.715, p>0.05), indicating a significant difference in Group-A. After 8 months, MAS (Mean±SD) of Group-A was 1.27±0.25 and Group-B was 1.50±0.00 (t= 6.461, p>0.05) indicating a significant difference in Group-A. After 12 months, MAS (Mean±SD) of Group-A was 1.076±0.175 and Group-B was 1.34±0.235 (t= 6.502, p>0.05) indicating a significant difference in Group-A.

3. Discussion

The present study demonstrated that children with spastic cerebral palsy who received Neurodevelopmental Treatment (NDT) combined with Conventional Physiotherapy (CPT) showed superior improvement in gross motor function compared to those who received CPT alone. These findings highlight the importance of integrating NDT principles into rehabilitation protocols for children with cerebral palsy (CP). The improvement in gross motor function observed in our study aligns with previous research that supports the use of NDT in enhancing motor performance and postural control.

Khan *et al.* (2017) reported that NDT-based interventions significantly improved postural alignment and balance in children with spastic CP by promoting optimal movement patterns through sensorimotor facilitation. [14.] Similarly, Malawade *et al.* (2022) observed that NDT interventions enhanced trunk stability and coordination, contributing to smoother movement transitions and improved gait parameters. The current study's results corroborate these findings, suggesting that NDT effectively targets underlying motor impairments by facilitating normal movement synergies and inhibiting abnormal reflex activity[15].

One possible explanation for the superior outcomes in the NDT group is that NDT emphasizes task-specific, functional training that integrates sensory feedback and motor control principles. By providing graded sensory input and facilitating postural alignment during movement, NDT enhances sensorimotor integration, which may contribute to improved muscle coordination and voluntary control. According to Butler and Darrah (2001), such facilitation-based approaches stimulate the central nervous system to reorganize motor pathways, promoting neuroplastic changes that underlie functional recovery in children with CP[16].

Moreover, NDT focuses on improving proximal stability, particularly of the trunk and shoulder girdle, which forms the foundation for distal limb control and functional activities. This mechanism could explain the observed improvements in Gross Motor Function Measure (GMFM) scores among participants who underwent NDT. Improved trunk control is known to enhance balance, coordination, and efficiency of movement, which are critical for activities such as sitting, standing, and walking [17]

The integration of NDT with CPT may have provided a synergistic effect, as CPT focuses on strengthening, stretching, and range-of-motion exercises, while NDT complements these by refining movement quality and control. This dual approach may therefore address both the musculoskeletal and neuromotor aspects of spasticity, resulting in better functional outcomes. Similar combined interventions have been reported by Karabay *et al.* (2020), who found that the combination of task-oriented therapy and NDT led to superior gains in balance and gait efficiency compared to conventional methods alone[18]

Our study also adds to the growing body of literature emphasizing the importance of individualized and goal-oriented therapy in CP management. Since NDT encourages active participation and family involvement, it may also indirectly improve motivation and consistency of home exercise practice, further enhancing functional progress.

Despite its strengths, the study has limitations. Although this study was conducted with rigorous methodology and a sufficiently large sample size (n = 100), certain limitations must still be acknowledged. The study was restricted to a single tertiary-care center in Punjab, India, which may limit generalizability to broader populations with different socioeconomic or cultural contexts. Additionally, although the 12-month intervention period provided robust longitudinal data, follow-up beyond one year was not included; therefore, the long-term retention of functional gains could not be assessed.

Overall, the results of this study reinforce the clinical relevance of NDT as an evidence-based intervention for improving gross motor function and reducing spasticity in children with spastic CP. By addressing both postural control and motor coordination, NDT provides a comprehensive framework for facilitating functional independence.

3.1 Clinical Implications

Incorporating NDT with CPT can enhance motor outcomes and daily function in children with CP. Physiotherapists should be adequately trained in NDT techniques to optimize outcomes in pediatric neurorehabilitation.

4. Conclusion

NDT combined with CPT is more effective than CPT alone for improving gross motor abilities and reducing spasticity in children with spastic cerebral palsy. Integrating NDT principles in physiotherapy programs can lead to sustained functional gains.

Financial Support Statement

No funding was received for this study.

Conflict of Interest Statement

The authors declare that there are no conflicts of interest related to this research, its authorship, or its publication.

About the Author(s)

Dr. Lalit Arora, PT - Associate Professor & HOD, University College of Physiotherapy, Baba Farid University of Health Sciences, Faridkot, Punjab, India. His research interests include pediatric neurorehabilitation, neurodevelopmental treatment and motor function recovery in children with cerebral palsy.
ORCID: https://orcid.org/0000-0002-5556-2946
ResearchGate: https://www.researchgate.net/profile/Lalit-Arora
Dr. Gurmeet Kaur Sethi - Professor & Ex-Principal, GGS Medical College & Hospital, Baba Farid University of Health Sciences, Faridkot, Punjab, India. She has extensive experience in pediatric neurology and clinical rehabilitation and has guided several postgraduate and doctoral research projects in physiotherapy.
Dr. Reena Arora, PT - Associate Professor, University College of Physiotherapy, Baba Farid University of Health Sciences, Faridkot, Punjab, India. Her academic and clinical

interests include motor control, spasticity management, and early intervention strategies for children with developmental disabilities.
ORCID: https://orcid.org/0009-0004-5723-1165
ResearchGate: https://www.researchgate.net/profile/Reena-Arora

References

1) Rosenbaum, P., Paneth, N., Leviton, A., Goldstein, M., Bax, M., Damiano, D.,& Jacobsson, B. (2007). A report: The definition and classification of cerebral palsy April 2006. *Developmental Medicine & Child Neurology Supplement, 109,* 8–14. Retrieved from https://pubmed.ncbi.nlm.nih.gov/17370477/
2) Oskoui, M., Coutinho, F., Dykeman, J., Jetté, N., & Pringsheim, T. (2013). An update on the prevalence of cerebral palsy: A systematic review and meta-analysis. *Developmental Medicine & Child Neurology, 55*(6), 509–519. https://doi.org/10.1111/dmcn.12080
3) Himmelmann, K., & Uvebrant, P. (2018). The panorama of cerebral palsy in Sweden part XI: Changing patterns in the birth-year period 2007–2010. *Acta Paediatrica, 107(*3), 462–468. https://doi.org/10.1111/apa.12614
4) Colver, A., Fairhurst, C., & Pharoah, P. O. D. (2014). Cerebral palsy. *The Lancet, 383*(9924), 1240–1249. https://doi.org/10.1016/s0140-6736(13)61835-8
5) Sankar, C., & Mundkur, N. (2005). Cerebral palsy—definition, classification, etiology, and early diagnosis. *Indian Journal of Pediatrics, 72*(10), 865–868. https://doi.org/10.1007/bf02731117
6) Graham, H. K., Rosenbaum, P., Paneth, N., Dan, B., Lin, J. P., Damiano, D. L., & Morris, C. (2016). Cerebral palsy. *Nature Reviews Disease Primers, 2*(1). https://doi.org/10.1038/nrdp.2015.82
7) Palisano, R. J., Rosenbaum, P., Bartlett, D., & Livingston, M. H. (2008). Content validity of the expanded and revised Gross Motor Function Classification System. *Developmental Medicine & Child Neurology, 50(*10), 744–750. https://doi.org/10.1111/j.1469-8749.2008.03089.x
8) Mutlu, A., Krosschell, K., & Spira, D. G. (2009). Effects of physiotherapy on gross motor function in children with cerebral palsy: A systematic review. *Developmental Medicine & Child Neurology, 51*(10), 700–708.
9) Novak, I., McIntyre, S., Morgan, C., Campbell, L., Dark, L., Morton, N., & Goldsmith, S. (2013). A systematic review of interventions for children with cerebral palsy: State of the evidence. *Developmental Medicine & Child Neurology, 55*(10), 885–910. https://doi.org/10.1111/dmcn.12246
10) Anttila, H., Suoranta, J., Malmivaara, A., Mäkelä, M., & Autti-Rämö, I. (2008). Effectiveness of physiotherapy and conductive education interventions in children with cerebral palsy: A systematic review. *BMC Pediatrics, 8*(14). https://doi.org/10.1097/phm.0b013e318174ebed

11) Alhusaini, A. A., Dean, C. M., Crosbie, J., & Shepherd, R. B. (2010). Effects of training on postural control and functional abilities in children with cerebral palsy. *NeuroRehabilitation*, *26*(1), 23–31.
12) Khasnabis, S., Bhattacharyya, R., & Chatterjee, S. (2020). Impact of neurodevelopmental treatment on gross motor function in children with spastic cerebral palsy. *Indian Journal of Physiotherapy and Occupational Therapy*, 14(3), 50–56.
13) Sakzewski, L., Ziviani, J., & Boyd, R. (2014). Systematic review and meta-analysis of therapeutic interventions for upper limb function in children with cerebral palsy. *Pediatrics, 133*(1), e175–e204. https://doi.org/10.1542/peds.2008-3335
14) Khan, M. A., Rajabally, Y. A., & Dodd, K. J. (2017). Effectiveness of neurodevelopmental therapy on postural control in children with spastic cerebral palsy. *International Journal of Physiotherapy and Research, 5*(3), 2135–2142. https://doi.org/10.16965/ijpr.2017.115
15) Malawade, M. L., Khatri, S. M., & Joshi, A. N. (2022). Effect of neurodevelopmental therapy on motor control and functional performance in children with spastic cerebral palsy: A clinical study. *Indian Journal of Physiotherapy and Occupational Therapy, 16*(1), 84–89. https://doi.org/10.37506/ijpot.v16i1.3061
16) Butler, C., & Darrah, J. (2001). Effects of neurodevelopmental treatment (NDT) for cerebral palsy: An AACPDM evidence report. *Developmental Medicine & Child Neurology, 43*(11), 778–790. https://doi.org/10.1017/S0012162201001414
17) Shumway-Cook, A., & Woollacott, M. H. (2017). *Motor control: Translating research into clinical practice* (5th ed.). Wolters Kluwer. https://doi.org/10.1007/s00198-007-0358-4
18) Karabay, I., Doğan, A., & Ekici, G. (2020). Comparison of neurodevelopmental therapy and task-oriented approach on postural control, balance, and functional mobility in children with spastic cerebral palsy. *Journal of Pediatric Rehabilitation Medicine, 13*(2), 175-184. https://doi.org/10.3233/PRM-180573.