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## ORIGINAL ARTICLE

# The Effect of Neuromobilization Techniques on Physical Activities in Cerebral Palsy: A Systematic Review

MUHAMMAD HUSSAIN IQBAL, FARIHA KHALID, SANA BATOOL, Ashfaq Ahmed

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### ABSTRACT

**Objective:** The aim of this review is to describe the effects of neuromobilization in improving functional limitations and disabilities in cerebral palsy patients.

**Study Design:** Systematic Review

**Place and Duration of Study:** University of Lahore, 6 months.

**Material and Methods:** Electronic databases such as google scholar, Cochrane, PubMed, PEDro were used to search literature. The databases search identified 86 articles, out of which only two articles fulfilled inclusion criteria; a cross-sectional observational study and a case report series.

**Results:** In the observational study a fair correlation of straight leg raise (SLR) was found with muscle strength and gross motor function measure (GMFM-66) scores. The levels of disability had a fair to moderate negative correlation with SLR which show that a decrease in degree of SLR results in an increase disability. In the case report series, all participants show some improvement in quality of life and function after intervention.

**Conclusion:** The limited literature available on neuromobilization showed that in cerebral palsy the neural structures are compromised and neuromobilization is an effective method in restoring the normal physiology of neural structures. Further studies need to be done to evaluate the effect of neuromobilization on different musculoskeletal and neurological conditions especially in children.

**Key Words:** CP, Cerebral palsy, Neuromobilization, Neural mobility, Neurodynamics, Neural structures

### Correspondence to:

**Fariha Khalid,**  
University Institute of Physical  
Therapy, The University of Lahore,  
1-KM Defence Road, Lahore

**E-mail:**  
fariha.khalid@dhpt.uol.edu.pk

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### INTRODUCTION

In Cerebral palsy, the cerebral means brain and palsy means the loss or impairment of motor function.<sup>1</sup> Cerebral palsy is a non-progressive neurological disorder due to brain injury that occurs before complete development of cerebral cortex in prenatal, perinatal, and postnatal time period.<sup>2</sup> In United states, it affects 2-2.5 children per 1000 born and is the most common childhood

physical disability.<sup>3</sup> In about 70-80% cases of cerebral palsy brain injury occurs in prenatal time due to unknown causes while about 10-20% cases are acquired postnatally because of viral encephalitis, increase level of bilirubinemia, bacterial meningitis, road traffic accidents, falls or child abuse.<sup>3</sup> The neonatal risk factors of cerebral palsy include premature birth, birth weight <2,500 g, growth retardation during pregnancy, trauma, and intracranial hemorrhage.<sup>2,3</sup> Cerebral palsy

results from the abnormalities or damage to the developing brain that disturbs the ability of brain to perform voluntary movement and maintain balance and posture.<sup>2</sup> According to types of movement disorder involved, cerebral palsy is classified into three main types. The first type is spastic cerebral palsy which is characterized by muscles stiffness.<sup>1</sup> The second type is athetoid cerebral palsy is identified by writhing movements and third type is ataxic cerebral palsy in which poor balance and coordination is disturbed. The additional symptoms include weakness (paresis) or paralysis (plegia) which may be present in one side of body (hemiplegia), or in all four limbs (quadriplegia).<sup>1</sup> All people with cerebral palsy have problems with movement and posture, and some also have some level of intellectual disability, seizures, and abnormal physical sensations or perceptions, as well as other medical disorders.<sup>2</sup> People with CP also may have impaired vision or hearing, and language, and speech problems.<sup>1</sup> Early treatments help better in overcoming developmental disabilities.

Cerebral palsy is due to upper motor neuron lesion in the developing brain, it causes increase in muscle tone.<sup>4</sup> Spasticity affects motor performance by compromising contractile and non-contractile structures. For normal physiological functioning, non-contractile structures mobility is also required.<sup>5</sup> Decreased elasticity of the non-contractile structure such as nervous system can arouse pain or restrict the movement. Different studies revealed the presence of nerve gliding during limb movements.<sup>6</sup> Research evidence has shown that normal neural physiology and biomechanics can be restored by two alternate nerve mobilization techniques: the slider and tensioner.<sup>7</sup>

In adults, injury to the central nervous system causes the neural structures to affect the motor performance. It was because of the decreased nerve mobility which influenced lower limbs muscle strength or motor performance.<sup>5</sup> Cerebral palsy is characterized by symptoms such as muscle weakness, muscle stiffness or spasticity and joints deformity which affect the motor skills; like difficulty in climbing stairs or small step length during walking.<sup>8</sup> As cerebral palsy cannot be cured, but medications, conventional treatments and surgery helps many patients to improve their

motor performance and social life.<sup>3</sup> As the musculoskeletal system is innervated by nervous system, the changes in nervous system directly affect muscles. Therefore, neuromobilization is a technique for gaining normal physiology of nervous system. It has two components: neural tension and neural slider.<sup>9</sup> The neuromobilization techniques help in improvement of the muscle strength and motor performance in adults; suggests that the neural structures could be an additional factor which influences movement. However, the evidence about neural structures and their affect on functional limitations and recovery in children with neurological disorders is scarce.<sup>5</sup>

The aim of this review is to describe the importance of neuromobilization in improving motor performance. Muscles tone is primary regulated by muscle spindles innervated by nerve fibres. In cerebral palsy the tone of muscles is affected and the evidence show that neuromobilization enhance motor performance in adult patients with brain damage. Hence, neuromobilization may be an effective treatment for improving motor skills and reducing functional limitations and disabilities.

## MATERIAL AND METHODS

**Study identification and selection:** Electronic databases such as google scholar, Cochrane, PubMed, PEDro were used to search literature by using the following keywords: CP, cerebral palsy in combination with neurodynamics, neuromobilization, and neural mobility. The literature was searched back to the earliest time available by two reviewers. Only the published articles in English were searched and the reference list of identified article was also scanned.

### Inclusion criteria:

1. Published articles available on scholar, Cochrane, PubMed, PEDro
2. Population should be children or adolescents with diagnosed CP
3. Neuromobilization techniques or a combination/comparison of these with other physiotherapy interventions

4. Assessment of impairment, functional limitation and disability.

**Study selection:** Two reviewers independently searched for articles and assessed them separately for inclusion criteria. The quality of the studies was not assessed in this review.

**RESULTS**

The literature available on the effect of

neuromobilization on spasticity, ranges of motion and functional activities is quite limited. The databases search identified 86 articles, out of which only two articles fulfilled inclusion criteria; a cross-sectional observational study and a case report series. Table 1 summarizes the findings of these studies.

**TABLE 1: Summary of studies**

Reference	Study Design	Outcome measures	Findings
Marsico P <sup>5</sup> (2016)	Prospective cross-sectional observational study	Relationship of the SLR with Muscle strength, Gross Motor Function Measure (GMFM-66) and activity score	SLR range of motion has a fair relationship with muscle strength and gross motor functions. Decrease in SLR range results in increase in disability.
Zollar JA <sup>10</sup> (2019)	Case Report series	Quality of life and function were measured with the CPCHILD and the WeeFIM at before intervention, after intervention and 3 months after intervention. Colonic motility was assessed by radiographic imaging before and after intervention.	Neural and visceral mobilization improve functions and quality of life. it should be considered in CP rehabilitation as an alternative for medications or invasive treatments,

SLR = Straight leg raise, GMFM = Gross motor function measure

**Participants:** The cross-sectional observational study<sup>5</sup> included 30 diagnosed patients of cerebral palsy who were able to communicate and follow instruction. Age ranged from 6 to 18 years. The children with ankle joint arthrodesis, athetosis, surgery of lower back or lower extremities, weight bearing restriction, flexion contractures in knee (in >5° flexion) and hip (<80° flexion) were excluded. The second study<sup>10</sup> consisted of case reports of cerebral palsy patients having gross motor function classification system level IV or V and diagnosed with chronic constipation; age limits from 2 to 16 years. The participants with any spica casts, abdominal aneurysm, coagulation disorders and any surgery within six weeks were excluded.

**Intervention:** Out of two studies included in this review, intervention was given in one study while the other is a cross-sectional study.<sup>5</sup> In case report series<sup>10</sup>, the intervention used were neural and visceral mobilization. The treatment was given after 2 weeks for 6 months and a treatment session lasted for 45 minutes.

**Outcome measures:** In observational study<sup>5</sup> (2016), the relationship between the straight leg raise and different functional outcomes was determined. The functional outcome Quadriceps strength was measured with a manual dynamometer, functional skills with the Gross Motor Function Measure (GMFM-66) and the daily motor activity of the child as evaluated by 3D accelerometer. Straight leg raised was performed and to differentiate between musculoskeletal and neural cause, structural differentiation maneuvers were used i.e. dorsiflexion and neck flexion. If after releasing ankle dorsiflexion and neck flexion. If SLR increased by at least 5° then test is said to be positive which indicates that the sciatic nerve is limiting the movement. The results of this study has shown that a fair correlation of SLR was found with muscle strength and GMFM-66 scores. The levels of disability had a fair to moderate negative correlation with SLR which show that a decrease in degree of SLR results in an increase disability.

The second study<sup>10</sup> evaluated the quality of life by using CPCHILD and for function WeeFIM scale

was used. the assessment was done three times; before intervention, after intervention and after 3 months of intervention. The radiological imaging was used to determine the colonic motility before and after treatment. All participants showed some improvement in quality of life and function after intervention. The number of bowel movements increased in all the participants but the results were not significant due to a small number of participants.

## DISCUSSION

This review was conducted to determine the effect of neuromobilization on cerebral palsy patients on functional limitations and disabilities. Only two studies were found.<sup>5,10</sup> The results of the observational study done by Marsico P<sup>5</sup> have shown that the neural structures are compromised in cerebral palsy so they should also be treated along with musculoskeletal structures. The other study done by Zollars JA<sup>10</sup> had used neuromobilization techniques in participants and concluded that neuromobilization is an effective method in improving quality of life and functions. It should be used in treating patients as an alternative for medications and invasive treatments.

There is evidence available which favours the neuromobilization techniques for treating musculoskeletal symptoms in adult stroke patients.<sup>11-13</sup> These studies indicate beneficial effects of neuromobilization in regulating muscle tone, increasing range of motion and improving functional mobility of patients affected by stroke. A cross-sectional study evaluated the efficacy of sciatic nerve mobilization technique in healthy adults and concluded that the mobilization of sciatic nerve helps in improving hamstring flexibility and postural balance.<sup>14</sup>

Limited evidence available suggests that in cerebral palsy the neural structure are affected.<sup>5</sup> Assessment and treatment of the neural tissue is as important as treating musculoskeletal structure. The literature available on neuromobilization is very limited. Further studies need to be done to evaluate the effect of neuromobilization on different musculoskeletal and neurological conditions especially in children. This area needs special attention and studies should be done to

explore more benefits of neuromobilization in evaluating and managing activity and participation limitations with cerebral palsy.

## CONCLUSION

Limited literature available on neuromobilization showed that in cerebral palsy the neural structures are compromised and neuromobilization is an effective method in restoring the normal physiology of neural structures.

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**Conflict of interest:** There are no financial conflicts of interest by authors regarding this study.

### Authors' affiliation

Muhammad Hussain Iqbal, Fariha Khalid, Sana Batool, Ashfaq Ahmed  
University Institute of Physical Therapy, The University of Lahore, 1-KM Defence Road, Lahore

## REFERENCES

1. Taylor F. Cerebral palsy: hope through research: The Institute; 1993.
2. Jones MW, Morgan E, Shelton JE, Thorogood C. Cerebral Palsy: Introduction and Diagnosis (Part I). *Journal of Pediatric Health Care.* 2007;21(3):146-52.
3. Krigger KW. Cerebral palsy: an overview. *American family physician.* 2006;73(1).
4. Bar-On L, Molenaers G, Aertbeliën E, Van Campenhout A, Feys H, Nuttin B, et al. Spasticity and its contribution to hypertonia in cerebral palsy. *Biomed Res Int.* 2015;15(3):317-47.
5. Marsico P, Tal-Akabi A, van Hedel HJA. The relevance of nerve mobility on function and activity in children with Cerebral Palsy. *BMC Neurology.* 2016;16(1):194.
6. Ridehalgh C, Moore A, Hough A. Repeatability of measuring sciatic nerve excursion during a modified passive straight leg raise test with ultrasound imaging. *Manual therapy.* 2012;17(6):572-6.
7. Herrington L. Effect of different neurodynamic mobilization techniques on knee extension range of motion in the slump position. *Journal of Manual & Manipulative Therapy.* 2006;14(2):101-7.

8. Kurz MJ, Arpin DJ, Corr B. Differences in the dynamic gait stability of children with cerebral palsy and typically developing children. *Gait & posture*. 2012;36(3):600-4.
9. Bertolini GR, Silva TS, Trindade DL, Ciena AP, Carvalho AR. Neural mobilization and static stretching in an experimental sciatica model: an experimental study. *Brazilian Journal of Physical Therapy*. 2009;13(6):493-8.
10. Zollars JA, Armstrong M, Whisler S, Williamson S. Visceral and neural manipulation in children with cerebral palsy and chronic constipation: five case reports. *Explore*. 2019;15(1):47-54.
11. Castilho J, Ferreira LAB, Pereira WM, Neto HP, Morelli JGdS, Brandalize D, et al. Analysis of electromyographic activity in spastic biceps brachii muscle following neural mobilization. *Journal of Bodywork and Movement Therapies*. 2012;16(3):364-8.
12. Nery dosSantos AC, deGoes ACG, Lago RMV, Petto J. Neural mobilization as a therapeutic option in the treatment of stroke. *Manual Therapy, Posturology & Rehabilitation Journal= Revista Manual Therapy*. 2016;14.
13. Godoi J, Kerppers I, Rossi L, Corrêa F, Costa R, Corrêa J, et al. Electromyographic analysis of biceps brachii muscle following neural mobilization in patients with stroke. *Electromyography and clinical neurophysiology*. 2010;50(1):55-60.
14. Park J, Cha J, Kim H, Asakawa Y. Immediate effects of a neurodynamic sciatic nerve sliding technique on hamstring flexibility and postural balance in healthy adults. *Physical Therapy Rehabilitation Science*. 2014;3(1):38-42.