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Original Research

An experimental study on comparison between proprioceptive neuromuscular facilitation technique and conventional physical therapy on lower extremity function of cerebral palsy

Madeeha Nabi[a], Syble Chiragh[b], Amber Tariq[c], Ayesha Rehman[d], Rabab Kompal[e], Iqra Nadeem[f*]

[a]Irha Physiotherapy and Rehabilitation Center, Lahore, Pakistan
[b]National Hospital and Medical Centre, Lahore, Pakistan
[c]Physiogic Physiotherapy Clinic, Lahore, Pakistan
[d]Lahore Institute of Science and Technology, Department of Allied Health Sciences, Lahore, Pakistan
[e]Royal Institute of Medical Sciences Multan, Pakistan
[f*]Department of Allied Health Sciences, University of Sargodha, Pakistan

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Correspondence:
iqranadeem7979@gmail.com

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Abstract

Background: Cerebral palsy (CP) has prevalence of 2 to 2.5 per 1000 live births. Causes of CP are still not known significantly. There are many risk factors of CP are known now a days. CP can cause other secondary abnormalities in musculoskeletal system like low muscle power, tightness, and many other bony and structural changes and also in gait. There are five different levels of gross motor function in which level I is the highest level and level V is the last level. This classification is according to the GMFCS. Objective: To determine the efficacy of conventional therapy and PNF techniques in reducing spasticity and improving gross motor function in subjects with cerebral palsy. Methods: Total 36 patients were divided equally into 2 groups. They were assessed at pretreatment, 4th and 8th session of treatment using GMFCS and Modified Ashworth Scale. Group A received PNF stretching (Contract-Relax Method) and Group B received Muscle passive stretching. Results: At post treatment assessment, PNF group had the highest score for GMFCS score (U=155.0, p=0.812), hip flexors spasm (U=121.50, p=0.178), knee flexors spasm (U=129.0, p=0.270), knee extensors spasm (U=152.00, p=0.731) foot dorsiflexors spasm (U=143.50, p= 0.530), foot planter flexors spasm (U=155.00, p=0.817) and on the other hand conventional treatment group had the high score in hip extensors spasm (U=114.50, p=0.098). Conclusion: It is concluded that both the techniques are helpful to enhance the GMFCS score and to reduce the spasticity. PNF stretching has the more positive effects on improving the GMFCS score than that of conventional muscle stretching, in reducing lower limb spasticity except the hip extensors where conventional muscle stretching was more effective.

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Introduction: Cerebral paralysis (CP) is the most well-known reason for physical inability in youth, with an expected occurrence of 2 to 2.5 per 1000 live births. Cerebral Palsy rate continues rising, incompletely because of more noteworthy quantities of untimely newborn children who are enduring and longer in general survival [1]. Intracranial blood loss and injury, birth weight under 2500g, intrauterine development hindrance and birth less than 32 weeks of development are the most neonatal risk factors for CP. When discussing postnatal, CP is caused in around 10-20% cases due to the different conditions like, brain detriment, from different bacterial, viral infections like meningitis, encephalitis, hyperbilirubinemia, falls and abusing the child on head [2]. Proper neuronal generation and propagation of action potential is also necessary for the normal functioning of brain [3]. Current ways to deal with treatment options for kids with cerebral palsy have risen up out of an assortment of sources, including neuromaturational, pharmacological, biomechanical and careful casings of reference. In word related treatment, neurodevelopmental treatment (NDT), proprioceptive neuromuscular help (PNF), development treatment, muscle re-instruction and the Vojta approach are clinical models which depend on a neuromaturational establishment [4]. Development of novel drug delivery system like silver nanoparticles of different compounds are also designed to make the accessibility of the drug to the target tissue like muscle, brain or neuron for treatment purpose [5]. According to a study hamstring's static stretching is more effectual than self-stretching and PNF stretching that fuses the hypothesis of corresponding restraint when utilizing a 30-second stretching portion connected 3 days of the week for about a month [6]. Whereas another study showed that PNF stretching is may be “the most effective form of flexibility training available to you for increasing your range of motion (ROM)”. This is a further developed type of adaptability preparation, including both the stretch and constriction of the focused-on muscle groups. While there are a few types of PNF stretching, they all make them think in the same manner they encourage solid restraint. It is accepted that this is the reason PNF is better than different types of adaptability training [7]. Research demonstrates that PNF stretching, both the CR and CRAC techniques are compelling in enhancing and sustaining after ROM, expanding strong quality and control, and expanding athletic execution, particularly after workout. However, legitimate convention and congruity must be pursued to accomplish and keep up the advantages of PNF procedures [8]. A systematic review by F. Kaya suggests that stretching practices are a vital segment of the preparing process regarding protecting characteristic adaptability of joints, expanding their proficiency and expelling damage hazard. Likewise, the genuine impact of expanding adaptability on athletic execution keeps its vulnerability. Future investigations ought to be for making proper conventions to expel the negative impacts of PNF stretching, explaining perfect PNF stretching sessions regarding span, recurrence and number of redundancies and shaping conventions explicit to sports [9]. Previous studies have been reported on different settings like sports, healthy individuals etc. There is lack of studies on comparison between PNF and conventional therapy on CP. We hypothesize that conventional therapy (passive stretch) and Proprioceptive Neuromuscular Facilitation (PNF) Technique have beneficial results on cerebral palsy management in enhancing range of motion and plasticity and lowering level of spasticity. However, the effectiveness of these two procedures is yet to be decided.

Material and Methods: Quasi experimental study was conducted in National Orthopedic Hospital (NOH), Bahawalpur within 4 months with 36 participants randomly recruited in two groups. Group A received PNF stretching (contract-relax method) and group B received passive muscle stretching. SAMPLING

Participants were included with prior diagnosis with Spastic CP, 6-12 years of age, both genders and 1+ grade at modified ashworth scale. Children with any prior surgery of lower limb were excluded and those who had a history of seizures. Data was collected by using Gross Motor Function Classification System for Cerebral Palsy Patients (GMFCS): Sitting, walking and use of mobility devices were assessed using GMFCS. A modified Ashworth Scale was used to measure resistance during passive soft-tissue stretching.

Data was analyzed by using SPSS version 20. Statistical significance was set at p=0.05. Descriptive statistics were applied. The Mann Whitney test was applied to see changes between successive visits. Friedman ANOVA was used to measure changes of objective measurements over time.

Results: Demographics of the CP patients are shown in Table 01. Pretreatment Mean rank of both groups were calculated using SPSS, GMFCS score, Hip Flex spasm, Hip extensor spasm, knee flexor spasm, knee extensor spasm, foot dorsiflexion and planterflexor spasm were recorded prior to the treatment sessions. Pre-treatment values are presented in table 02. Pre-treatment comparison of both groups was done by using non-parametric T-tests.

Table 02 showed that in pretreatment assessment, data was insignificant and PNF group has the highest score for GMFCS score (*U=155.0, p=0.812),* hip flexors spasm (U=121.50, p=0.178), knee flexors spasm (U=129.0, p=0.270), knee extensors spasm (U=152.00, p=0.731) and on the other hand convention treatment group has the high score in hip extensors spasm (U=114.50, p=0.098).

Post treatment measurements were taken at session 4th and session 8th. Table 03 presented the comparison of both groups mean at post treatment at 8th session. Table 03 showed that data was insignificant and at 8th sessions assessment (*U* = 135.00, p= 0.305) of GMFCS score, PNF group has the highest rank. At the 8th session’s assessment of hip flexors spasm, data was insignificant and the PNF group has the highest rank (*U*= 156.000, p= 0.828). At the 8th sessions assessment of hip extensors spasm, conventional treatment group has the highest rank *U*= 102.000, p= 0.032. For knee flexors spasm data was insignificant and PNF group has the highest rank at 8th session of treatment assessment (*U*= 142.000, p=0.481). for Knee extensor spasm data was insignificant and conventional treatment group has the highest rank in 8th session of treatment (*U*= 128.00, p= 0.169).

Discussion: A study conducted on effectiveness of passive stretching on muscle length reported in their findings that all factors were fundamentally more noteworthy during pre-and post-stretch preliminaries contrasted with the resting angle and were self-sufficient of stretch system. There was an estimated 10° increment in the most extreme

dorsiflexion post-stretch, and this was represented by lengthening of both muscle (0.8 cm) and ligament (1.0 cm). Muscle fascicle length expanded altogether (0.6 cm) from pre-to post-stretch [10]. In current study we found that both treatments have positive effects on reducing the muscle spasms of the foot dorsiflexors (PNF group (χ^2 (2) = 16.909, p= 0.000) and conventional treatment group (χ^2 (2) = 14.000, p=0.001). and foot planter flexors (PNF group (χ^2 (2) = 20.150, p= 0.000) and conventional treatment group (χ^2 (2) =14.966, p= 0.001). An evidence based systematic review reported that treatment options focusing on issues at body capacity and structure level, influenced this dimension without critical overflow to movement level and the other way around. Stretching can be helpful to enhance ROM in youngsters with CP. The stretch ought to ideally be kept up for at least 30s [11]. In current study we found that PNF stretching has the highest ranks in lowering the lower limb muscle spasm except the hip extensors spasm where the conventional muscle stretching has the highest ranks in lowering the muscle spasm (χ^2 (2) =12.000, p= 0.002). In a study on evaluation of spasticity in CP patients using two scales (Ashworth and Tardieu scale) and they concluded that spasticity, contracture, and expanded latent muscle firmness are for the most part complex wonders existing together in cerebral palsy and influencing useful motor execution. Ashworth Scale distinguished 26 of 27 with spasticity, while the Tardieu Scale recognized 18 of 27 [12]. In current study results showed that spasticity of lower limb in patients with CP can be controlled by applying the PNF contract relax method and for hip extensors spasticity conventional muscle stretching is very useful. From finding of another research it was confirmed that both Task-Oriented Approach and Proprioceptive Neuromuscular Facilitation Exercises are helpful in enhancing the lower limb function in children with cerebral palsy [1]. The current study concluded that to improve the GMFCS score and to reduce the spasticity PNF stretching (Contract-Relax Method) proven to be effective.

Conclusion: From the results of the current study, it can be concluded that both the techniques are helpful to improve the GMFCS score and to reduce the spasticity. PNF stretching has the more positive effects on improving the GMFCS score than that of conventional muscle stretching, in reducing the disability level among Cerebral Palsy children by reducing lower limb spasticity except the hip extensors where conventional muscle stretching is more effective.

Recommendations: It is recommended that in future studies patients with CP of below 6 years and above 12 years can be recruited to check the response of patients to the PNF stretching in early and later ages. In future studies comparison of improvement in male and female patients can be studied to check the gender response to the physical therapy interventions. Inclusion and exclusion criteria for future studies can be modified to recruit the patients for study.

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Table. 1. Demographics of PNF and Conventional group

Demographics of case and control groups		
Demographics	PNF Group	Conventional group
Age	8.27±1.839	7.25±1.712
Gender	Male 61%, Female 39%	Male 44%, Female 56%
Weight	28.75±4.62	31.24±5.48

Table. 2. Pre-Treatment Comparison of Both groups

Pre-treatment comparison of both groups					
	GMFCS	Hip Flx Spasm	Hip Ext Spasm	Knee Flx Spasm	Knee Ext Spasm
Mann-Whitney U	155.0	121.5	114.5	129.0	152.000
Wilcoxon W	326.0	292.5	285.5	300.0	323.000
Z	-.237	-1.347	-1.653	-1.103	-.344
Asymp. Sig. (2-tailed)	.812	.178	.098	.270	.731

Table. 3. Post treatment comparison of both groups at 8th session

Post treatment comparison of both groups at 8th session					
	GMFCS	Hip Flx Spasm	Hip Ext Spasm	Knee Flx Spasm	Knee Ext Spasm
Mann-Whitney U	135.000	156.000	102.000	142.000	128.000
Wilcoxon W	306.000	327.000	273.000	313.000	299.000
Z	-1.026	-.217	-2.139	-.705	-1.374
Asymp. Sig. (2-tailed)	.305	.828	.032	.481	.169