

EFFECTS OF MYOFASCIAL STRETCH WITH AND WITHOUT FUNCTIONAL MASSAGE ON SPASTICITY AND GROSS MOTOR FUNCTION IN CHILDREN WITH CEREBRAL PALSY

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Background: Cerebral Palsy is a well-known childhood disability. CP produces disorders of tone, motor development and gait. Spasticity is one of those disorders resulting from lesion of upper motor neuron on spinal or cerebral level which trigger high stretch reflex with exaggerated tendon jerks making movements difficult and labored.

Objective: The aim of the study was to compare the effects of myofascial stretch (MFS) with and without functional massage on spasticity and gross motor function in children with cerebral palsy (CP).

Methods: 22 children with Diplegic CP aged 6-12 years were randomly allocated into two groups. Group A (Experimental) received myofascial stretch along with functional massage while Group B (Control) received myofascial stretch only for 8 weeks. Outcome measure tools included MAS (Modified Ashworth Scale) to assess spasticity in lower limbs and Gross Motor Function Measure (GMFM-88) to assess gross motor function. Data were collected at baseline and after 8 weeks of treatment. Data were analyzed using SPSS version 25.

Results: Within group analysis exhibited significant improvement in GMFM total scores with change in median from 55.07 to 72.74 in Experimental group and from 54.04 to 68.61 in control group. Similar improvement was also observed with respect to MAS grades in both groups ($p < 0.05$). However, between groups analysis revealed that there was no significant difference between both groups with respect to GMFM scores ($p > 0.05$) and MAS grades except GMFM score of right hamstrings.

Conclusions: It was concluded that myofascial stretch with and without functional massage both are effective and useful in improving gross motor function and decreasing spasticity. However, no intervention is found superior to other intervention.

Keywords: Cerebral palsy, Gross Motor Function, Modified Ashworth Scale, Spasticity

Introduction

Cerebral palsy is the most well-known actual disability in pediatric population across the globe. CP produces disorders of tone, motor development and postural control.(1) The motor disorders of CP are usually accompanied with disorders of perceptions, sensations, cognition, behavior and communication. CP may also include epilepsy and other musculoskeletal complications.(2) Spasticity is one of the signs showing lesion of upper motor neuron on spinal or cerebral level.

The prevalence of cerebral palsy is reported between 2 and 3 per 1,000 live births. Spastic CP, particularly spastic diplegia, is the most common form of CP, accounting for 50-60% of total cases.(3) CP constitutes the non-progressive brain disorders or anomalies that are static, though the physical depiction of symptoms is different with the time.(4) Spasticity is defined as resistance to passive stretch which is velocity-dependent in nature. Spastic CP is associated with damage in the brain's pyramidal areas. The deformities of bones and joints in CP is due to contractures and muscle spasticity. The most affected parts of body are lower extremities and spinal joints. According to one survey, it has been reported that 77% of CP children have spasticity, 80% have musculo-skeletal contractures and 18% have daily pain. The abnormal increase in muscle tone results in muscle growth failure along with other functional complications.(5, 6)

Many interventions have been used to improve the lifelong disability in this population. In a systemic review, it was concluded that anticonvulsants, ankle casting, BoNT (botulinum toxin), bisphosphonates, diazepam and selective dorsal rhizotomy help in improving the body structure and function while interventions like bimanual training, constraint-induced movement therapy, context-focused therapy, goal-directed/functional training, home programmes, and occupational therapy after BoNT improves functions at activities level. So, no interventions were shown to work conclusively at more than one level of the ICF.(7)

Massage therapy is a highly modest, low-cost and non-invasive treatment, and has been implemented to treat stroke patients for decades. Massage therapy is implied to recover spasm of the muscle, to reinforce the elastic quality of muscles and connective tissue, to decrease muscle pain, increase range of motion, to decrease muscle contractures and to induce relaxation. (8, 9)

There is no specific medication available which can cure cerebral palsy. However anti-spasmodic medications (muscle relaxants) are the ones that are being utilized the most. Though botulinum toxin can release the spasm quickly but its outcome are usually transient in nature, therefore needs frequent sessions which puts a financial burden on the family.(10)

One of the interventions used for CP is myofascial release which is the assistance to mechanical, neural and psycho-physiological variation in the myofascial system. It is performed manually and used to help in relieving stiffness in the fascia.(11)

The treatment for tightness in spastic CP children is very vast consisting of numerous techniques which take account of but not limited to static stretching, antagonistic muscles strengthening or application of orthosis and education for the postures, etc. The researchers and experts also advise to use Myofascial Release Technique (MFR) to elongate spastic muscles.(12)

A conflict of interest has been reported amongst health professionals on use of massage therapy in the management of spasticity in CP population. This study might help in resolving these issues and guiding in use of functional massage to decrease spasticity.

MATERIAL AND METHODS

This randomized controlled trial was conducted after the Ethical approval from ethical committee of Riphah International University Lahore. The clinical trial was registered at WHO trail registry with the number NCT05392335. After informed written consent, a total of 22 patients were enrolled in this study and then divided into two groups with 11 patients in each group. Sample size was calculated using Epitool software. Non probability sampling technique was used to collect data from District Headquarter Hospital, Okara, Gunj Shakar Special Education School, Okara.

Following inclusion Criteria was used:

- Age 06-12 years
- Diagnosed with diplegic cerebral palsy
- GMFCS levels I-IV
- Both Genders

Following Exclusion criteria was used:

- Children with cognitive dysfunction
- Children having visual and auditory deficits
- Children undergone through lengthening surgeries
- History of uncontrolled seizures were excluded from the study.

Randomization:

The randomization was conducted using sealed envelopes organized by the physical therapy unit of the respective settings. Children were randomly assigned to treatment group in a 1:1 ratio with block sizes of 4 and 6.

Data Collection Procedure:

There were two groups in the study. Group A received functional massage along with myofascial stretch to hip adductors, hamstrings and calf muscles. In functional massage the muscles in shortened position were extended passively with one hand and petrissage was applied simultaneously with the other hand for 10 minutes. At the end of extension, myofascial stretching was applied to the muscles sustained for 120 second for 10 -15 repetitions on each muscle. Total number of sessions were 3 sessions per week for 8 weeks. While group B received only myofascial stretch muscles sustained for 120 second for 10 -15 repetitions on each muscle. Along with this, both groups received device-assisted walking training. Data were collected at baseline and after completion of intervention.

The outcome measure tools used were Modified Ashworth Scale for spasticity and Gross Motor function Measure (GMFM-88) for motor activity. The reliability of Modified Ashworth Scale is (ICC+=0.686).(13) The Intra-rater and inter-rater reliability of GMFCS is 0.98 and 0.97 respectively.(14)

Ethical Consideration:

- Ethical approval was obtained from the Ethical committee of Riphah International University, Lahore.
- Informed consent was taken from the participants and confidentiality was assured to the patients.
- All the information was provided to the patient that what will be potential benefits of the treatment and without any harm.

RESULTS

The normality of data was analyzed by using Shapiro-Wilk test and non-parametric test were applied to compare the variables within and between groups.

Descriptive Statistics like mean \pm standard deviation were determined for quantitative data while the qualitative data were presented in the form of frequencies and percentages. The significance level set for this study was 95% ($p < 0.05$).

Table 1 shows the demographic data of both groups which shows that the mean age of participants in Myofascial stretch and functional massage group was 9.09 ± 1.92 whereas mean age of participants in myofascial group was 9.00 ± 1.94 . Out of 22 patients in Group A, 7(63.6) were male and 4(36.4) were female. In group B, 6(54.5) were male and 5(45.5) were female. Out of 22 patients in Group A, 3(27.3) shows family history and 8(72.7) shows no history. In group B, 4(36.4) shows family history and 7(63.6) shows no family history. In Group A, 2 patients belonged to upper class, 4 patients belonged to upper middle class, 3 patients belonged to lower middle class and 2 patients belonged to lower class family. Similarly in Group B, 1 patient belonged to upper class, 4 patients belonged to upper middle class, 3 patients belonged to lower middle class and 3 belonged to lower class family. In group A out of total 11 patients, 2 were in level II, 5 were in level III and 4 were in level IV. Similarly, out of 11 patients in group B, 1 were in level II, 4 were in level III and 6 were in level IV.

As per results of table 2, within group analysis revealed statistically significant difference ($P < 0.05$) in MAS grades of right and left side adductors, hamstrings and quadriceps muscle and GMFM-88 total score. While for between group analysis in table 3, results were non-significant ($P > 0.05$) between both groups except for MAS grades of right hamstrings and GMFM-88 total score ($P < 0.05$).

Table No 1: Baseline characteristics & Demographic Features

Variables	Sub-category	Total Population	Control Group	Experiment Group	P Value
Age		22	9.00±1.941	9.09±1.921	0.913
Gender	Male	13	6	7	0.665
	Female	9	5	4	
Family history	Yes	7	4	3	0.647
	No	15	7	8	
Socioeconomic Status	Upper Class	3	1	2	0.912
	Upper Middle Class	8	4	4	
	Lower Middle Class	6	3	3	
	Lower Class	5	3	2	
GMFCS	Level II	3	1	2	0.656
	Level III	9	4	5	
	Level IV	10	6	4	

Table 2: Within group Analysis using Wilcoxon-rank test**A) GMFM-88**

Groups	Treatment	median	Mean rank	Z score	P value
Experimental Group	Pre-Treatment	55.07	6.00	-2.936	0.003
	Post Treatment	72.74	0.00		
Control Group	Pre-Treatment	54.04	6.00	-2.936	0.003
	Post Treatment	68.61	0.00		

B) MAS

Study Groups	Muscle Group	Treatment	Median	Mean Rank	Z-score	P value
Experimental Group	Left Hamstring	Pre-Treatment	4.00	0.00	-3.207	0.001
		Post Treatment	3.00	6.00		
	Left Calf	Pre-Treatment	5.00	0.00	-3.317	0.001
		Post Treatment	4.00	6.00		
	Left Adductor	Pre-Treatment	4.00	0.00	-3.051	0.002
		Post Treatment	3.00	5.50		
	Right Hamstring	Pre-Treatment	4.00	5.00	-2.178	0.029
		Post Treatment	3.00	6.22		
	Right Calf	Pre-Treatment	3.00	0.00	-2.810	0.005
		Post Treatment	3.00	5.00		
	Right Adductor	Pre-Treatment	5.00	0.00	-2.919	0.004
		Post Treatment	4.00	5.50		

Control Group	Left Hamstring	Pre-Treatment	4.000	0.00	-2.887	0.004
		Post Treatment	3.000	5.00		
	Left Calf	Pre-Treatment	4.000	0.00	-2.530	0.011
		Post Treatment	3.000	4.00		
	Left Adductor	Pre-Treatment	4.000	0.00	-2.887	0.004
		Post Treatment	3.000	5.00		
	Right Hamstring	Pre-Treatment	4.000	0.00	-2.887	0.004
		Post Treatment	4.000	5.00		
	Right Calf	Pre-Treatment	5.000	0.00	-2.887	0.004
		Post Treatment	4.000	5.00		
	Right Adductor	Pre-Treatment	3.000	0.00	-2.887	0.004
		Post Treatment	3.000	5.00		

Table 3: Between Group Analysis using Mann-Whitney U Test**A) GMFM-88 Total scores**

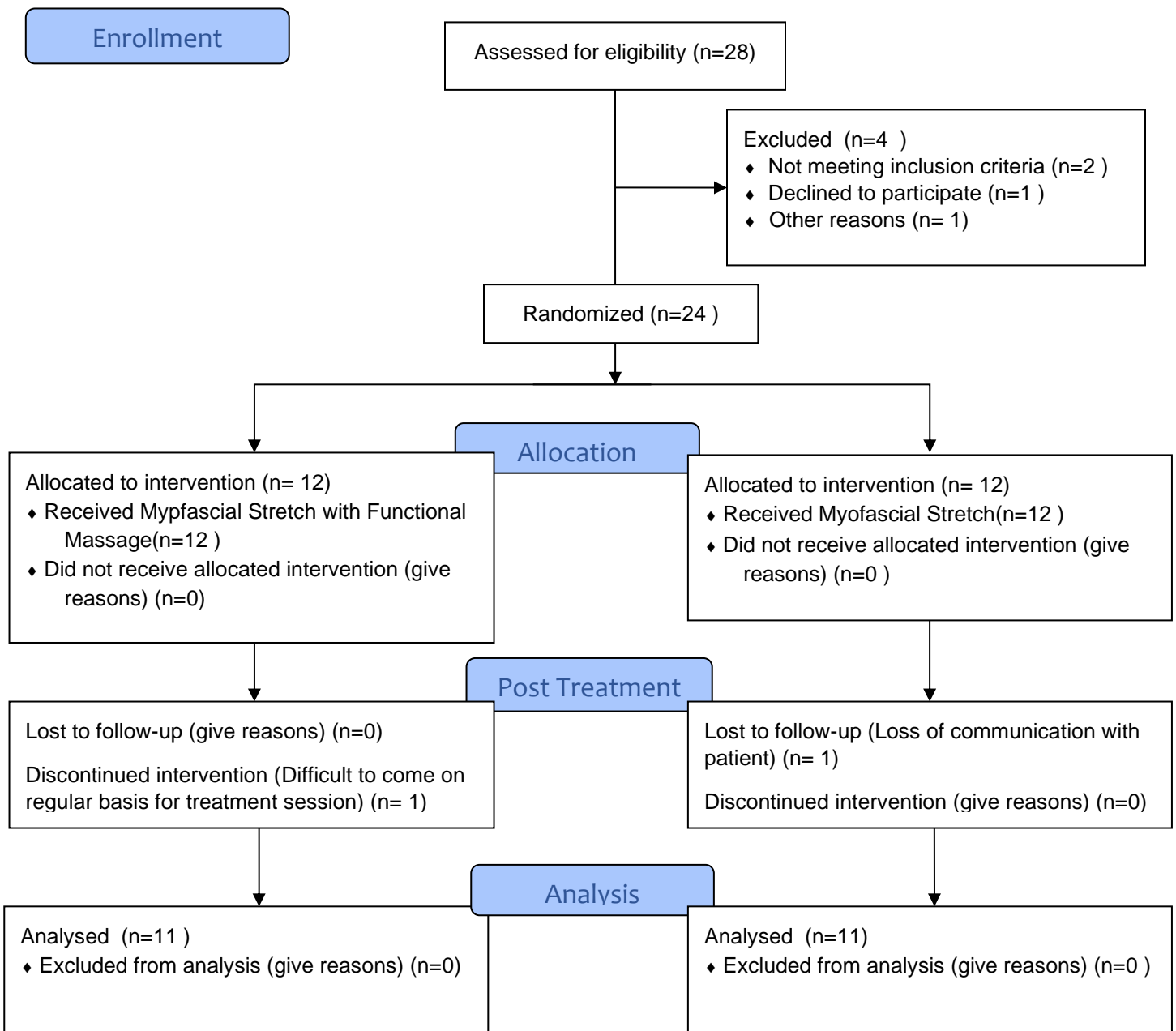
Treatment	Group	Mean Rank	Mean \pm SD	Median	Z score	P value
Pre-treatment	Experimental Group	12.18	52.38 \pm 8.08	54.41	-0.493	0.622
	Control Group	10.82				
Post Treatment	Experimental Group	12.36	69.92 \pm 7.91	70.56	-0.624	0.533
	Control Group	10.64				

B) MAS

		Muscle Group	Group	Median	Mean \pm SD	Mean Rank	Z Score	P value
Right Side Muscle Groups	Pre-treatment	Hamstrings	Exp. Group	8.73	4.1364 \pm 1.03719	4.00	-2.156	0.031
			Control Group	14.27				
		Calf	Exp. Group	11.14	4.4545 \pm 1.22386	5.00	-0.271	0.786
			Control Group	11.86				
		Adductor	Exp. Group	13.23	4.3182 \pm 1.04135	5.00	-1.336	0.182
			Control Group	9.77				
	Post-treatment	Hamstrings	Exp. Group	7.73	3.2273 \pm 0.81251	3.000	-2.922	0.003
			Control Group	15.27				
		Calf	Exp. Group	11.00	3.5000 \pm 1.30018	4.000	-0.379	0.705
			Control Group	12.00				
		Adductor	Exp. Group	13.05	3.2727 \pm 1.03196	3.000	-1.181	0.237
			Control Group	9.95				
Left Side Muscle Groups	Pre-treatment	Hamstrings	Exp. Group	11.09	3.9545 \pm 0.72225	4.0	-0.322	0.748
			Control Group	11.91				
		Calf	Exp. Group	12.59	4.0909 \pm 1.06499	4.0	-0.824	0.410
			Control Group	10.41				
		Adductor	Exp. Group	11.27	4.0909 \pm 0.81	4.0	-0.178	0.859
			Control Group	11.73				
	Post-treatment	Hamstrings	Exp. Group	10.77	2.90 \pm 0.81	3.000	-0.588	0.577
			Control Group	12.23				
		Calf	Exp. Group	12.32	3.22 \pm 1.02	3.000	-0.623	0.534
			Control Group	10.68				
		Adductor	Exp. Group	10.95	3.09 \pm 0.92	3.000	-0.420	0.675
			Control Group	12.05				



CONSORT 2010 Flow Diagram



Discussion

This study discussed about the comparative effects of myofascial stretch with and without functional massage on spasticity and gross motor function in children with Diplegic Cerebral Palsy. The current study was carried out on 22 children with CP with use of Gross Motor Function Measure (GMFM) and Modified Ashworth Scale as outcome measures to assess motor function and spasticity in Diplegic CP respectively. For within group analysis, significant improvement in GMFM total scores and MAS grades was observed ($p < 0.05$) however, no significant improvement was observed between both groups except for MAS grade of right hamstring only and same was the case with GMFM total score and MAS grades for other muscles.

Santosh Metgud et al in 2022 studied the immediate effects of adductor stretch and myofascial stretch in participants with hip adductor stiffness. 54 participants with stiffness of hip adductors assessed through hip abduction range of motion using goniometer were randomly divided into adductor, myofascial and conventional stretch groups. Within groups analysis exhibited statistically significant improvement in overall hip abduction range of motion score. The pre and post values were statistically significant ($p < 0.05$). This study was in coherence with the current study because significant difference in motor functions and calf and hip adductors tone was observed during within groups analysis ($p > 0.05$). (15)

Priya J. et al in 2021 estimated the combine effects of cryotherapy and myofascial stretch over calf muscle stiffness in Diplegic CP Population. Sample size was 30 Diplegic CP who were randomly divided into 3 groups. Group A was given Cryotherapy, Group B was given MFS and Group C was given combined Cryotherapy and Myofascial stretch. MAS. Goniometry was used to assess spasticity and ankle PROM. This study showed good results of combined effects of Cryotherapy and MFS in Calf muscles and range of motion was increased ($p < 0.05$) in intragroup comparison in Diplegic CP. The reference study used cryotherapy along with Myofascial stretch to reduce stiffness of calf muscles while in current study functional massage was used along with myofascial stretch with the similar results. (16)

Faisal Rasool et al. in 2017 estimated the effects of cross friction massage on muscle tone in spastic CP children who were divided into control group receiving routine physiotherapy and experimental group receiving deep friction massage in addition to routine physiotherapy. After six weeks of intervention, there was no significant difference in the results of spasticity and motor function between both the experimental and control group while significant improvement was observed in reducing spasticity in experimental group when compared to the baseline. Hence this reference study also supports the findings of current study with similar results.(3)

Hasan Bingol et al in 2018 evaluated the consequences of functional massage on tone and motor skills in CP patients. After 8 weeks of treatment consisting of functional massage applied to hamstrings, hip flexors, adductors and calf muscles along with traditional physiotherapy that involved stretching exercises, strengthening exercises and gait training. When the post-treatment values of spasticity and motor function of both groups were assessed with the baseline, statistically significant difference was observed in both groups ($P < 0.05$) except for hip flexor muscles ($P > 0.05$) but results of spasticity and motor function were not significant when both groups were compared with each other. The results were in complete coherence with the results of current study as significant improvement was found in both groups when compared to the baseline but no significant results were observed between both groups comparison .(18)

Louisa M et al in 2012 studies the effect of Qigong Massage for Motor Skills in Young Children With Cerebral Palsy and Down Syndrome. The purpose of the study was to evaluate the effect of massage in managing hyper tonicity of cerebral palsy and hypo tonicity of down syndrome and found promising results in improving motor skills on 10 months follow up similar to current study but no change in sensory responses were observed.(19)

The present study did not estimate the prolong effects as the data was analyzed only on short term basis. Parents of the children were reluctant to engage in this experimental study as it was difficult for them to bring their children on regular basis. Data collection was difficult as there were permission issues from institutes. Further studies are required to estimate the long-term effects of massage and stretch. More RCTs are required to search the effects of different types of massage, handling techniques of masseurs and oils used for this purpose and to determine more instant and

long-lasting effects of massage therapy. This study disapproves the harmful effects of the massage on spasticity and motor function.

Conclusion:

It was concluded that myofascial stretch alone and along with functional massage are equally effective in managing tone and improving motor function in children with diplegic cerebral palsy.

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