ORIGINAL ARTICLE

The effects of traditional massage on spasticity of children with cerebral palsy: a randomized controlled trial

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Abstract

Objective: To examine the effects of traditional massage on spasticity of children with cerebral palsy.

Methods: The randomised control trial was conducted at the National Institute of Rehabilitation Medicine, Islamabad, Pakistan, from September 2016 to August 2018, and comprised children with spastic cerebral palsy aged 2-10 years who were randomly allocated to control and intervention groups. Both the groups received routine physical therapy once daily, five times a week for three months. The intervention group additionally received traditional massage. Spasticity was evaluated using the Modified Ashworth Scale at baseline, and after 6th and 12th weeks of intervention. Data analysed using SPSS 20.

Results: Of the 86 subjects enrolled, 75(87.2%) completed the study; 37(49.3%) in the control group with a mean age of 6.81±2.31 years, and 38(50.6%) in the intervention group with a mean age of 7.05±2.47 years. There were 25(68%) boys among the controls and 22(58%) in the intervention group. There was no statistically significant difference in baseline scores between the groups ($p>0.05$). At 6th week, reduction in scores was statistically significant in the right upper limb ($p<0.05$), and in the right lower limb ($p<0.05$) after the 12th week.

Conclusion: Traditional massage was found to have significant effect on the right side compared to the routine physical therapy for reduction of spasticity in children with cerebral palsy.

Keywords: Cerebral palsy, Massage, Modified Ashworth scale, Spasticity.

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Introduction

Cerebral palsy (CP) is defined by Rosenbaum as "a group of permanent disorders of the development of movement and posture, causing activity limitation that is attributed to non-progressive disturbances that occurred in the foetal or infant brain. The motor disorders of CP are often accompanied by disturbances of sensation, perception, cognition, communication, and behaviour; by epilepsy and by secondary musculoskeletal problems".[1]

Amongst the physical disabilities, CP is the most common type presenting in children across the world.[2] Its incidence is 2.6 to 2.9 cases per 1000 live births.[3] Population-based studies from around the world report prevalence estimates ranging from 1.5 to more than 4 per 1,000 live births.[4] CP results in disorders of muscular and postural tone. Tone may be abnormally high making body parts stiff in certain patterns and postures which is called spasticity, or it may be fluctuating resulting in involuntary movements called athetosis and dyskinesia, or it may be difficult to coordinate movements in anti-gravity postures called ataxia.[5] More than 65% of tone disorders due to CP fall in the category of spasticity which is velocity-dependent increase in tone, and provides resistance to passive movement. When spasticity increases, movements become difficult, resulting in the development of contractures and deformities which may eventually compromise the person's activity and participation, resulting in compromised quality of life.[6]

Many interventions are used to manage the lifelong disabling effects of this condition. However, effectiveness of these interventions remains in question. In a systematic review it was concluded that 40% of such interventions had no reported evidence base, while 20% were unnecessary, ineffective or even harmful.[7] Another systematic review re-evaluated 64 discrete interventions for the management of CP and concluded that physical

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therapy, occupational therapy, speech therapy and massage had sufficient evidence to be included in the category of 'probably do it' which allows its use in the management of CP.[8] Massage has historically been used for the treatment of tiredness, muscle soreness and to improve general health of the infants and adults since ancient times. It is commonly used as a complementary alternative medicine therapy (CAM).[9] It is amongst the many approaches available for the management of the spasticity for children with CP. Massage is practised in different forms across the world. These include, but are not limited to, Swedish massage, aromatherapy massage, hot stone massage, deep tissue massage, Shiatsu, Thai massage, reflexology and sports massage.[10] Each type is performed in a specified manner for which professionals are trained, educated and certified. Types of massage being practised range from professional certified approaches to traditional ones. For traditional massage, no special training or certification is necessary. In each society it is practised in its own way. Traditional massage in Pakistan is usually performed by mothers or care-givers and has its own way of application. Little work has been done to find the effectiveness of traditional massage for the management of spasticity across the world. No study exists to find its effectiveness in Pakistan which is a developing country with low socio-economic status (SES) having approximately 200 million population. Disability is most common amongst the poor populations across the globe and multiplies the burden of poverty manifold. Lack of financial resources to cope with disability results in social isolation and emotional distress, affecting the quality of life of the whole family. In developed countries, resources needed are mostly met by the state which is not the case in Pakistan. So it is necessary to find such interventions which are low-cost, easily available, affordable, accessible and doable by the poor families. World Health Organisation (WHO) has advocated the use of such interventions using community-based models to cope with increasing burden of disability in under-developed countries.[11] Massage therapy is included in the category of such interventions. In Pakistan, there is a lack of professional masseurs to impart this treatment for children with CP. Even if available, their services are beyond the reach of low and middle class families. In this scenario, traditional massage, which is already being practised in the homes, becomes a viable option. Most of the physicians and paediatricians advise parents to use massage as part of management for their children with CP. However, many physiotherapists believe that this may increase spasticity, and advice against it. They think that massage results in stimulation of the somato-sensory system which may increase spasticity. This difference of opinion between two credible and knowledgeable groups of health professionals puts the parents in a dilemma. The current study was planned to examine the effects of traditional massage on the spasticity of children with CP.

Patients and Methods

The randomised control trial (RCT) was conducted at the Physiotherapy Department of the National Institute of Rehabilitation Medicine (NIRM), Islamabad, Pakistan from September 2016 to August 2018. After getting approval from the ethics review committee of Isra University, Islamabad, and permission from NIRM management, the sample size was calculated Using OpenEpi Version 3 software,[12] taking a confidence interval of 95 % with a power of 80% and 5% margin of error, as 42 per each group. Mean and standard deviations used for control and intervention group for sample calculation were 61.85±18.2 & 49.97±20.2 respectively with a difference of 11.88 between the groups and taken from the Study of Elgawish.[13] The sample was raised using non-probability, purposive sampling technique who were then randomly allocated to intervention and control groups. Children with diagnosis of spastic CP (diplegia: spastic paralysis of both legs to major extent with mild involvement of both arms) aged 2-10 years were included. Children were diagnosed by a paediatrician, neurologist or neuro-physician and were referred to the Physiotherapy Department for rehabilitation. All children having moderate to severe contractures, moderate to severe mental retardation, with multiple disabilities, attention deficit hyperactive disorder (ADHD), uncontrolled seizures and behavioural disorders were excluded.

After informed consent was obtained from the parents of the children, both groups received routine physical therapy in 30-minute sessions once daily, five times a week for three months. However, the intervention group also received traditional massage in 30-minute sessions additionally before the start of exercises. Routine physical therapy provided to both the groups comprised stretching exercises, strengthening exercises and positioning. Each spastic muscle was stretched up to the

level of mild discomfort where it was held for 20 seconds and the procedure was repeated five times. Each CP child was assessed separately for spastic group of muscles, but certain groups were found to be common in spastic diplegia. In lower limb flexors, adductors and internal rotators of hip, flexors of knee, plantar flexors of ankles and invertors of feet were mostly found to be spastic in nature, while in the upper limb shoulder adductors, internal rotators, elbow flexors, forearm pronators, wrist flexors, fingers flexors, thumb adductors and flexors were mostly spastic. Each weak muscle was made to contract against resistance 10 times in one session. These included hip extensors, abductors, external rotators, knee extensors and dorsiflexors at ankle in the lower limb and shoulder abductors, extensors, external rotators, elbow extensors, wrist and fingers extensors in the upper limb. Parents were advised to make their child sit with open legs on bench/block with heels touching the ground. They were asked to keep back straight to avoid posterior pelvic tilt, to avoid W sitting and crossed-leg sitting postures on the floor for their children. They were also advised to make standing position against a wall with legs in moderate abduction and external rotation for 15 minutes daily after exercises.

For the purpose of the study, traditional massage was defined as rubbing the body parts with oil in proximal to distal direction on all four limbs while on front and back of trunk area, from centre to periphery. This rubbing was superficial, gentle and longitudinal in nature. Deep pressures, stroking and circular movements were avoided. Each limb, front and back of trunk area was massaged for five minutes each. Proper and detailed training regarding routine physical therapy and traditional massage was provided to the mothers / care-givers up to the satisfaction of the attending physical therapist. The RCT was registered with the United States (US) National Library of Medicine and can be accessed online from https://clinicaltrials.gov/ct2/show/NCT03771599.

Data was collected at baseline, and after 6th and 12th weeks of intervention using a predesigned structured questionnaire and the Modified Ashworth Scale (MAS). The questionnaire included demographic and baseline characteristics about age, gender, birthplace, nature of pregnancy and associated post-natal complications. MAS was used to determine the level of spasticity subjectively. It comprised six grades (0, 1, +1, 2, 3, 4) where zero denotes normal tone and four denotes severe spasticity. This scale has satisfactory-to-good inter-rater and intra-rater reliability.[14,15]

The outcome assessor was kept blind to group randomisation during all assessments. Data was analysed using SPSS 20. Shapiro-Wilk test showed normal distribution of data ($p>0.05$), therefore parametric tests of significance i.e. independent sample t test and paired sample t test, were used to compare mean differences between the groups and within the groups respectively.

Results

Of the 86 subjects enrolled, 75(87.2%) completed the study (Figure); 37(49.3%) in the control group with a mean age of 6.81±2.31 years, and 38(50.6%) in the intervention group with a mean age of 7.05±2.47 years. There were 25(68%) boys among the controls and 22(58%) in the intervention group. There were no statistically significant differences in demographic characteristics and MAS scores at the baseline between the groups (Table 1). Reduction in MAS grades were statistically significant in the right upper limb at the 6th week ($p<0.05$), and in right lower limb after at the 12th week ($p<0.05$) in the intervention group (Tables 2-3). There was statistically significant difference from the baseline to the 6th and 12th week readings in both the groups (Table 4).

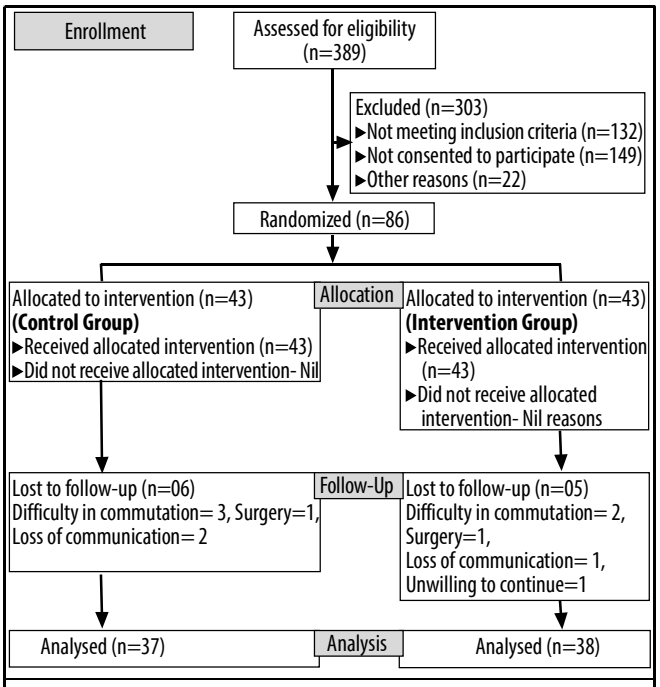

Figure: Study flowchart..

Table-1: Demographic and Baseline Characteristics.

Demographics & Baseline Characteristics	Study Population (n= 75)	Control group (n= 37)	Interventional group (n= 38)	*p*-value
Age Years ±SD	6.93±2.37	6.81±2.10	7.05±2.47	0.663a
Gender n (%)				0.390b
Male	47(63)	25(68)	22(58)	
Female	28(37)	12(32)	16(42)	
Birth Place n (%)				0.178b
Govt. Setup	31(41)	14(38)	17(45)	
Pvt. Setup	29(39)	12(32)	17(45)	
Home	15(20)	11(30)	4(10)	
Nature of Pregnancy n (%)				0.741b
Full term	56(75)	27(73)	29(76)	
Pre-Mature	19(25)	10(27)	9(24)	
P-Natal Complications n (%)				0.986b
Fever	11(15)	4(11)	7(18)	
Late Cry	40(53)	22(60)	18(48)	
Ventilated	4(5)	2(5)	2(5)	
Others	20(27)	9(24)	11(29)	
MAS Scores Mean±SD				
Right Upper Limb		0.32±0.51	0.16±0.28	0.09a
Right lower Limb		1.59±0.89	1.68±0.85	0.95a
Left Upper Limb		0.20±0.31	0.12±0.24	0.08a
Left Lower Limb		1.70±0.89	1.68±0.85	0.95a

a: p value calculation with parametric tests, b: p value calculation with non-parametric tests, MAS= Modified Ashworth Scale, Govt. = Government, Pvt. = Private, P-Natal = Post natal, SD Standard deviation.

Table-2: Comparison of MAS Grades in Both Upper Limbs.

MAS	Control group (Mean ±SD)	Interventional group (Mean ±SD)	*p*-value
Right Upper Limb			
Baseline	0.32±0.51	0.16±0.28	0.09
After 6 weeks	0.18±0.32	0.05±0.18	0.03*
After 12 weeks	0.11±0.24	0.03±0.12	0.06
Left Upper Limb			
Baseline	0.20±0.31	0.12±0.24	0.20
After 6 weeks	0.11±0.21	0.03±0.16	0.08
After 12 weeks	0.06±0.13	0.03±0.16	0.42

*= $p < 0.05$, MAS= Modified Ashworth Scale (Lower is optimal), SD: Standard deviation

Table-3: Comparison of MAS Grades in Both Lower Limbs.

MAS	Control group (Mean ±SD)	Interventional group (Mean ±SD)	*p*-value
Right Lower Limb			
Baseline	1.69±0.89	1.68±0.85	0.95
After 6 weeks	1.34±0.86	1.04±0.80	0.11
After 12 weeks	1.19±0.90	0.72±0.69	0.01*
Left Lower Limb			
Baseline	1.70±0.89	1.68±0.85	0.95
After 6 weeks	1.34±0.86	1.03±0.80	0.11
After 12 weeks	1.00±0.86	0.70±0.68	0.08

*= $p < 0.05$, MAS= Modified Ashworth Scale (Lower is optimal), SD: Standard deviation

Discussions

Results showed that spasticity decreased in the intervention group in the right upper limb after 6 weeks and in right lower limb after 12 weeks of intervention to a significant level. The spasticity in the left upper and lower limbs of the intervention group did definitely show a decreasing trend but not to a statistically significant level. A similar study observed the reduction of spasticity in the intervention group which received massage for three months compared to the control group which received reading activities. However, this reduction was significant in the arms only. In the legs, it showed decreasing trend but the effect was not statistically significant.[16] This study partially supports the findings of the current study where reduction in spasticity was significant on the right side only. The common finding in both studies was that spasticity showed a decreasing trend in the control group.

One RCT found that although the decreasing trend of spasticity was observed in both groups, there were no statistically significant differences between the groups. The said study used the intervention of Swedish massage by trained professionals with occupational therapy techniques.[17] The findings of this study supports the current study as there was a decreasing trend for spasticity in the control group as well. Another RCT used deep friction massage on soleus and gastrocnemius along with routine physical therapy for six weeks and found no statistically significant differences in spasticity reduction and functional level between the groups.

Table-4: Within Group Comparison of MAS Grades in Both Groups.

MAS all 04 Limbs	Baseline (Mean ±SD)	After 6 weeks Mean ±SD)	*p*-value
Control Group	0.92±0.45	0.75±0.46	0.010
Interventional Group	0.87±0.42	0.54±0.40	0.00
MAS all 04 Limbs	**Baseline (Mean ±SD)**	**After 12 weeks Mean ±SD)**	***p*-value**
Control Group	0.92±0.45	0.57±0.43	0.001
Interventional Group	0.87±0.42	0.36±0.32	0.00

MAS= Modified Ashworth Scale (Lower is optimal), SD: Standard deviation

However, spasticity showed significant reduction in the intervention group on comparison within the groups.[18] In the current study, spasticity decreased significantly when compared between and within the groups collectively.

A systematic review re-evaluated 64 discrete interventions for CP management for evidence, and included specific studies[16,17] on the topic of massage.[8] Although results differed, with some in favour of massage[16] and others having doubts about its effectiveness,[17] the review[8] did support the findings of the current study with mixed results. In another study reduction in MAS grades was observed with the use of Thai massage 30 minutes after the session, but long-term retention of this reduction was not recorded.[19]

In the control group of the current study, which was receiving routine physical therapy alone, comparison within the group showed that reduction in spasticity was statistically significant. Literature has consistently shown the usefulness of physical therapy in reducing spasticity, improving range of motion (ROM), strength, endurance, mobility and overall quality of life of persons with disabilities.[8,20,21]

The question that why the reduction in spasticity was significant on right side only in the intervention group created an urge to search the literature further. First possible explanation of this phenomenon was the uneven distribution of tone on the two sides in spastic diplegia. We assumed that the left side was more spastic at the start of the study which might have resulted in less response to massage therapy. This feature of uneven distribution of tone is also quite common in spastic quadriplegia where mostly the left side is more involved than the right side.[22] However, after analysis of results, we found that mean scores of MAS were higher at the baseline on the right side which showed that the right side was already a bit more spastic. So we refuted this explanation. The other possible explanation was the effect of handedness. One extensive study mentioned that handedness resulted in better reaction time, development of perceptions, improved cortical output and enhanced motor function.[23] As right-handedness is much more common than the left one across the globe, this might have helped in better recovery on the right side even when this side was initially more spastic than the left side. However, further research with longitudinal designs in different types of CP is needed to explore this phenomenon in detail.

It was observed that in the right upper limb of the intervention group, reduction in spasticity reached significant level after 6 weeks compared to the control group. However, after 12 weeks of intervention, there was no significant difference between the groups. In the right lower limb, reduction in spasticity gradually reached significant level after 12 weeks of intervention compared to the control group. The same pattern was observed in the left upper limb of the intervention group and both upper limbs of the control group where spasticity reduced but not to a significant level. Literature was searched about this unusual finding but no answer was found. Since this phenomenon was prominent in both the groups, we decided to evaluate the similarities and dissimilarities of the physical therapy programme for upper and lower limbs. We found that stretching and strengthening exercises were the same in both the groups, but differences were found in positioning and handling techniques. In both the groups, we advised parents to make their child sit on a block/bench and stand against a wall with open legs to produce moderate abduction and external rotation at hips. This type of posture is called "reflex inhibiting posture" for a person who exhibits scissoring of legs and is usually opposite to pattern in which spastic muscles behave. Weight-bearing in reflex inhibiting postures is commonly used in the management of spasticity. Bobath et al has spoken at length on the role of reflex-inhibiting patterns /postures for the management of spasticity. It was believed that this may help in reduction of spasticity.[24,25] We used the same pattern for lower limbs in sitting and standing positions, so this might have helped in gradual and sustained reduction of spasticity till the 12th week of intervention. However, this was not the case for upper limbs where we advised overhead activities in sitting and standing positions to help the child to elongate his trunk and to move the pelvis anteriorly. These activities did not fulfil the purpose of weight-bearing in reflex-inhibiting postures. In everyday activities too, we hardly used weight-bearing postures for upper limbs. So lack of weight-bearing for upper limbs might have resulted in decline of spasticity from significant to non-significant level after 6th week of intervention. Present literature regarding effects of weight-bearing for the management of spasticity has shown conflicting results.[26] Therefore, we propose further studies for in-depth analysis of the

role of weight-bearing within reflex-inhibiting patterns/ postures for the management of spasticity.

The current study has its limitations. As care-givers were providing intervention at home, there was no check and balance about intensity, frequency and continuity of the treatment. Also, since immediate and visible relief does not take place during the short span of time in CP management, it was quite difficult to keep the care-givers who wanted urgent relief motivated till the completion of the study.

Conclusion

The traditional massage in conjunction with routine physical therapy was found to have a statistically significant effect on the reduction of spasticity on the right side compared to routine physical therapy alone in children with spastic CP. On the left side, its effect was the same compared to the control group but the difference was not significant. The traditional massage was not found to increase spasticity, had no harmful effects and could be administered by mothers at home, making it suitable for the management of CP children.

Disclaimer: The text is part of a PhD (Rehabilitation Sciences) thesis.

Conflict of Interest: The person who signed the ethical review statement in 2015 subsequently became a co-author of the same manuscript in 2019.

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