Effect of Wrapping Technique on Range of Motion and Muscle Tone of Upper Extremity in Children with Spastic Cerebral Palsy: A Pilot Study

Mehdi Bigham Sarvestani [a], Maryam Mehdizadeh [b], Fatemeh Mehdizadeh [a], Shila Shabdini [a*]

a Hasti Rehabilitation Center, Tehran, Iran; *b* Department of Neurosciences, Faculty of Advance Technology of Medicine, Iran University of Medical Sciences, Tehran, Iran

***Corresponding Author:** Shila Shabdini, First floor, Number 92, Bagherkhan Street, Sattarkhan Street, Tehran, Iran. **Tel:** +98-21 66901720, 66593953; **E-mail:** Shilashabdini26@yahoo.com

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Abstract

Introduction: In children with severe spastic cerebral palsy, the presence of primary reflexes prevents normal movement patterns and delayed treatment. Wrapping technique is one of the methods used to reduce muscle tone. Wrapping technique is one of the methods used to increasing upper extremity function. The aim of this study was to evaluate the effect of this technique on the reduction of spasticity and increase the range of upper extremity in children with cerebral palsy. **Materials and Methods:** In this experimental and pilot study, 20 children {mean (±SD) age = 4.35 (±1.18) year} were randomly assigned to intervention and control groups. In both groups, the passive ranges of motion and muscle tone (external shoulder rotation, shoulder abduction, shoulder flexion, and wrist extension) were measured by goniometer and modified Ashworth scale before and after the intervention. Both groups received regular rehabilitation services, and the intervention group took wrapping along with those services. Independent t-test was used to examine the pretest and posttest to differentiate between the two groups. **Results:** The results of this test showed an increase in the passive range of motion in the intervention group compared with the control group. Our study also suggested tone reduction in all intended muscles, except in wrist extensor, during 12 treatment sessions in the intervention group. **Discussion:** In summary, the use of the wrapping technique is an effective method for reducing muscle tone and increasing the passive range of motion.

Key words: Muscle Tone, Range of Motion, Spastic Cerebral Palsy, Upper Extremity, Wrapping Technique

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Introduction

Cerebral palsy is a brain disorder that affects the movement and posture long life. Lesions can occur before birth and cause various complications. Cerebral palsy can affect several organs and is characterized by impaired motor function (1-3). Clinical manifestations of the disease are classified into four types: spastic, dyskinesia, ataxia, and hypotonic (4). Spasticity may be defined as an increase in tone during passive movement that exacerbates muscle tension reflexes. In the spastic type, the involvement of the motor cortex and the peripheral descending paths are discussed (5, 6).

Different approaches have been proposed for addressing motor impairments caused by spasticity in the affected children, which include sensory integration, rood, and neurodevelopmental therapy (7-10). Moreover, taking medications such as diazepam and baclofen as well as Botox injections can be useful in reducing the tone in these children (11, 12).

Among other procedures, wrapping technique is used to reduce muscle tone. In this technique, the upper limb is bandaged for one to four days for 2-4 weeks. Various studies demonstrated that this method can increase the passive range of motion in the upper limb in patients with stroke (13, 14).

Children with cerebral palsy include a large portion of people referring to the Rehabilitation Centers. In children with spastic cerebral palsy, high muscle tone and primary reflexes prevent normal movement patterns and postpone the intervention process. The aim of this study was to investigate the effect of wrapping technique on increasing the passive range of motion and decreasing muscle tone of the upper extremity in children with spastic cerebral palsy.

Table1. Distribution of age range in both groups (n=20)

Age	Treatment Group		Control Group	
	Number	Percent	Number	Percent
2.5	1	10	1	10
3	2	20	1	10
3.5	2	20	2	20
4	3	30	1	10
4.5	0	0	1	10
5	1	10	1	10
5.5	0	0	1	10
6	1	10	2	20
	10	100	10	100
	Mean (SD)=3.85 (1.02)		Mean (SD)=4.35 (1.24)	

Table2. The results of outcome measures pre and post-treatment in both groups (n=20)

Muscle	Test	Group	Mean (SD)	t/z	Significance
Shoulder. Int. Rot	Spasticity	Treatment	2.00 (0.47)	-	-
		Control	1.00 (0.00)		
Shoulder. Ext. Rot	Passive. ROM	Treatment	25.40 (7.02)	4.07	0.001
		Control	14.80 (4.29)		
Shoulder. Flex	Spasticity	Treatment	1.40 (0.51)	3.64	0.003
		Control	0.60 (0.53)		
Shoulder. Flex	Passive. ROM	Treatment	20.10 (5.21)	5.61	0.000
		Control	10.40 (1.64)		
Shoulder. Add	Spasticity	Treatment	1.30 (0.48)	2.78	0.012
		Control	0.70 (0.49)		
Shoulder. Add	Passive. ROM	Treatment	19.20 (3.73)	7.43	0.000
		Control	9.10 (2.13)		
Wrist. Flex	Spasticity	Treatment	1.10 (0.31)	1.43	0.196
		Control	0.80 (0.63)		
Wrist. Ext	Passive. ROM	Treatment	17.10 (4.22)	5.43	0.000
		Control	8.80 (2.34)		

Materials and Methods

In this study, 20 children with spastic cerebral palsy were randomly assigned to intervention and control groups. Inclusion criteria were the following: upper limb spasticity, age range of 2.5-5 years, ability to control upper limb movements voluntarily, and ability to understand commands during intervention process.

Information was obtained through observation by evaluating muscle tone based on criteria of modified Ashworth scale and assessing the passive range of motion by goniometer in the first and last sessions (15-17).

The child's primary caregiver signed a consent form before participating in the study. Ethical approval was obtained from the Occupational Therapy Research committee Iran University of Medical Sciences (IUMS).

Procedure

The child was placed on a mattress in a comfortable position. Flexor, adductor, shoulder internal rotator, and wrist flexor tone were assessed during the passive movement according to the modified Ashworth method. The manual goniometer was used to obtain the child's range of motion, passive range of motion of shoulder flexion-abduction-external rotation, and extension of the wrist. Then the affected upper limb was wrapped with a 4-inch elastic bandage from the wrist to the axilla for 3 hours every day. Intervention was applied for 12 sessions. All the participants received 3 days a week regular rehabilitation services during this period.

Statistical analysis

The Shapiro-Wilk test was used to examine the normal distribution of data (18). All results were normally distributed.

Demographic data were analyzed using descriptive statistics. To investigate the effect of treatment, mean, independent t-test (passive range of motion) and Mann-Whitney U test (Spasticity) were used. The significance level was less than 0.05 (19).

Results

Table 1 shows the percentage of participants' age in both intervention and control groups. The mean ages of the intervention and control groups were found to be 4.35 and 3.85 years, respectively. The results of the comparison of spasticity and passive range of motion between the treatment and control groups showed that there was no significant difference between the two groups (P>0.05).

Table 2 shows the mean difference before and after intervention in both and control groups. The results demonstrate that the amount of spasticity in the upper limb decreased in both groups; while the decrease is more in the intervention group (pretest and posttest differentiate). The upper limb passive movement also increased in both groups; while the increase is higher in the intervention one. Independent t-test results show that there is a significant difference between the intervention and control groups for the passive range of motion and the amount of spasticity in the upper limb muscle group, except spasticity in Wrist extensors.

Discussion

The purpose of this study was to investigate the effect of wrapping technique on increasing the passive range of motion and reducing the amount of spasticity in the upper limb muscle groups in children with spastic cerebral palsy. Our results suggest that use of wrapping technique could be effective in reducing muscle tone and increasing the passive range of motion. The usefulness of the technique may be due to the following factors:

First, the heat generated by the bandage. Wrapping the part of body with bandage increases the local temperature. Increasing the temperature of the tissue can cause physiological changes. One of the changes is the improvement in blood circulation, which can increase the speed of muscle activity leading to better movement of the muscles. As a result, wrapping technique helps increase blood circulation and limb position that eventually can be useful for improving passive range of motion (20-22).

Secondly, the way the bandage applied. Because the upper extremity is placed in anti-spasticity position for a considerable time, it can reduce spasticity and increase the passive range of movement (23-25).

Shoulder internal rotator and abductor, arm and wrist flexor displayed the highest reduction in spasticity. Shoulder external rotator and abductor, arm flexor, and wrist extensor showed the highest improvement in passive range of motion. As results suggested, it is likely that the bandage direction helped hand to be rotated out during the intervention sessions. This may cause shoulder internal rotator muscles to show higher tone reduction. Since, a large part of the brain controls the movement of the wrist, more intervention sessions should be considered for them (26-28).

We found that there was no significant relationship among age and the increase in passive movement or reduction of muscle tone. According to the general theory, the younger the age, the more is the chance of neuroplasticity and motor improvement. The small sample size may be due to this result. (29, 30).

The limitations of this study included limited intervention sessions and limited accession of a wide range of precise assessment tools and therefore, must be addressed in future studies. Furthermore, increasing sample size can consolidate the generalization of results.

Conclusion

The results of this study show that use of wrapping method would be helpful for reducing the muscle tone and improving passive range of motion in the upper limb for children with spastic cerebral palsy. More capability in motor skills results in improvement in the quality of life and community participation in this population.

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Conflict of interest:
None

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Authors' contributions:
All authors made substantial contributions to conception, design, acquisition, analysis and interpretation of data.

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