Original Research Paper

Volume - 16 | Issue - 08 | August - 2026 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Physiotherapy

TESTING THE COMPARATIVE EFFICACY BETWEEN SLOW ICING PLUS LOWGRADE SUSTAINED STRETCHING VERSUS WEIGHT BEARING EXERCISES PLUS PASSIVE MOVEMEMTS IN REDUCING SPASTICITY OF UPPER EXTREMITY IN STROKE

Dr. P. Gopi Krishna — Associate Professor MPT Orthopedics

Dr. K. Sridevi — Assistant Professor MPT Neurology

ABSTRACT

Background: Spasticity is a common motor impairment following middle cerebral artery stroke, affecting upper limb function & rehabilitation outcomes. cryotherapy & weight bearing exercises are commonly used to manage spasticity, but comparative efficacy remains unclear. **Aim:** To compare the effects of slow icing with sustained stretching versus weight bearing with passive movements on upper limb spasticity in MCA stroke patients. **Methods:** A to-group pretest-posttest experimental study was conducted on 30 subjects aged 40-60 years with MCA stroke upper extremity spasticity <2 on Modified Ashworth Scale. Participants were randomly allocated to Group A (n=15): Slow icing + sustained stretching, and Group B (n=15): Weight bearing + passive movements. Treatment was given for 30 min, 3 days/week for 6 weeks. Outcome measure was Modified Ashworth Scale assessed at baseline and post 6 weeks. Data were analyzed using unpaired t-test. **Results:** There was no significant difference in pre-treatment values between groups (p=0.007). Post-treatment, Group A showed significantly greater reduction in spasticity compared to Group B(p=0.013). **Conclusion:** Slow icing combined with sustained stretching is more effective than weight bearing with passive movements in reducing upper limb spasticity in MCA stroke patients.

KEYWORDS : Stroke, Spasticity, Cryotherapy, Sustained Stretching, Weight Nearing, Modified Ashworth Scale.

INTRODUCTION

Stroke is a sudden loss of neurological function caused by an interruption of blood flow to the brain. Neurological deficits are characterized by paralysis(hemiplegia) or weakness (hemiparesis) typically on the side of the body opposite to the side of the brain lesion1. In stroke spasticity is one of commonest complication. It is the second most common cause of death and fourth leading cause of disability worldwide2

According to WHO estimation stroke risk is found increase both in male and. female in age 25-85 years[3].Annually, 15 million people worldwide suffer a stroke. Of these, 5 million die and another 5 million are left permanently disabled, placing a burden on family and community

Middle artery syndrome presents with contralateral sensory loss of the legs, arms, and lower two-thirds of the face due to tissue necrosis of the primary somatosensory cortex. Contralateral paralysis of the arms, legs, and face may be observed due to necrosis of the primary motor cortex, which is observed clinically as muscle weakness, spasticity, hyperreflexia and resistance to movement.

Spasticity is a common finding after middle cerebral artery (MCA) stroke and if not proactively managed, can lead to serious complications, including contracture, pain, and skin breakdown[7]

In the upper limbs, the most frequent pattern of arm spasticity is internal rotation and adduction of the shoulder coupled with flexion at the elbow, the wrist and the fingers[11] About 17-42% of the chronic stroke survivors report the persistence of spasticity in their extremities, with the elbow joint known to be more commonly affected (79%) as compared to the other joints[1]

This study includes the physical management of icing, low grade sustained stretching and weight bearing exercises, passive movements

Literature reports that icing temporarily decreases spasticity as well as deep tendon reflexes and clonus, due to decreased sensitivity of skin mechanoreceptors, slowed transmission of sensory and motor nerve fibres (alpha) or the decrease in the sensitivity to stretching of the neuromuscular spindle and consequently, of the activity of the gamma system[18,19.]

Limiting muscle contractures and reducing hyperactivity for at least a short period of time can be helpful. The aim of stretching is to improve the viscoelastic properties of the muscle-tendon unit and to increase its extensibility. The prolonged stretch of a muscle may inhibit that muscle (Griffin,1974). It is thought that adaptation of the intrafusal fibres (striated fibres within a muscle spindle) to the increased extrafusal length occurs (Kroll, Otis & Root,1985). Low-force, long-duration stretching has been shown to be effective in producing musculotendinuous elongation[20]

Weight bearing exercises stimulate the proprioceptors in joint capsules and tendons of the muscle crossing the joints and works like constant stimulation of these receptors[21].

Upper extremity weight-bearing exercise includes motions to support or push something with the hands and being in quadruped, prayers and tripod positions[22].

Passive movements may also influence the excitability of lower motor neurons, reducing spasticity in individuals with neurological disabilities and thereby directly or indirectly increasing muscle extensibility[23.]

Aim is to test the comparative efficacy between slow icing plus low grade sustained stretching versus weight bearing exercises plus passive movements in reducing spasticity of upper extremity in stroke.

METHODOLOGY

Study Design: Two group pretest-posttest experimental design.
Sample Size: 30
Sample Design: Random sampling method.
Source of Data Collection:
MIMS Hospital, Nellimarla, Vizianagaram.
Medicover Hospital, PVR complex, Vizianagaram.
Duration of the Study: 1 year
Treatment Duration: 30 mins per session for 3 days a week for 6 weeks

Inclusion Criteria

1. Subjects have been diagnosed with middle cerebral artery stroke.
2. Subjects with stroke predominantly having spasticity in upper extremity of Grade (<2) on Modified Ashworth scale.
3. Age group: 40-60 years.
4. Gender: Male and Female.

Exclusion Criteria:

1. Cryophobia
2. Psychological impairments.
3. History of cardiovascular problems.
4. Fixed muscle contractures in the affected limb.
5. Other neurological and orthopedic conditions involving the affected limbs.

Outcome Measures

Modified Ashworth Scale.

Group-A

Icing

A brief introduction about the procedure was explained to the patients and was made to experience the cold before the actual treatment, and their sensitivity cold were also analyzed. The patients were seated in a comfortable position. with an icepack, stroked over the biceps brachii

slowly from origin to insertion, maintaining a continuous and direct contact for 20 mins.

Stretching:
The patients were placed in a comfortable seated position. The therapist was in walk standing position. The therapist grasping distal forearm with one hand and the other hand stabilizes the scapular anterior Proximal humerus. Then therapist extend the hand and wrist with forearm is supinated and the elbow is extended. Extend the elbow just pass the point of tissue resistance to lengthen the elbow flexors. Then maintain this stretched position for 20s for 10 repetitions in a session.

After the treatment, all the subjects were subjected to the posttest measurements measured by MAS grading.

Group-B:
Interventions were weightbearing on affected limb with range of motion exercises.

Upper extremity weight bearing exercises performed based on methods introduced by wang and Salem, kim, seong et al. and koo et al. Each patient adopted a particular posture, maintained it for 10 seconds in one direction, repeated the exercise 10 times. since the subjects might not be able to quickly switch between postures, one posture was repeatedly adopted before adopting the next one. The exercises were performed for 20 minutes

Prone on elbow- Right/left weight shifting Back/forth weight shifting

Quadruped- Right/left weight shifting Back/forth weight shifting

Sitting (bearing the weight with the affected hand placed on the couch)- Affected hand placed on the couch, with the unaffected hand placed on the affected

Standing (bearing the weight with the palms placed on a table)- Right/left weight shifting Back/forth weight shifting

Passive movements done by positioning the patient in supine position and therapist in walk standing position. Hold the upper arm with one hand and forearm with the other hand. Bend the arm at the elbow so that the hand touches the shoulder. Then straighten the arm all the way out. Repeat 10 times*3 sets

Statistical Analysis:
Table 1:

	MEAN	N	Std. DEVIATION	P VALUE
GROUP-A PRETEST	2.13	15	0.20	0.01
GROUP-A POSTTEST	1.46	15	0.51	
GROUP-B PRETEST	2.13	15	0.83	0.05
GROUP-B POSTTEST	1.6	15	0.48	

Table 2:

	N	MEAN	Std. DEVIATION	P VALUE
GROUP-A (POST-TEST)	15	1.46	0.51	0.013
GROUP-B (POST-TEST)	15	1.6	0.48	

DISCUSSION

This study deals with the reduction of spasticity through icing and stretching versus weight bearing and passive movements for elbow flexors. In patients with stroke, at the time of diagnosis of spasticity, most patients showed only a slight increase in muscle tone, which was observed most frequently in the elbow, followed by the wrist and fingers (kyung et al 2009)

In this study, it was intended to apply the cold therapy for 20minsonelbow flexors, aiming to gain significant and long duration reduction in spasticity followed by sustained stretching of elbow flexors. skeletal muscles consist of sensory nerve fibres i.e.,1a fibre and 1b fibre.1a fibre which is innervated to muscle spindle responsible for changes in the length of the muscle fibre and detects how much muscle fibre stretched and send this information to higher centre whereas1b fibre which is innervated in GTO is responsible for change in muscle tension. The mechanism of reduction in spasticity in sustained stretching is autogenic inhibition on the muscle through the golgi tendon organ that located near the musculotendinous junction, which wraps around the ends of the extrafusal fibres of a muscle. The Golgi tendon organ is a protective mechanism that inhibits contraction of the muscle in which it lies. It has a very low threshold for firing after an active muscle contraction has a high threshold for firing with stretch. when excessive tension develops in the muscle, the GTO fires through 1b fibres and inhibits alpha motor neuron activity and thereby decrease the tension in the muscle that leads to reduction of spasticity.

During stretching procedure passive tension will be developed in the muscle that will fire the GTO, inhibit the alpha motor neuron activity and decrease tension in the spastic muscle. There was one study done which examined the immediate post 24 hours effect of cooling and sustained passive stretching as treatment techniques for reduction of spasticity in hemiplegics using H-reflex

The post treatment results of MAS revealed a significant difference between the groups in favor of group A. This difference may be attributed to the effect of cold therapy on reducing spasticity.

There are many possible underlying mechanisms that explain how cold therapy reduces spasticity. The first mechanism was explained by Eldredet al., Ottosn, and Knutsson and Mattsson[48,49,50]. who reported that ice application reduces muscle tone through a reduction of spindle sensitivity. They found that the rate of spontaneous spindle discharge decreases with decreasing temperature.

They found that hyperpolarization or low potassium concentration, reduced or abolished spindle discharge Also, their findings are in agreement with those of Eldred et al.51and associates who concluded that the site of thermal effect is the sensory terminal itself and is likely to be the result of change in membrane stability similar to those included axons by lowering the temperature.

Finally, Miglietta[52] reported that clonus and spasticity are not abolished unless the muscle temperature drops significantly. He mentioned the possibility that sympathetic fibres stimulation by cold application not only produces vasoconstriction but also decreases spindle sensitivity[53]

Joint awareness maybe improved by joint compression which will lead to enhancing motor control. Receptors in joints and muscles are involved with the awareness of joint position and movement which are stimulated by joint compression. Joint compression can have both facilitatory and inhibitory effects. Joint compression of the joint surfaces facilitates posture extensors which are needed to stabilize the body. Compression can be applied slowly to inhibit muscle[54]. The application may be manually or by using weight bearing postures. Normal bodyweight bearing applied through the long axis of the bone which is thought to inhibit muscle spasticity.

The results of this study showed a significant reduction in spasticity in both groups, which may be due to stretching of elbow flexor muscle through manual passive stretching and hand weight bearing more significant reduction in spasticity noted in group A

REFERENCES

1. https://www.scitcentral.com/article/43/1361/Effectiveness-of-Sustained-Stretching-in-Upper-Limb-Elbow-Flexor-Spasticity-on-Stroke-Patients#tabs
2. https://www.frontiersin.org/articles/10.3389/fneur.2021.742260/
3. C.E.Lang, D.F.Edwards, and R.L.Birkenmeier, "Estimating minimal clinically important differences of upper-extremity measures early after stroke," Arch Phys Med Rehabil, vol. 89, no. 9, 2008, pp. 1693-1700.
4. https://www.ncbi.nlm.nih.gov/books/NBK526002/
5. https://emedicine.medscape.com/article/323120-overview
6. https://www.researchgate.net/publication/263399298_The_Effects_of_Weight-Bearing_Exercise_on_Upper_Extremity_Activities_Performance_in_the_Female_Stroke_Patients
7. https://www.scitcentral.com/article/43/1361/Effectiveness-of-Sustained-Stretching-in-Upper-Limb-Elbow-Flexor-Spasticity-on-Stroke-Patients.
8. https://www.researchgate.net/profile/AuroreThibaut/publication/252323397_Spasticity_ after_stroke_Physiology_assessment_and_treatment/links/0c9605201ee4332a23000000/Spasticit y-after-stroke-Physiology-assessment-and-treatment.
9. https://journals.indexcopernicus.com/api/file/viewByFileId/1269081
10. https://www.google.co.in/search?q=Aug+8%2C2019+spasticity+and+stroke+neofect+smart+glove&ie=UTF-8&oe=UTF-8&hl=en-us&client=safari
11. https://www.researchgate.net/profile/AuroreThibaut/publication/252323397_Spasticity_after_stroke_Physiology_assessment_and_treatment/links/0c9605201ee4332a23000000/Spasticit y-after-stroke-Physiology-assessment-and-treatment.
12. Jinsook Roh, William Z.Rymer and randall F.Beer, evidence for altered upper extremity Muscle synergies with mild and moderate impairment, Front. Hum. Neurosci., 11feb,2015.
13. https://journals.indexcopernicus.com/api/file/viewByFileId/1269081https://www.google.co.in/search?q=Aug+8%2C2019+spasticity+and+stroke+neofect+smart+glove&ie=UTF-8&oe=UTF-8&hl=en-us&client=safari
14. M. Pontillo, K. F. Orishimo, I.J. Kremenic, M. P.McHugh, M. J. Mullaney, and T. F. Tyler, "Shoulder musculatureactivityandstabilizationduringupperextremityweight-bearing activities," N Am J Sports Phys Ther, vol. 2, no. 2, 2007, pp. 90-9

15. https://www.dovepress.com/revisiting-spasticity-after-stroke-clustering-clinical-characteristics-peer-reviewed-fulltext-article-JMDH
16. https://ttu-ir.tdl.org/bitstream/handle/2346/23133/31295012857230.pdf?sequence=2
17. https://www.longdom.org/open-access-pdfs/effects-of-joints-weight-bearing-exercises-combine-with-range-of-motion-exercises-on-affected-limbs-in-patents-with-stroke-2329-9096-1000410.pdf
18. https://www.researchgate.net/publication/263399298_The_Effects_of_Weight-Bearing_Exercise_on_Upper_Extremity_Activities_Performance_in_the_Female_Stroke_Patients
19. https://www.longdom.org/open-access-pdfs/effects-of-joints-weight-bearing-exercises-combine-with-range-of-motion-exercises-on-affected-limbs-in-patents-with-stroke-2329-9096-1000410.pdf
20. Monaghan K, Horgan F, Blake C, Cornall C, Hickey PP, Lyons BE, et al. Physical treatment interventions for managing spasticity after stroke. Cochrane Database Syst Rev. (2017) 2017:CD009188. doi: 10.1002/14651858.CD009188.pub2