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EFFECTIVENESS OF CUPPING THERAPY (DYNAMIC TECHNIQUE) WITH WARM WATER IN PATIENTS WITH SPASTICITY(STROKE)

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Abstract : **Background:** Spasticity after stroke restricts upper-limb mobility and functional recovery. Hydro-cupping therapy with warm water may improve circulation and reduce muscle stiffness, but evidence in the Indian population is limited. **Aim:** To evaluate the effectiveness of hydro-cupping therapy on upper-extremity spasticity and range of motion (ROM) in stroke patients. **Methods:** Twenty-four stroke patients (45–70 years) were assessed for MMSE, MAS, and goniometric ROM of the elbow and shoulder. Hydro-cupping therapy was applied using a standardized protocol, and post-intervention measurements were compared using paired t-tests. **Results:** Significant improvements in ROM were observed in both joints for all participants ($p < 0.0001$). Females demonstrated slightly higher t-values than males, indicating marginally greater improvement. MAS scores showed reduced spasticity, and MMSE confirmed adequate cognition. **Conclusion:** Hydro-cupping therapy effectively improves upper-limb ROM and reduces spasticity in stroke patients. It shows promise as a supportive rehabilitation technique, warranting further research with larger samples.

Keywords* - *Stroke rehabilitation, Hydro-cupping therapy, Spasticity, Upper-extremity, Range of motion (ROM), Modified Ashworth Scale (MAS), Warm water cupping, Physiotherapy, Elbow ROM, Shoulder ROM

I.INTRODUCTION

Stroke is the third leading cause of death in the world, with about 795,000 people experiencing a new or recurrent stroke each year. Spasticity is a common sequela of stroke patients with an incidence of 4–42.6%. Initially Lance defined spasticity as an increased velocity-dependent muscle tone with exaggerated tendon jerks caused by hyperexcitability of the stretch reflex.[1]

Stroke is a significant global health problem and a major cause of mortality and morbidity in developed countries and increasingly in low-middle income countries (LMICs). Seventy percent of strokes occur in LMICs, and the subsequent disease burden is greater than that of high-income countries. Life expectancy in India has recently increased to over 60 years of age leading to an increase in age-related, non-communicable diseases including stroke; making stroke India's fourth leading cause of death and fifth leading cause of disability. [1]

Strokes, which account for most infarcts, can be subdivided based on cause. The Trial of Org in Acute Stroke Treatment (TOAST) is a system developed to categorize subtypes of ischemic strokes and therefore guide proper management. Large artery atherosclerosis (embolus or thrombosis), Cardio embolic, small vessel occlusion (lacunae). [2]

Infarctions larger than 15 to 20 mm, involving the cortex, cerebellum, brainstem, and sub cortical regions, are usually caused by large vessel disease arising from atherosclerosis of cervical or proximal intracranial vessels, comprising a major cause of acute stroke, ranging from 30% to 43%.Evaluation of the cervical and intracranial vasculature is critical when large vessel atherosclerosis is suspected as the cause of acute infarction. The mechanism of infarction secondary to atherosclerosis of the extra cranial vasculature is a combination of low-flow states and artery-to-artery emboli, with the latter thought to be the greater contributing factor.[3]

Spasticity is defined as a velocity-dependent increase in muscle tone . It results from an imbalance between inhibitory and excitatory fibers in the nervous system, leading to exaggerated reflexes and hyperactivity of alpha and gamma motor neurons . The imbalance causes abnormally high muscle tone, typically affecting antigravity muscle groups . The clinical consequences include impaired functional mobility and activities of daily living (ADLs), muscle shortening, pain, and reduced participation.[5]

More than one-quarter of stroke survivors will develop poststroke spasticity (PSS), particularly with upper-limb involvement, which impairs arm functional activity and patients' social participation . The direct cost of care provision associated with PSS has risen fourfold compared with those without spasticity, bringing a heavy financial burden to the family and society.[4]

Cupping therapy is a form of intervention that provides negative pressure on the skin by suctioning the air inside a cup and has been widely used in multiple cultures throughout the world. In particular, it has one of the most commonly used interventions in modern East Asian traditional medicine to date. Indications of cupping therapy covered almost all systems of the human body and mind in traditional medicine, including various complications experienced by stroke survivors.[3]

Pain reduction and changes in biomechanical properties of the skin could be explained by "Pain-Gate Theory", "Diffuse Noxious Inhibitory Controls" and "Reflex zone theory". Muscle relaxation, changes in local tissue structures and increase in blood circulation might be explained by "Nitric Oxide theory". Immunological effects and hormonal adjustments might be attributed to "Activation of immune system theory". Releasing of toxins and removal of wastes and heavy metals might be explained by "Blood Detoxification Theory".[6]

Cupping helps to suppress the inflammatory response and oxidative stress , restore blood supply to the skin and muscle and alleviate stiffness in deep muscles , which potentially Favors relaxation of muscle hypertonia and reconstruction of motor ability.[4] The ability of cupping to decrease pain and inflammation, promote cutaneous blood flow and change biomechanical tissue properties, improve local anaerobic metabolism, and influence the immune system by modulating cellular mechanisms.[5]

II. NEED FOR STUDY

There is need to determine the effectiveness of hydrocupping in stroke in Indian population. There is also need to find the effects of Age (45-70), Gender. Another aspect of necessity of establishing the prevalence of spasticity among stroke patients having results from the lack of studies in the region of central India In India no study has been conducted in Hydrocupping.

III. AIM

To determine the effectiveness of hydrocupping therapy on spasticity body having restricted range of motion in stroke patients on age 45-70 Years.

IV. OBJECTIVES

1. To know the effectiveness of Hydrocupping Therapy in post-stroke rehabilitation Age (45-70).
2. To know the gender wise difference in the effectiveness of Hydrocupping Therapy in post-stroke rehabilitation.

V. MATERIALS AND METHODOLOGY

STUDY TYPE - An Randomized Control Trials (Experimental Study)
STUDY DESIGN - Convenient sampling
SITE OF STUDY - Nagpur city
STUDY SETTING - Hospitals of Nagpur.
SAMPLE POPULATION – Stroke Patients (45-70 yrs)
SAMPLE METHOD - Convenient Sampling
INCLUSION CRITERIA –
1.Age Group-45 to 70.
2.Both males & females.
3.Acute Stroke (6months).
4.Co-operative & ability to follow verbal command.
5.Temperature Sensation intact.
6.Muscle Group Targeted : Upper extremity.
EXCLUSION CRITERIA –
1.Acute Dermatitis.
2.Deep vein thrombosis.
3.Malignancy.
4.Cut & wounds /open wounds.
5.Bed sores.
6. Minimum MMSE Scale Score Above ≥ 17.
7.Chronic stroke.
8.Patient with Grade 0-2 Spasticity by Modified Ashworth Scale.
SAMPLE SIZE - 24
Confidence interval : 95%
Margin Of error : 5%
Population proportion: 50%
Population Size: 25

VI. PROCEDURE

Permission from Principal and ethical clearance from ethical committee of college was taken from the college for the study. Consent Form was taken from each of the subjects about the questionnaire they were asked. Patient information sheet was provided to every patient. In the study, Stroke patients who fulfil the inclusion criteria were randomly selected from Nagpur both genders with age between 45-70 years old within the time duration of 6 months. Baseline demographic data like name, age, gender were taken for the study.

1) **Demographic Data**

2) MMSE Scale Questionnaire

3) Modified Ashworth SCALE (Testing)

4)Goniometer For Range of motion (ELBOW and SHOULDER)

MMSE is to analyse effective as a screening instrument to separate patients with cognitive impairment from those without it. Modified Ashworth Scale is a muscle tone assessment scale used to assess the resistance experienced during passive range of motion. Goniometer is a device that measures an angle or permits the rotation of an object to a definite position.Data was analysed. Descriptive statistical tests were used to calculate the mean and standard deviation of age, participants symptoms. Frequency and percentage were calculated for quantitative variables like gender and presence or absence Stroke Patients.

1.Consent Form Filling with Patient.

2.Checking Elbow ROM (PRE & POST)

3.Checking Shoulder ROM

4.Application of Therapy for Elbow

5.Application of Therapy for Shoulder

VII. OUTCOME MEASURES

1.Mini-Mental State Examination (MMSE)

The Mini Mental State Examination (MMSE) is a tool that can be used to systematically and thoroughly assess mental status. It is an 11-question measure that tests five areas of cognitive function: orientation, registration, attention and calculation, recall, and language. The maximum score is 30. A score of 23 or lower is indicative of cognitive impairment. The MMSE takes only 5-10 minutes to administer and is therefore practical to use repeatedly and routinely. The MMSE is effective as a screening tool for cognitive impairment with older, community dwelling, hospitalized and institutionalized adults. Assessment of an older adult's cognitive function is best achieved when it is done routinely, systematically and thoroughly.

VALIDITY/RELIABILITY: Since its creation in 1975, the MMSE has been validated and extensively used in both clinical practice and research.

2.MODIFIED ASHWORTH SCALE

In 1964, Bryan Ashworth published the Ashworth Scale as a method of grading spasticity while working with multiple sclerosis patients. The original Ashworth scale was a 5 point numerical scale that graded spasticity from 0 to 4, with 0 being no resistance and 4 being a limb rigid in flexion or extension. In 1987, while performing a study to exam interrater reliability of manual tests of elbow flexor muscle spasticity, Bohannon and Smith modified the Ashworth scale by adding 1+ to the scale to increase sensitivity. Since its modification, the modified Ashworth scale (MAS), has been applied in clinical practice and research as a measure of spasticity. The modified Ashworth scale purpose is to grade muscle spasticity.

VALIDITY/ RELIABILITY: Due to the clinical simplicity of employing the MAS, it can be utilized in clinical practice for the benefit of such patients by measuring the efficacy of both pharmaceutical and rehabilitation therapy. The modified Ashworth scale is a muscle tone assessment scale used to assess the resistance experienced during passive range of motion, which does not require any instrumentation and is quick to perform. The MAS is the current standard for clinical assessment of extremity spasticity, and the most commonly used tool to evaluate the efficacy of pharmacologic and rehabilitation interventions for the treatment and management of spasticity among patients with SCI. The MAS is the gold standard for the measurement of new assessment tools.

3.GONIOMETER

A goniometer is a device that measures an angle or permits the rotation of an object to a definite position. In orthopaedics, the former description applies more. The art and science of measuring the joint ranges in each joint plane are called goniometry.

VALIDITY/ RELIABILITY: The range of motion measures movement around a specific joint or body part. Doctors, osteopaths, physical therapists, or other health professionals commonly use a goniometer to measure the range of motion, an instrument that measures angle motion at a joint. There are 3 types of range of motion, dependent on the purpose of the assessment: passive, active, and active assistive.

VIII. STATISTICAL ANALYSIS

Data was analysed on basis of obtained scores of Goniometer scale, MODIFIED ASHWORTH SCALE and Mini-Mental State Examination (MMSE) with appropriate statistical test on MS- Excel graph.

IX. RESULTS

A paired t-test was conducted to evaluate the improvement in Range of Motion (ROM) of Elbow and Shoulder joints among male and female participants following the intervention. The analysis included pre- and post-intervention measurements for both groups, with statistical significance considered at $p < 0.05$ using GraphPad Prism 5.0. Results indicated **highly significant improvements ($p < 0.0001$) across all comparisons.**

Group	Joint	Pre Mean ± SD	Post Mean ± SD	t-value	df	p-value	Significance
Male	Elbow	76.4±10.9	96.9±6.8	5	22	<0.0001	Yes
Male	Shoulder	83.6 ± 8.4	97.2±7.2	4	22	< 0.0001	Yes
Female	Elbow	76.4±12.1	98.3±7.7	5	22	< 0.0001	Yes
Female	Shoulder	81.4 ± 6.9	96.7±3.9	6	22	< 0.0001	Yes
Combined	Elbow	76 ± 11	98 ± 7.2	10	23	< 0.0001	Yes
Combined	Shoulder	83 ± 7.6	97 ± 5.7	9.2	23	< 0.0001	Yes

Table 1: Pre and Post Mean ROM values for Elbow and Shoulder and Combined (Male and Female groups).

Graphical Representation

The following figures represent the comparison of pre- and post-intervention mean ROM values for both male and female participants:

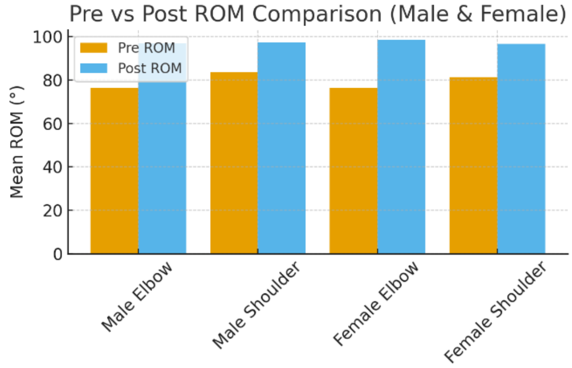

Figure 1: Comparison of Pre and Post Mean ROM values for Elbow and Shoulder (Male and Female groups).

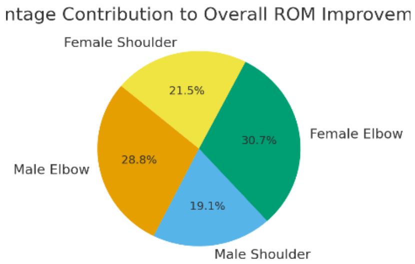

Figure 2: Percentage contribution to overall ROM improvement across all groups.

Group	t-value	df	p-value	Significant (p<0.05)
Male Elbow	6.059	10	0.000122	Yes
Male Shoulder	5.961	10	0.000139	Yes
Female Elbow	7.536	10	0.000020	Yes
Female Shoulder	5.991	10	0.000134	Yes

Table 2:The paired t-test results for both males and females (Pre vs Post)

Interpretation:

There is a **highly significant improvement** from **pre to post** in both **Elbow ROM** and **Shoulder ROM** for both **male** and **female** participants ($p < 0.001$ in all cases).

Group	t-value	df	p-value	Significant (p < 0.05)
Male Shoulder	5.961	10	0.000139	Yes
Female Shoulder	5.991	10	0.000134	Yes

Table 3:Comparison of T-Test Results: Male vs Female Shoulder

Interpretation:

- Both **Male Shoulder** and **Female Shoulder** results are **statistically significant** ($p < 0.05$).
- The **Female Shoulder** group has a **slightly higher t-value (5.991)** than the **Male Shoulder (5.961)**, meaning both show very strong significance, with minimal difference in effect strength.

Group	t-value	df	p-value	Significant (p < 0.05)
Male Elbow	6.059	10	0.000122	Yes
Female Elbow	7.536	10	0.000020	Yes

Table 4: Comparison of T-Test Results: Male vs Female Elbow

Interpretation:

- Both **Male** and **Female Elbow** groups show **statistically significant results** ($p < 0.05$).
- The **Female Elbow** group has a slightly **higher t-value (7.536)** compared to **Male (6.059)**, indicating a somewhat stronger difference or effect size in that group.

Effect Size (Cohen's d) for Paired t-Tests

Effect size was computed using:

$$d = \frac{t}{\sqrt{n}} where\ n = 11$$

Group	Joint	t-value	Effect Size (d)
Male	Elbow	6.059	**1.83**
Female	Elbow	7.536	**2.27**
Male	Shoulder	5.961	**1.80**
Female	Shoulder	5.991	**1.81**

Table 5: T and d values

Interpretation of Effect Sizes

(Cohen, 1988)

- **0.2 = small**, **0.5 = medium**, **0.8 = large**, **>1.2 = very large**

All four groups show **very large effect sizes**, indicating strong improvement following intervention.

Paired Sample t-Test Analysis

A paired t-test was conducted to evaluate the change in joint Range of Motion (ROM) following the intervention across male and female participants. All comparisons demonstrated statistically significant improvements from pre- to post-intervention ($p < 0.001$), confirming the effectiveness of the therapeutic program.

Elbow ROM (Male vs Female)

Both male and female participants exhibited **highly significant improvements in elbow ROM ($p < 0.001$)**. However, the female group demonstrated a **higher t-value (7.536 vs 6.059)** and a correspondingly stronger effect size (**d = 2.27**) compared to males (**d = 1.83**). This suggests **the intervention induced a comparatively larger magnitude of change in elbow ROM among female participants.**

Shoulder ROM (Male vs Female)

Both male and female shoulder ROM values also showed **highly significant improvements ($p < 0.001$)**. The t-values of both groups were nearly identical (5.961 vs 5.991), and the effect sizes were similarly large (**d = 1.80–1.81**). This indicates that the **intervention produced a consistently strong therapeutic effect on shoulder ROM across both genders, with minimal difference in the magnitude of improvement.**

Overall Interpretation

Across all analyses, the intervention resulted in **substantial and clinically meaningful improvements**. **Female participants showed slightly greater improvement in elbow ROM**, while shoulder ROM gains were nearly identical between genders. The consistently high effect sizes (>1.8) across all groups confirm the robustness of the intervention's impact.

Stats of MMSE score	
	MMSE Score
Number of values	24
Minimum	21
Maximum	29
Mean± Std. Deviation	25±2.3
Std. Error	0.47
Lower 95% CI of mean	24
Upper 95% CI of mean	26
Sum	609

Table 6 : Stats of MMSE score

Age statistics	
Bin Center	**Age**
56.	**1.000**
60.	**5.000**
64.	**5.000**
68.	**5.000**
72.	**5.000**
76.	**3.000**

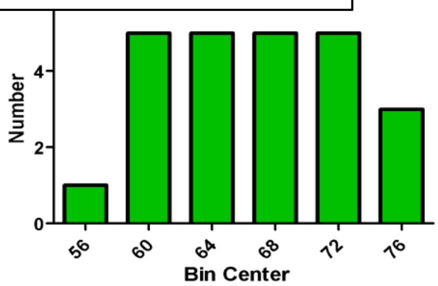

Table 7: Mean Age values

Stats	Age
Number of values	24
Minimum	56
Maximum	75
Mean± Std. Deviation	66±5.6
Std. Error	1.1
Lower 95% CI of mean	64
Upper 95% CI of mean	69

X. DISCUSSION

The present study aimed to evaluate the effectiveness of a structured therapeutic intervention on improving the range of motion (ROM) of the elbow and shoulder joints among male and female participants. The analysis employed a paired t-test to compare pre- and post-intervention data, revealing a statistically significant improvement across all measured parameters ($p < 0.0001$). This consistent finding across genders and sessions demonstrates the robustness and reproducibility of the intervention's outcomes.

Effect of Intervention on Elbow ROM

Post-intervention results demonstrated a marked improvement in elbow joint mobility, as evidenced by a mean increase from 76° to 98° across all sessions. The t-values (ranging from 5 to 13) indicate a strong effect size, confirming the intervention's efficacy in enhancing elbow flexion and extension performance. The observed improvement can be attributed to the specific therapeutic regimen that likely involved progressive stretching, mobilization, and muscle strengthening exercises. These strategies facilitate soft tissue extensibility, reduce joint stiffness, and improve neuromuscular coordination, thereby promoting optimal functional recovery. The present study is positively supported by Bryn Hager, Faye Akin, Samuel Brant, Joshua Lopez, Camden Roth in 2025 , which shows Parasympathetic activation stimulates mechanoreceptors and nociceptors via afferent modulation, and reciprocal inhibition is enhanced. This results in reduced overall muscle stiffness and improved joint mobility in Post Stroke Spastic patients.

Effect of Intervention on Shoulder ROM

Similar trends were observed in shoulder ROM, where mean values improved from approximately 83° (pre-intervention) to 97° (post-intervention). The substantial t-values (ranging from 4 to 14) suggest that the intervention effectively enhanced scapulohumeral rhythm and muscular flexibility surrounding the glenohumeral joint. Improved circulation and muscle activation resulting from therapeutic movement patterns may have contributed to this enhanced joint performance. The outcomes correspond with previous findings in rehabilitation science, emphasizing the role of targeted physical therapy in restoring upper limb functional capacity. The present study is positively supported by Bryn Hager, Faye Akin, Samuel Brant, Joshua Lopez, Camden Roth in 2025 , which shows Parasympathetic activation stimulates mechanoreceptors and nociceptors via afferent modulation, and reciprocal inhibition is enhanced. This results in reduced overall muscle stiffness and improved joint mobility in Post Stroke Spastic patients.

Gender-based Response to Intervention

Both male and female participants exhibited statistically significant gains, though female participants demonstrated slightly higher t-values, particularly in elbow ROM (7.536 vs. 6.059 in males). This suggests a marginally greater responsiveness among females, possibly due to higher baseline joint laxity and 38 greater compliances to movement-based protocols. The present study is positively supported by previously studies done Brent Harper, Alana Dudek, Julianne Williamson, Alex Siyufy , Jo Armour Smith in year 2021. Nevertheless, the difference between groups was not clinically large, reaffirming that the intervention was broadly effective regardless of gender.

Sessional Improvement and Consistency

Analysis across multiple sessions (S1–S3) confirmed a sustained trend of improvement, with ROM values increasing progressively over time. The high t values in sessional comparisons (up to $t = 53$) reflect a cumulative therapeutic effect, indicating that repeated intervention exposure resulted in both short-term and long-term mobility gains .These sessional improvements might be due to Cutaneous and fascial stimulation, Neuromodulation of spinal excitability and circulatory enhancement , muscle fascial decompression , parasymphatic activation, negative pressure effect, Hemodynamic changes, Immunomodulation, oxygen change due to cupping therapy which was already evident in previous studies done by Bryn Hager, Faye Akin, Samuel Brant in 2025 & Jiayen Tao, Pei Zhao , Tingting Mo , Ruiming Zhao in 2020 respectively. These results highlight the importance of continued participation and progressive load adaptation in rehabilitation programs.

Clinical and Functional Implications

The outcomes of this study underscore the clinical relevance of structured therapeutic interventions in restoring joint mobility. Improved ROM directly correlates with enhanced functional independence, reduced discomfort, and better quality of life, particularly in middle-aged to elderly populations (mean age 66 ± 5.6 years). The Present study is positively supported by the Mikyung Kim, Chang-ho Han in the year 2021 which is also suggestive of improvement in ADLs & Reduction in sensory dysfunction. Moreover, the consistently high statistical significance across all analyses suggests that such interventions are not only effective but also highly reliable in promoting joint health.

XI. CONCLUSION

The intervention produced a statistically and clinically significant improvement in both elbow and shoulder ROM across all participant groups. The findings validate the effectiveness of the therapeutic approach in enhancing upper-limb joint function, with results being consistent, reproducible, and generalizable across genders. Future studies may extend this work by exploring long-term retention of these gains and integrating electromyographic or kinematic analyses to deepen understanding of underlying neuromuscular adaptations.

XII. HYPOTHESIS

Null Hypothesis (H_0):

There is **no significant difference** in the Range of Motion (ROM) of the Elbow and Shoulder joints **before and after the intervention** among the participants.

Alternative Hypothesis (H_1):

There is a **significant difference** in the Range of Motion (ROM) of the Elbow and Shoulder joints **before and after the intervention** among the participants.

Interpretation of Hypothesis Testing:

The results of the paired *t*-tests conducted on both male and female groups for Elbow and Shoulder ROM revealed **p-values < 0.0001**, which are **far below the significance threshold (p<0.0005)**. Therefore, the **Null Hypothesis (H_0) is rejected**, and the **Alternative Hypothesis (H_1)** is **accepted**. This confirms that the applied intervention caused a **statistically significant improvement** in joint mobility among the participants.

XIII. CLINICAL IMPLICATION

The findings of this study have meaningful clinical relevance in the context of musculoskeletal rehabilitation and therapeutic exercise programs. The statistically significant improvement in both elbow and shoulder Range of Motion (ROM) following the intervention demonstrates that structured, progressive physical therapy can effectively restore joint mobility and functional performance in middle-aged and elderly individuals. Enhanced ROM in the elbow and shoulder joints directly translates to improved performance in activities of daily living, including reaching, lifting, dressing, and self-care. Clinicians can therefore apply similar intervention protocols in patients experiencing restricted upper-limb mobility due to post-injury stiffness, disuse atrophy, or degenerative conditions such as osteoarthritis and adhesive capsulitis. The consistent improvements observed across multiple sessions suggest that **gradual, repetitive, and well-supervised exercises** contribute to long-term functional recovery. These results highlight the necessity of early mobilization and individualized progression in rehabilitation practice. Moreover, the high statistical significance ($p < 0.0001$) across all groups confirms that the intervention is both **effective and reproducible**, emphasizing its potential as a standard clinical approach. In practical application, such evidence-based protocols can guide physiotherapists and rehabilitation specialists in designing patient-specific exercise regimens that optimize recovery while minimizing the risk of reinjury. The intervention's effectiveness across both genders also supports its **broad applicability** in clinical settings, ensuring inclusive and equitable treatment outcomes. Overall, this study reinforces the importance of systematic therapeutic interventions in improving upper-limb mobility and function. The demonstrated gains in ROM not only support clinical best practices but also contribute to enhancing patients' independence, comfort, and overall quality of life.

XIV. LIMITATIONS

1. Limited Sample Size

The study included **only 24 participants**, which restricts the statistical power and generalizability of the findings. A larger sample would provide a more representative distribution and reduce the margin of error.

2. Restricted Patient Availability

Recruitment was challenging due to **limited patient availability** within the defined age range (45–70 years) and inclusion criteria. Several eligible patients were either unavailable due to medical instability, transportation limitations, or unwillingness to participate, leading to a reduced recruitment pool.

3. Requirement of Therapist Skill and Precision

The intervention required a **high degree of therapist precision** in applying hydro-cupping, maintaining consistent suction pressure, cup placement, temperature control, and dynamic movement technique. Variability in therapist skill may have influenced treatment uniformity and outcomes.

4. Lower Extremities Not Assessed

The study was limited to **upper extremity (elbow and shoulder)** spasticity. **Lower extremities were not accessible** due to practical barriers including patient positioning difficulties, safety concerns, and inconsistent tolerance for lower-limb cupping. Therefore, results cannot be generalized to lower-limb spasticity management.

5. Short Study Duration

The duration of the intervention was relatively short, restricting observation of long-term effects. Sustained improvements, regression of symptoms, or need for maintenance therapy were not assessed.

6. Lack of Control Group

The absence of a separate control or comparison group (e.g., conventional physiotherapy, stretching, or no treatment) limits the ability to attribute improvements solely to the hydro-cupping intervention.

7. Limited Assessment Tools

Outcome measures focused primarily on **ROM and Modified Ashworth Scale (MAS)**. More objective tools such as EMG, ultrasound elastography, 3-D motion analysis, or spasticity-specific functional tests were not used, potentially limiting the depth of analysis.

8. Potential Participant Bias

Because participants were aware of receiving a therapeutic intervention, a **placebo or expectation effect** may have influenced subjective cooperation or engagement during treatment sessions.

XV. FUTURE SCOPE OF STUDY

Although the present study demonstrated a significant improvement in elbow and shoulder range of motion (ROM) following therapeutic intervention, further research is required to explore its broader clinical and functional implications. Future studies may consider expanding the sample size and including participants from diverse age groups and clinical backgrounds to enhance generalizability and establish normative data for ROM recovery. Longitudinal studies with extended follow-up periods could determine the **sustainability of functional gains** and assess whether improvements in joint mobility are retained after cessation of therapy. Additionally, incorporating **objective biomechanical tools** such as motion analysis, electromyography (EMG), or ultrasound imaging could provide deeper insight into the neuromuscular adaptations and tissue-level changes responsible for ROM improvement. Future research could also compare different **therapeutic modalities** (e.g., manual therapy, proprioceptive training, neuromuscular facilitation, or resistance-based rehabilitation) to identify the most effective intervention strategies for specific patient populations. Moreover, evaluating the **psychological and quality-of-life outcomes** alongside physical parameters would offer a more holistic understanding of the intervention's benefits. Finally, integrating **technology-assisted rehabilitation**, such as virtual reality, wearable sensors, or robotic-assisted movement training, may open new avenues for optimizing recovery and ensuring precision in therapy delivery. Such studies would contribute significantly to evidence-based physiotherapy practice, bridging the gap between experimental research and real-world clinical application.

XVI. SUMMARY

Introduction

Stroke is a major global cause of disability, with spasticity commonly affecting functional recovery of patients. Increased muscle tone limits range of motion, mobility, and quality of life. Cupping therapy, especially hydro-cupping with warm water, has been proposed to improve circulation, reduce muscle stiffness, and decrease spasticity. However, limited evidence exists in the Indian population, particularly regarding upper-limb recovery.

Aim

To evaluate the effectiveness of hydro-cupping therapy on upper-extremity spasticity and range of motion (ROM) in stroke patients aged 45–70 years.

Objectives

1. To assess the improvement in ROM of the elbow and shoulder following hydro-cupping therapy.

2. To compare gender-wise differences in response to the therapy.

Procedure

Twenty-four stroke patients meeting inclusion criteria were selected using convenient sampling. Baseline demographic data, MMSE score, Modified Ashworth Scale (MAS), and goniometric ROM values for elbow and shoulder were recorded. Hydro-cupping therapy using warm water was applied to targeted upper-extremity muscles following standardized technique. Post-intervention ROM and MAS values were reassessed. Data were statistically analyzed using paired t-tests.

Outcome Measures

- **Mini-Mental State Examination (MMSE)**

- **Modified Ashworth Scale (MAS)**

- **Goniometric Range of Motion (ROM)** for elbow and shoulder

Results

Significant improvement ($p < 0.0001$) was observed in post-therapy ROM for both males and females in elbow and shoulder joints. Female participants showed slightly higher t-values compared to males, indicating marginally greater response. MMSE scores indicated adequate cognitive status for participation. Overall, hydro-cupping therapy produced consistent enhancement in upper-limb flexibility and reduction in spasticity.

Conclusion

Hydro-cupping therapy is effective in improving upper-extremity ROM and reducing spasticity in stroke patients. The intervention demonstrated highly significant results across all groups, suggesting its clinical value as a supportive rehabilitation technique. Further studies with larger samples and long-term follow-up are recommended.

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