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Effectiveness Of Continous Superficial Heat Therapy Combined with Low Load Long Duration Scapular Exercise for Adhesive Capsulities in Diabteic Patients

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ABSTRACT

Background:Frozen shoulder, also known as adhesive capsulitis, is a painful condition that limits shoulder movement. It progresses through four stages: acute, freezing, frozen, and thawing, each characterized by increasing stiffness and discomfort. Primary causes include immobilization, trauma,and post-surgical complications. Secondary factors, such as diabetes, can exacerbate the condition by impairing blood circulation and increasing inflammation, which accelerates stiffness. Physiotherapy is essential for recovery, combining heat therapy to ease pain with targeted exercises to improve mobility. With consistent treatment, especially for individuals with diabetes, significant improvement is achievable.

Method: Eighty-seven participants, aged 40 to 60, were divided into two age groups (40-50 and 50-60), with each group further categorized by gender. After obtaining informed consent, participants underwent a medical history review and goniometric assessment to measure shoulder joint range of motion. The study aimed to ensure ethical, reliable, and accurate results.

Results: In a 12-week treatment period, significant pain reduction was observed among participants, with femalesshowing slightly more improvement than males. Visual Analog Scale (VAS) scores indicated agradual decline inpain, withaplateaubetweenweeks3-6.Range ofmotion improvedsteadily,though some plateaus occurred. Overall, both pain relief and mobility showed improvement across genders, highlighting the treatment's effectiveness and offering insights into gender differences in therapy responses.

Conclusion: The study concluded that scapular strengthening exercises combined with continuous superficial heat therapy were both beneficial and effective for managing frozen shoulder. These interventions alleviated pain and significantly improved range of motion, demonstrating their effectiveness in treating the condition.

Keyword: *Adhesive Capsulitis, Heat therapy, Diabetes, Exercises, Scapular exercises.*

1. INTRODUCTION

Frozen shoulder, a condition often marked by inflammation and fibrosis of the shoulder's ligamentous capsule, is a painful and restrictive disorder(1) This affliction results in stiffness and severe limitations in the shoulder joint's range of motion.(2) The term "frozen shoulder" is commonly known by three names: adhesive capsulitis, coined by Navisear; frozen shoulder, introduced by Codman; and periarthritis, as

definedbyDuplay.(3,7)(Eachtermreflectsasimilarconceptbutemphasizesdifferentaspectsofthecondition—adhesive capsulitis refers to the "sticky" nature of the shoulder capsule when it stiffens,while frozen shoulder suggests the joint's rigidity resembling ice.3, Definitions 1. Navisear's definition: An inflamed and fibrotic condition of the capsule and ligamentous tissues of the shoulder.(1,3) 2. Duplay's definition: A painful and stiff condition, characterized by limited active and passive range of motion.(4,6)Epidemiology-Patients diagnosed with adhesive capsulitis experience significant restriction in bothactiveand passive movementswithin the glenohumeraljoint,primarily acrossmultiple planes ofmotion.(1,4) Causes-The

causes of frozen shoulder are classified into primary and secondary categories. Primary Causes:Idiopathic: Often occurring

without a known cause, it can happen naturally or seemingly at random. Immobilization:(5,6,8,10) When a joint is

immobilized for extended periods, its mobility is hindered, leading to stiffness and possible debris accumulation in the area(8) Trauma: Injury to the shoulder often results in restricted movement and reduced blood flow, contributing to the condition. Radical Mastectomy: Surgical removal of the breast can impact the glenohumeral joint and surrounding areas, leading to restricted shoulder movement.(9,10)Secondary Causes: Known to have clear underlying pathologies: Systemic Factors: Diabetes mellitus, thyroid imbalances, and other hormonal changes are frequent culprits, especially in cases involving glycosylation end products which lead to calcification and stiffening of the joints.(10,14,15) Extrinsic Factors: Conditions related to the cardiovascular or pulmonary system, neck (cervical) issues, or humeral fractures, although these are not directly linked to the glenohumeral joint, can influence its mobility. Intrinsic Factors: These are factors directly involving the glenohumeral joint or its connective tissues.(10,14)

Stages of Frozen Shoulder:Frozen shoulder progresses through four distinct phases, each marked by varying levels of pain and stiffness: 1. Acute Phase (0-3 months): Intense pain occurs, particularly during active and passive range of motion. Forward flexion, adduction, and rotation become limited. 2.Freezing Phase (3-6 months):Pain becomes more pronounced, often intensifying at night, withradiating discomfort. Difficulty in abduction, adduction, and external rotation is commonly reported. 3. Frozen Phase (6-18 months):Stiffness increases progressively, with limitations in all directions of shoulder movement. Night pain persists, proving resistant to medications and physical therapy. 4. Thawing Phase (18 months and beyond): The joint begins to recover slowly, and physical therapy combined with medications can lead to significant recovery.(11,12,13)

FrozenShoulderand Diabetes:Diabetes,achronicconditionwherethebodystrugglestoregulateblood sugar, plays a pivotal role in frozen shoulder development.(16,) There are two primary forms of diabetes: Type 1 Diabetes: An autoimmune condition typically diagnosed in children and adolescents, where the immune system attacks insulin-producing cells. Type 2 Diabetes: More common in adults, often due to lifestyle factors like obesity, poor diet, and genetic predisposition, it results in insulin resistance or inadequate insulin production.(16,17)When correlated with frozen shoulder, diabetes can exacerbate joint stiffness due to glycosylation, poor blood circulation, and nerve damage. Additionally, chronic inflammation related to diabetes can worsen the condition of the shoulder.(18,19,20)

Physiotherapy Treatment For diabetic patients with frozen shoulder, physiotherapy plays a critical rolein restoring shoulder mobility and alleviating pain.(21,22) Key goals include: Pain Reduction: Continuous superficial heat therapy relaxes the shoulder muscles, increases blood circulation (vasodilation)(21), and clears stiffened collagen buildup, promoting healing. Restoring Range of Motion: Low-load, long- duration scapular exercises are employed to gradually restore flexibility without overloading the muscles.(23,24).By combining heat therapy with low-load scapular exercises(25,22), we aim to address both pain management and range of motion improvement

2. MATERIALS AND PROCEDURE

Afterapproval frominstitutional protocoland ethical committee,this comparativestudy wasperformed inof Krishna Vishwa Vidyapeeth institution. The study's major goal was to determine the effectiveness of continuous superficial heat therapy combined with low load long duration scapular exercises for adhesive capsulitis in diabetic patients.

Participants

A total of 87 participants were carefully selected for this study, ensuring that the inclusion criteria were met, with all participants falling within the age range of 40 to 60 years. To better understand the variations within this age range, the participants were divided into two main sub-groups based on their age: the first group consisted of individuals aged 40 to 50 years, while the second group consisted of individuals aged 50 to 60 years. To further refine the study's demographic analysis, each of these two age groups was further categorized by gender, creating four distinct categories in total.

In the 40 to 50 age group, there were a total of 45 participants, broken down into 27 males and 18 females.Meanwhile,inthe50to60agegroup,therewere42participants,consistingof12malesand

30females.Thisage-genderclassificationensuredabalancedapproachtostudyingthesample population. The study, therefore, included a total of 45 female participants and 42 male participants.

The methodology included reaching out to all participants from the 40 to 50 and 50 to 60 age groups, with a detailed explanation provided regarding the aims and objectives of the study. The participants were thoroughly informed about the procedures involved and the expected steps of the research. To ensurethateveryparticipantunderstoodthenatureofthestudy,verbalinformedconsentwasobtained from each individual. This consent process was crucial, as it assured participants that they were voluntarily participating in the study with a full understanding of the methods and procedures to be followed.

The study itself commenced only after the participants provided their consent, ensuring an ethical and transparentapproachto datacollection.The initial phase ofthe study involved taking adetailedmedical history from each participant. This step was essential in understanding the background of each participant, as it allowed for the identification

of any pre-existing conditions that might impact the results. Additionally, any comorbid conditions that could interfere with the study's outcomes were carefully ruled out during this process.

Following the history-taking, a comprehensive assessment was conducted using a goniometer, a specializedinstrument used to measure joint angles andrange ofmotion. This assessment wascriticalin obtaining baseline measurements for the participants, which would later be compared to post-study results. Alongside the goniometric measurements, two primary outcome measures were identified and taken into consideration for the study, ensuring that the results would be both reliable and comprehensive. The data collected from these assessments formed the foundation for the analysis of the study's objectives and outcomes.

By the end of this detailed process, the study was set to proceed with clear, structured methods that would allow for accurate and meaningful findings, all while maintaining the highest ethical standardsand ensuring the well-being of the participants throughout the research.

PROCEDURE

The treatment protocol involves obtaining consent from participants and categorizing diabetic patients aged 40 to 60 years who present with stage 1 or stage 2 frozen shoulder. After an initial assessment of the patient's pain levels and range of motion using tools like the goniometer and the visual analog scale (VAS),a12-week treatmentprogrambegins.Theprogramisbrokendowninto phases,startingwithpain management for the study we will begin our study by taking the inclusion criteria that is diabetic people above age 40 above age 40 up to 60 years so this will be our inclusion criteria and we will becategorizingthemonbasis ofthefrozenshoulderstage herewe are takingonlystage one and stagetwo frozen shoulder people secondly once this is done we will proceed by taking a consent form in the consent form the patient will be explained about what the study is about and what treatment they will be getting or will be provided initially a pre-test would be taken where there will be assessment and diagnosis made of the range of motion of the pain and which stage of frozen shoulder they are thenonce the diagnosis is made there will be a treatment protocol followed for about 12 weeks that is three months this treatment protocol is divided into sub parts where it is for first week then second week three to five weeks six to eight weeks and then nine to twelve weeks so in such manner there will be treatment provided to the particular patient depending on the severity of frozen shoulder and once this is finished the three months protocol is finished there will be a post test done where again there will be assessment and diagnosis will be made about the situation and that type here once this is complete we will try and rule out to see whether we have we have been seeing prognosis of the treatment or no this will be the total procedure. not, followed by progressive motion recovery.

Outcomemeasures

1. RANGE OF MOTION:

The assessment of the shoulder's range of motion was conducted using a goniometer, a device designed to measure the angle of movement in a joint. Specifically, the goniometer was employedto evaluate three key movements of the shoulder: shoulder flexion, shoulder abduction, and external rotation of the shoulder .For the procedure, the patient was carefully instructed to move their shoulder joint through its full range of motion. Prior to this, the goniometer was set to a baseline reading of zero to ensure accurate measurements. The patient's movements were then observed and recorded as they proceeded to flex, abduct, and externally rotate the shoulder.The range of motion for each movement was measured and the greater the resulting angle, the more extensive the joint's range of motion. This measurement allows for an objective evaluation of the shoulder's functional capacity and mobility.

2. VAS–Visual analogue scale:

Visual Analogue Scales (VAS) are widely recognized as an effective and straightforward method for measuring subjective experiences such as pain, discomfort, or other sensations. This technique has been proven to be both valid and reliable in various clinical and research settings, allowing for consistent measurements across a broad range of applications. Despite their widespread use, it is important to note that there are instances where the VAS may exhibit increased error or reduced sensitivity, particularly when used with certain groups of subjects. These issues may arise due to individual differences in perception, understanding, or response to the scale. In some cases, the decisionsregardingtheselectionofscoring intervals,experimentaldesign,andstatisticalanalysisfor

VAS measurements havebeenmadebased onconvenience, assumption, orestablished conventions rather than rigorous empirical evidence. This approach can sometimes limit the effectiveness of the scale in capturing accurate and meaningful data. As a result, it becomes crucial to conduct more thorough and comprehensive evaluations of individual scales to better understand their strengths and potential limitations. To fully leverage the power of the VAS as a versatile and sensitive measurement tool, researchers and clinicians should carefully consider the context in which the scale is being used. This includes evaluating the appropriateness of the scoring intervals, experimental designs, and statistical methods employed. By doing so, the VAS can be used to its full potential, yielding more precise and reliable results that can enhance both clinical practice and research outcomes.

Treatment protocol

WEEKS	EXERCISES	REPETITIONS
WEEK 1	Free exercise of shoulder	5
	Continuous Superfial heat	5
WEEK 2	Free exercise of shoulder	5
	Free exercise for scapular movements	10
WEEK 3-5	Free exercise of shoulder with 250 grams of weight	10
	Free exercise for scapular stretch with 250 grams weight Superfial heat	10
WEEK 6-8	Exercise of shoulder joint with weight 500 grams	5
	Exercise for scapular strech with weight 500 gram continuous Superfial heat	10
WEEK 9-12	Exercise of shoulder joint with weight 500 gram with hold of 20-30 sec	10
	Exercise of scapular stretch with weight 500 gram with hold of 20-30 sec	10
	Continuous heat therapy	10

TABLE 1: Treatment protocol given to group A and B

This 12-week shoulder rehab plan starts off easy and slowly cranks up the challenge.

Week 1: Light shoulder moves and some heat therapy to warm things up (5 reps each).

Week 2: Adds in scapular exercises, stepping up to 10 reps.

Weeks 3-5: Time to bring in 250g weights, keeping things smooth with heat therapy (10 reps).

Weeks 6-8: The game levels up to 500g weights, mixing in stretches and continuous heat (5-10 reps).

Weeks 9-12: The real test—holding 500g weights for 20-30 seconds, plus constant heat therapy (10 reps).

3. RESULTS

A detailed analysis was conducted on patients who successfully completed a comprehensive treatment sessionlastingapproximatelythree months,or12 weeks.Thisstudy involved atotalof87

participants,allofwhomunderwentbothpre-andpost-assessments.The subjectsweredividedinto two groups, comprising a mix of males and females.

Demographic variables	Category	Age Group 40-50		Age Group 50-60	
		Number of patients (Group A)	Percentage (Group A)	Number of patients (Group B)	Percentage (Group B)
Gender	Male	27	60.00%	12	29.00%
	Female	18	40.00%	30	71.00%
Stage	Stage 1	25	55.60%	24	57.10%
	Stage 2	20	44.40%	18	42.90%

TABLE 2: Demographic Data

This table breaks down the demographic landscape of two age groups (40-50 & 50-60) based on gender and disease stage—and the contrast is striking.

Gender Split:

The 40-50 crowd (Group A) is male-dominated (60% men, 40% women).

The 50-60 group (Group B) flips the script, with women taking the lead (71% female, 29% male).

Both groups are evenly split between Stage 1 and Stage 2, but slightly more patients fall into Stage 1 in both cases (~55-57%).

The younger group skews male, while the older group is mostly female.

Disease progression stays fairly balanced across both groups, with just a slight tilt toward earlier-stage cases.

VAS (at rest)	Pre test	Post test	Mean Difference	p value	t value
Group A Female	2.494±0.909	2.011±0.815	0.483	<0.0001	2.31
Group A Male	2.317±0.97	0.967±0.851	1.35	<0.0001	8.13
Group B Female	7.564±1.139	4.441±0.9595	3.123	<0.0001	17.33
Group B Female	7.238±1.267	1.708±0.669	5.53	<0.0001	31.96

TABLE 3: Pain assessment by visual analogue scale
VAS - Visual Analogue Scale; p-value - probability value

This table presents pain assessment using the Visual Analogue Scale (VAS) at rest, comparing pre-test and post-test values for different groups.

Key Findings:

Group A (40-50 years): Females: Pain slightly reduced from 2.49 to 2.01 (mean difference: 0.483).

Males: Pain dropped more significantly from 2.31 to 0.97 (mean difference: 1.35).

Group B (50-60 years): Females: Major pain reduction from 7.56 to 4.44 (mean difference: 3.123).

Males: Most dramatic drop from 7.23 to 1.70 (mean difference: 5.53).

Group B (older patients) started with more pain but showed greater relief post-treatment.

Men in both groups experienced a larger pain reduction compared to women.

Range of Motion	Pre -test	Post – test	Mean difference	p-value	t value
Flexors : Group A - Females	2.5 ± 1.159	3.441 ± 0.560	0.941	<0.0001	6.03
Group A - Males	2.470± 0.0506	2.823 ± 0.520	0.353	0.0061	5.57
Extensors: Group A - Females	2.647 ± 0.54	3.499 ± 0.564	0.852	<0.0001	9.00
Group A - Males	2.470 ± 0.506	2.794 ± 0.538	0.324	0.013	3.62
Flexors: Group B - Female	2.470 ±0.507	2.617 ± 0.493	0.147	0.2296	1.71
Group B - Males	2.617 ± 0.493	3.499 ± 0.507	0.882	<0.0001	10.31
Extensors: Group B - Female	2.617 ± 0.493	3.470 ± 0.506	0.853	<0.0001	9.95
Group B - Males	2.412 ± 0.499	2.705 ±0.523	0.293	0.0208	0.2352

TABLE 4:
Range of Motion

Flexibility Gains: A Range of Motion Breakdown

This table highlights how range of motion (ROM) improved across different groups after treatment. The numbers don't lie—some groups saw major flexibility gains, while others had only slight improvements.

Key Takeaways:Group A Women:

Flexors: show 2.5 to 3.44 (0.94 increase, $p < 0.0001$).

Extensors: Impressive boost from 2.65 to 3.49 (0.85 increase, $p < 0.0001$).

Group A Men:

Flexors: Modest rise from 2.47 to 2.82 (0.35 increase, $p = 0.0061$).

Extensors: Small but significant bump from 2.47 to 2.79 (0.32 increase, $p = 0.013$).

Group B Women:

Flexors: Almost no change (2.47 to 2.61, $p = 0.2296$).

Extensors: Strong improvement from 2.61 to 3.47 (0.85 increase, $p < 0.0001$).

Group B Men:

Flexors: Dramatic jump from 2.61 to 3.49 (0.88 increase, $p < 0.0001$).

Extensors: Minor increase from 2.41 to 2.70 (0.29 increase, $p = 0.0208$).

Women in Group A saw consistent and significant improvements in both flexors and extensors.Men in Group B had the best overall increase in flexor ROM, showing that the treatment worked exceptionally well for them.

Group B Women's flexors barely improved, suggesting they may need additional interventions.p-values confirm statistical significance for most groups, but some cases (like Group B Women's flexors) weren't as strong.

Bottom Line:

The treatment worked, especially for Group A women and Group B men! Some groups might need a different approach, but overall, mobility gains were real and measurable.

4. DISCUSSION

The study of effectiveness of continuous superficial heat therapy combined with low load long duration scapular exercises for adhesivecapsulitis in diabetic patient was conducted to see whether continuously providing of superficial heat with certain type of low load and long duration scapular exercises isworking for frozen shoulder or not in this study we use we have used diabetic people as the primary inclusioncriteria in which we have again segregated the age as 40 to 60 and segregated two groups that is group 1 will be women and group 2 will be made this study considered of about 87 of total people or total patients out of which almost 87 people were dealing with excessive pain and excessive restriction of movement also some people who are associated with frozen shoulder had extremely decreased pain and were associated with and some were associated with pain only on movement so this was further categorized and our physical therapy was provided to them in the physical therapy we provide that isthe explain the people about what the therapy is about and how it will benefit them from frozen shoulder with diabetes as we are considering a population that has frozen shoulder with diabetes and we know that diabetes is also associated with many complication so excessive use of medications here could again further lead to increase in the complications so we without using of excessive medicationsor excessive painkillers

We relied more on superficial heat which was given continuously throughout the treatment to the patient with low load. So here in the physical treatment we provided or the physiotherapy we provided post physiotherapy the results were there was as we were providing its superficial heat continuously throughout the protocol there was increase in vasodilation seen due to which the patient was reacting well to the certain restricted movements as the blood circulation there was increased the muscles got relaxed and there was significantly increase seen in the range of motion also along with increase inrange of motion due to low load long duration scapular exercises we were providing superficial heat which led to relaxation of the muscles.

So together the both. Combined together showed great results in frozen shoulder with primarily leading to decrease pain and increase range of motion also there were studies performed by May S. F. Leung in 2008 where he considered about 80-30% of people here he categorized them on different types of heatingwhere he used deepheating superficialheating and both type ofheating and he gave treatment for 3-4 times in a week. here he considered about 30 people for stiffness in frozen shoulder there alsohe saw that there was a significant improvement in all outcome groups except for shoulder range of motion..

There was significant improvement .Why range of motion also along with pain because we are giving superficial heat therapy in combination with low load long duration stretch. So we combined not only providing heat but we are also combining heat with scapular scapular exercises with low load. Hot moist packs have been found effective to manage pain in shoulder pain following stroke (26). Stretching maneuver are commonly used to enhance lengthening of muscles and soft tissues.

5. CONCLUSION

The 12-week treatment program delivered impressive results, significantly reducing pain and enhancing flexibility across different demographics. While all groups benefited, the most striking improvements were seen in older patients (50-60 years), particularly men, who experienced the greatest pain relief. This suggests that the program was especially effective

for those with higher initial discomfort.

When it comes to mobility, younger women and older men emerged as the biggest winners, showcasing the strongest flexibility gains. However, older women saw only marginal improvement in flexor range, signaling the need for additional or modified interventions to maximize their progress.In essence, the program proved its effectiveness, but the data underscores the importance of personalized treatment strategies. Fine-tuning approaches for specific subgroups could unlock even greater results, paving the way for more tailored rehabilitation solutions in the future

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