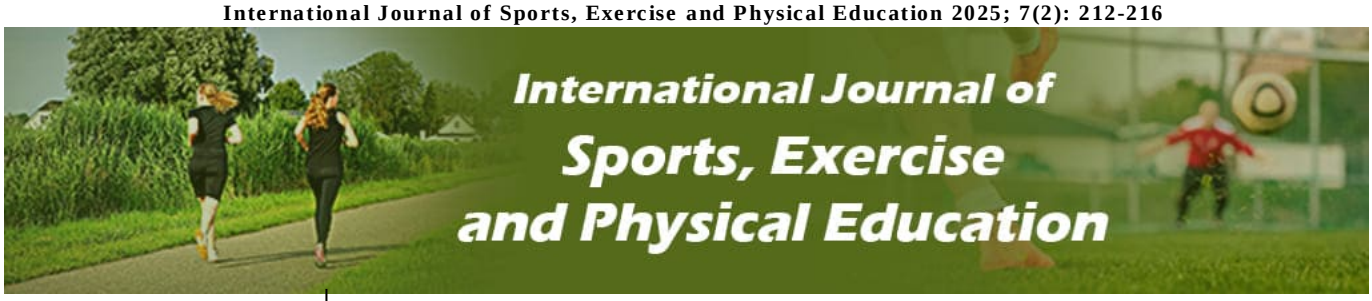

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The effect of spencer technique exercises along with ultrasound therapy and interferential therapy for adhesive capsulitis in diabetic population

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Abstract
Frozen shoulder, or adhesive capsulitis, is a painful and disabling condition characterized by stiffness and limited range of motion in the shoulder joint, commonly affecting individuals between 40 to 60 years of age and particularly prevalent among diabetic patients. The aim of this study was to compare the effectiveness of Spencer technique exercises combined with ultrasound therapy and interferential therapy (IFT) against the use of ultrasound and IFT alone in individuals with adhesive capsulitis in a diabetic population. A quasi-experimental design was used, involving 20 participants divided into two groups: Group A received Spencer technique with ultrasound and IFT, while Group B received only ultrasound and IFT. Both groups underwent treatment three times a week for three weeks. Outcome measures included shoulder flexion, abduction, and the Shoulder Pain and Disability Index, assessed pre- and post-treatment. Statistical analysis using the unpaired t-test showed significant improvements in Group A compared to Group B. The post-test p-values for shoulder flexion (0.000092), abduction (0.000074), and SPADI score (0.007507) were all below 0.05, indicating statistical significance. The findings suggest that the addition of Spencer technique to conventional modalities resulted in greater improvements in pain reduction, range of motion, and functional ability of the shoulder. In contrast, although Group B also showed improvement, the results were comparatively less significant. It was concluded that the Spencer technique, when combined with ultrasound and IFT, is more effective in managing adhesive capsulitis in diabetic individuals than conventional modalities alone.

Keywords: Interferential Therapy (IFT), Ultrasound Therapy (UST), spencer technique, spadi scale, range of motion

Introduction
Adhesive Capsulitis, or frozen shoulder, is a common musculoskeletal condition characterized by spontaneous shoulder pain and stiffness, leading to limited daily activity [1] It results from inflammation of the shoulder joint capsule and progresses through four clinical stages from early pain and mild ROM restriction to chronic stiffness and joint adhesion [1, 3] The condition affects 3-5% of the general population and up to 39% of individuals with diabetes or thyroid disorders, mostly in the 40-60 age group, with higher incidence in women, manual workers, and post-surgical patients [2] The pathology involves cytokine-mediated synovial inflammation, fibroblastic proliferation, and increased collagen formation, often affecting the coracohumeral ligament [4]. Though 20-50% of cases may become chronic, most resolve within 1-3 years [5]. Treatment aims to reduce pain and improve function, depending on the stage and severity [6]. Initial management is non-operative, typically for 4-6 months, involving medications (NSAIDs, steroids), physical therapy, and electrotherapeutic modalities like moist heat, ultrasound, and Interferential Therapy (IFT) [2, 7]. IFT, using medium-frequency currents to generate low-frequency stimulation, offers pain relief via nerve inhibition, endogenous opioid release, and improved circulation [1]. Ultrasound therapy helps break down dense collagen tissue, especially when applied at 1 MHz for deeper penetration [12, 13]. The Spencer Technique, a seven-step osteopathic method involving passive, rhythmic movements, is also used to restore ROM, stimulate circulation, and reduce stiffness [17, 22]. Functional outcomes are often assessed using the Shoulder Pain and Disability Index (SPADI), which evaluates both pain and functional limitations [16].

Materials and Methods

Study Design

A quasi-experimental study was conducted to assess the effectiveness of Spencer technique combined with Ultrasound Therapy (UST) and Interferential Therapy (IFT) in patients with Grade 2 adhesive capsulitis.

Study Setting

The study was carried out in the Department of Physiotherapy, Modern Hospital, Kodungallur Ltd (PIN: 680668).

Sampling Method

Purposive convenience sampling was used to recruit eligible participants.

Sample Size

A total of 20 participants diagnosed with Grade 2 adhesive capsulitis were selected and divided into two groups of 10 participants each:

- **Group 1:** Received Spencer technique exercises along with IFT and UST.
- **Group 2:** Received only IFT and UST.
  The intervention was carried out over a period of 3 weeks.

Study Duration

The overall study duration was 3 months.

Treatment Duration

Both groups underwent physiotherapy thrice a week for 3 weeks:

- **Group 1:** Received Spencer technique (2 sets of 10 repetitions, 1-minute rest between sets) for 20 minutes and electrotherapy (10 minutes UST + 10 minutes IFT) totaling 45 minutes per session.
- **Group 2:** Received only electrotherapy (10 minutes UST + 10 minutes IFT) totaling 20 minutes per session.

Selection Criteria

Inclusion Criteria

- Unilateral Grade 2 frozen shoulder
- Age: 30-60 years
- Both genders
- Diagnosed with diabetes mellitus
- Difficulty in overhead activities
- Night pain disrupting sleep and pain during movement
- Guarded and restricted shoulder movements (flexion, extension, abduction, adduction, internal/external rotation)
- Stooped posture and rounded shoulders
- Ability to complete questionnaires

Exclusion Criteria

- Polyarthritis, osteoporosis
- Recent infection/surgery (<6 months), trauma
- Shoulder arthroplasty, impingement syndrome, or recurrent dislocation
- Hemiplegic shoulder
- Hypertension
- Subscapularis flexibility deficits
- Cervical spondylosis or neuralgia

Procedure

After obtaining ethical approval, eligible participants were selected based on inclusion/exclusion criteria. All participants were informed of the study purpose and consented to participate. Pre- and post-treatment assessments included

- **Pain and function:** Measured using the Shoulder Pain and Disability Index (SPADI)
- **Range of motion (ROM):** Measured using a universal goniometer

Intervention

- **Group 1:** Spencer technique exercises plus UST and IFT for 45 minutes
- **Group 2:** UST and IFT only for 20 minutes
  Treatments were administered three times per week for 3 weeks.

Study Methodology (Flowchart Summary)

- Ethical clearance and participant recruitment
- **Initial Assessment:** ROM (Goniometer), Pain & Function (SPADI)
- **Group 1:** Spencer Technique + UST + IFT
- **Group 2:** UST + IFT
- **Post-intervention Assessment:** ROM and SPADI
- Data analysis and result interpretation

Variables

Independent Variables

- Spencer Technique
- Interferential Therapy
- Ultrasound Therapy

Dependent Variables

- Pain
- Range of Motion (ROM)
- Functional Activity

Outcome Measures

- **SPADI:** To assess shoulder pain and disability
- **Universal Goniometer:** To measure shoulder ROM (flexion and abduction)

Materials Used

- Ultrasound machine and gel
- Interferential Therapy machine
- Universal goniometer
- Inch tape
- Treatment couch, pillows, stool
- Cotton for cleaning/comfort

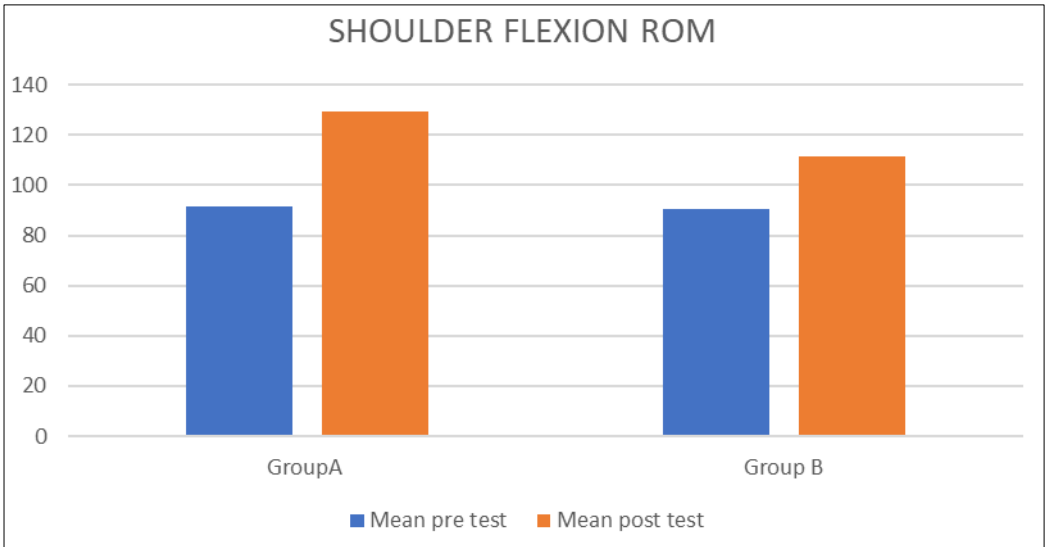
Measurement Tools

- **SPADI (Shoulder Pain and Disability Index):** For pain and functional assessment
- **Goniometer:** To measure shoulder flexion and abduction range of motion

Statistical Analysis

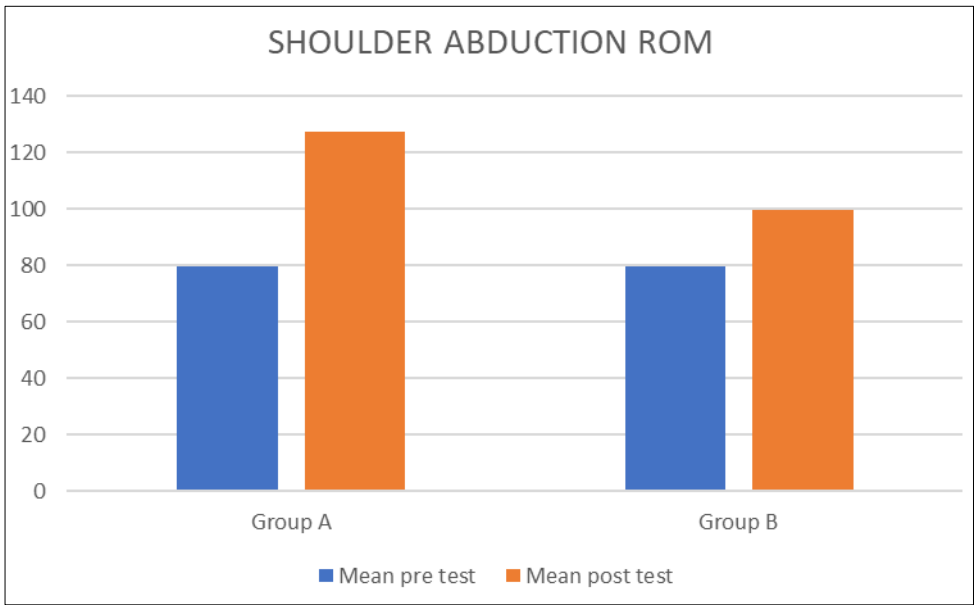
Pre-test and post-test values of the study were collected and assessed for variations in improvement and their results were analysed using independent t test and parried t test. The statically analysis of the study showed that there is a significant difference between the group in ROM and SPADI with a t value of ROM and SPADI was 1.833.

Results



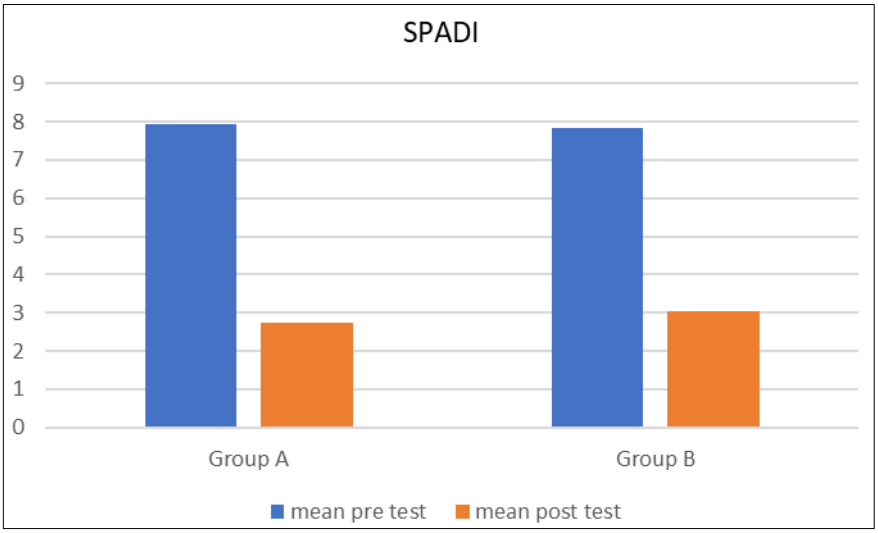
Graph 1: Comparison of shoulder flexion in Group A and B

Post-test values for Group A and Group B of Shoulder Flexion was analysed by unpaired 't' test. The mean value used for post-test Shoulder Flexion for Group A is 141.9 which is less than the mean value of the post-test Shoulder Flexion for Group B, the value being 111.6. The 'p' value obtained is 0.000092 which is <0.05. There is significant improvement in ROM between Group A and Group B patients where patients in Group A showed significant improvement in ROM



Graph 2: Comparison of shoulder abduction in Group A and B

Post-test values for Group A and Group B of Shoulder Abduction was analyzed by unpaired 't' test. The mean value calculated for post-test Shoulder Abduction for Group A is 127.5 which is less than the mean value of the post-test Shoulder Abduction for Group B, the value being 99.8. The 'p' value obtained is 0.000074 which is <0.05. There is significant improvement in ROM between Group A and Group B patients where patients in Group A showed significant improvement in ROM.



Graph 3: Comparison of SPADI in Group A and B

Post-test values for Group A and Group B of Shoulder Pain and Disability Index (SPADI) was analyzed by unpaired 't' test. The mean value used for post-test of Shoulder Pain and Disability Index (SPADI) for Group A is 2.75 which is less than the mean value of the post-test of Shoulder Pain and Disability Index (SPADI) for Group B, the value being 3.05. The 'p' value obtained is 0.007507 which is <0.05. There is significant improvement in Functional Activity and reduction in Pain between Group A and Group B patients where patients in Group A showed more significant improvement in Functional Activity and reduction in Pain.

Discussion

This study evaluated the effectiveness of the Spencer Technique combined with Interferential Therapy (IFT) and Ultrasound Therapy (UST) in improving shoulder range of motion (ROM), reducing pain, and enhancing functional activity in patients with frozen shoulder.

Group A, which received Spencer Technique alongside IFT and UST, showed more significant improvements compared to Group B, which received only IFT and UST. The results align with previous findings by Jivani RR *et al.* and Hingarajia DN *et al.*, who reported that the Spencer Technique effectively stretches the shoulder capsule and surrounding soft tissues, restores joint mobility, reduces pain, and improves lymphatic drainage. The technique also aids in resetting neural reflexes and repairing biomechanical alterations of the joint, as supported by Haveela B *et al.*, Dowle P *et al.*, and Chandrasekhar P *et al.*

In support of the electrotherapy component, Goats GC *et al.* suggested that IFT enhances peripheral circulation, activates muscles, and accelerates bone healing while reducing pain. Ekisha Gaba *et al.* and Mona Bhardwaj *et al.* further emphasized that IFT delivers medium-frequency currents with low skin resistance, leading to pain relief, improved blood flow, and reduction in edema particularly useful in addressing joint capsule adhesions and collagen cross-linking. Similarly, Zambito *et al.* found strong evidence of IFT's role in pain reduction, highlighting its therapeutic and placebo effects in frozen shoulder treatment.

Regarding ultrasound therapy, O'Brien *et al.*, Dogru *et al.*, and Ebadi *et al.* highlighted both thermal and non-thermal mechanisms, including molecular vibration-induced cavitation, microstreaming, and enhanced collagen extensibility. These effects help in breaking fibrotic adhesions, reducing pain, and improving mobility. Additionally, Hamed *et al.* and Bishop S *et al.* noted that UST raises the threshold for free nerve activation via heat in large myelinated fibers, supporting pain reduction through the gate control mechanism.

Overall, the combination of Spencer Technique with IFT and UST proved more effective than IFT and UST alone in improving pain, ROM, and shoulder function in patients with adhesive capsulitis.

Conclusion

This study concluded that the combination of Spencer Technique with Interferential Therapy (IFT) and Ultrasound Therapy resulted in a significantly greater improvement in shoulder pain, range of motion, and functional activity compared to IFT and Ultrasound Therapy alone. While both groups showed some level of improvement, Group A demonstrated more notable outcomes, supporting the alternative hypothesis. These findings highlight the added value of incorporating manual therapy like the Spencer Technique in conservative management of adhesive capsulitis. However, given the limited sample size and short treatment duration, further research with larger populations and longer follow-up is recommended to validate and generalize these results.

Declaration by Authors

Ethical Approval

Ethical approval was obtained from the institutional review board of Sri Ramakrishna institute of paramedical sciences. All respondents agreed to participate in the study and informed consent was obtained from all the subjects. The privacy of the participants information was maintained, and there was no disclosure of their names or any information that could identify them.

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Conflict of Interest: The authors declare no conflict of interest.

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