Original Article

Unveiling the Effectiveness of Spencer technique and Activity Oriented Exercise Approach in subjects with Diabetic Adhesive Capsulitis-An Experimental Study

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Abstract

Background: This study aims to assess the influence of the Spencer technique and Activity Oriented Exercise Approach in managing pain and functional ability in subject withType-2 diabetes Adhesive capsulitis. As diabetic patients have high incidence of being diagnosed with Adhesive Capsulitis, the need for a better treatment for the pain and other symptoms are required.

Methods: An experimental study design was conducted at Saveetha College of Physiotherapy that included female subjects aged 45 to 65 years with history of Type -2 diabetes, unilateral adhesive capsulitis, and shoulder pain and stiffness for over 4 months. Spencer group (n=22) treated with Spencer technique with active shoulder ROM exercises while the Activity Oriented Exercise Approach group (n=23) treated with individual tailored exercises of Activities of Daily living.

Results: The post-test values of SPADI score (p-value < 0.0001) and joint measurements - abduction, internal rotation and external rotation of shoulder (p-value <0.0001) was statistically improved in both groups but Activity Oriented Exercise Approach group showed a greater and significant improvement in the outcomes than the Spencer group.

Conclusion: From the results it was concluded that Activity Oriented Exercise Approach was effective in improving functional ability and range of motion in Type-2 diabetic adhesive capsulitis subjects. Future researches should be done with larger sample size and studies on absolute diagnostic test to identify the underlying mechanism of Adhesive Capsulitis.

Keywords: Capsular stiffness, function ability, shoulder stiffness, shoulder active range of motion, Type-2 diabetic adhesive capsulitis.

Introduction

Diabetic adhesive capsulitis, commonly known as frozen shoulder, is a prevalent and debilitating condition among individuals with diabetes mellitus. Characterized by progressive stiffness, pain, and restricted range of motion in the shoulder joint, this condition significantly impairs daily activities and quality of life. The aetiology of diabetic adhesive capsulitis is multi-factorial, with factors such as glycaemia control, systemic inflammation, and micro vascular complications contributing to its development and progression. It was estimated that between two to five percent of the general population worldwide tend to have adhesive capsulitis while women are significantly vulnerable in India.[1]

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Type-2 diabetes mellitus, a persistent metabolic condition identified by insulin resistance and compromised insulin secretion. The prolonged effects of high blood sugar levels leads to changes in structure and function of connective tissues, particularly the capsule surrounding the shoulder joint which includes collagen changes, inflammation changes, glycosylation and potentially altered blood flow to the joint.[2,3,4] In majority of cases, there is a notable reduction in joint range both actively and passively. The fibrotic changes of the capsule cause limitation of the joint range of motions causing a characteristic functional disability. The pattern of movement loss in adhesive capsulitis patients was generally external rotation, abduction, and internal rotation.[5,6] An effective magnetic resonance indicator (MR) criterion for adhesive capsulitis diagnosis is joint capsule and synovium thickness larger than 4 mm. Recent studies on diagnosis through ultrasonography has been carried out which shows findings of adhesive capsulitis that include thickening of the shoulder pulleys and axillary pouch and decreased sliding of the infraspinatus tendon.[7]

The typical approach for management of diabetic mellitus involves lifestyle adjustments, adopting nutritious diet plan and engaging in routine physical activity.[3] Current treatment modalities for diabetic adhesive capsulitis include pharmacological interventions, physical therapy, and surgical options.[8,9,10] While corticosteroid injections and surgical procedures have demonstrated effectiveness in certain cases, there is a growing interest in exploring non-invasive and conservative treatment approaches.[11] Among these, the Spencer Technique and activity-oriented exercise approaches have emerged as potential therapies.[12,13]

The Spencer Technique, a form of manual therapy focuses on specific mobilization techniques aimed at improving shoulder joint mobility and reducing pain.[14] Although the technique has gained traction in the management of various shoulder disorders, its effectiveness in diabetic adhesive capsulitis remains underexplored. On the other hand, activity-oriented exercise approaches emphasize functional rehabilitation through targeted exercises designed to restore range of motion and strength. These approaches are grounded in the principles of progressive loading and functional integration, and they have shown promise in managing shoulder conditions; however, their efficacy in diabetic adhesive capsulitis requires further validation.

This experimental study seeks to address the gap in the literature by directly comparing the effectiveness of the Spencer Technique and activity-oriented exercise approaches in managing diabetic adhesive capsulitis. By evaluating their impacts on pain relief, range of motion, and overall functional improvement, we aim to provide evidence-based recommendations for clinicians and enhance the therapeutic options available for individuals suffering from this challenging condition.

Our study will contribute to the growing body of knowledge on non-pharmacological treatments for diabetic adhesive capsulitis and inform clinical practice by identifying effective, evidence-based strategies for managing this condition.

Materials and Methods

This was a Randomized clinical study conducted in Physiotherapy Out-patient department of Saveetha Medical College and Hospital. The study was approved and were conducted in accordance with the Institutional Scientific Review Board of the Saveetha College of Physiotherapy with ISRB No.01/009/ISRB/PGSR/SCPT. Informed consent was obtained from all the subjects on explanation about the treatment program, duration of the treatment, expected outcomes, privacy policies, their rights, confidentiality and safety policy. Using G-power calculator the included sample size was forty-five. It was calculated with effect size of 0.5 and 25% size inflation considering drop outs rates.

Female subjects with a long-standing history of Type 2 diabetes, with unilateral adhesive capsulitis within age group 45 to 65 years, Type-2 diabetic history (Fasting sugar level-80 to 130 mg/dl, Postprandial sugar level- <180 mg/dl), pain and stiffness of shoulder for more than 4 months were included. Recent upper limb fractures/ dislocations,

recent history of shoulder joint surgery, metabolic conditions, recent history of trauma or injury around shoulder joint, rotator cuff rupture, were excluded.

Subjects were recruited from Physiotherapy Out-patient department of Saveetha Medical College and Hospital, Thandalam by simple random sampling. Study team consisted of one principal investigator, secondary investigator and two intervention administrators.

A total number of 60 subjects were selected for the study, considering 25% possibility of drop outs. Based on the selection criteria a total of 45 subjects and were randomly allocated into two groups through closed envelope method by the principal investigator. Two intervention administrators were allocated to both the groups for blinding and to prevent treatment bias. The secondary investigator recorded the baseline characteristics, pre and post-test measurements of both groups.

Spencer group (n=22) were treated with Spencer technique along with active shoulder range of motion exercises, while Activity Oriented Exercise Approach (AOEA)group (n=23) treated with exercises tailored on Activities of daily living (ADL) exercises. The postprandial blood sugar test measured indicated the diabetic baseline of the subjects (less than 140 mg/dl as normal, 140-199 mg/dl indicated pre-diabetes status and 200 mg/dl or higher indicated diabetes. The subjects with 200 mg/dl or higher sugar level only were included.

Outcome Measures

1. SPADI scale (Shoulder Pain and Disability Index) has 13 items, with 5 items for pain and 8 items for disability. It is a useful tool for evaluating adhesive capsulitis because it measures both pain and functional limitations in the shoulder. This is important for adhesive capsulitis, as pain and reduced shoulder function are major symptoms.[15]Pre and post test scores of SPADI score was compared.
2. Goniometric measurements are used to assess the range of motion (ROM) in the shoulder joint, which is essential for monitoring adhesive capsulitis. This condition often causes stiffness and reduced mobility due to thickening and inflammation of the joint capsule. Goniometry provides precise measurements of movement limitations in various directions.[11]

Spencer Technique Group: (ST group)

Subjects received Spencer seven stages of mobilization technique with Active range of motion exercises.[12]

STEP 1: With the subject in side-lying, the therapist stabilized the shoulder girdle and supported the wrist and forearm with elbow in flexion and performed passive, rhythmic shoulder extension movement.

STEP 2: With the subject in side-lying, the therapist stabilized the shoulder girdle, with elbow extended, performed passive shoulder forward flexion movement.

STEP 3: With the subject in side-lying, the therapist stabilized the shoulder girdle with one arm, elbow flexed and with other arm performed passive adduction and internal rotation movements.

STEP 4: Subject in side-lying position, therapist stabilized the shoulder girdle with one arm; elbow flexed and with other arm performed passive abduction and external rotation movements.

STEP 5: Subject in side-lying position, therapist stabilized the shoulder girdle with one arm; elbow flexed and with other arm performed passive shoulder circumduction with maintained compression force over joint.

STEP 6: Subject in side-lying position, therapist stabilized the shoulder girdle with one arm; elbow extended and with other arm performed passive shoulder circumduction with maintained distraction force over joint.

STEP 7: Subject in side-lying position, therapist stabilized the shoulder girdle with one arm, elbow 20°-30° flexed and with other arm performed passive shoulder internal rotation.

The sequences were performed 8-10 repetitions along with active shoulder movements (each exercise 10 repetitions) with 5 sessions/ week for 8 weeks.

Figure 1: STEP 1 of spencer technique (mobilisation of shoulder extension movement)

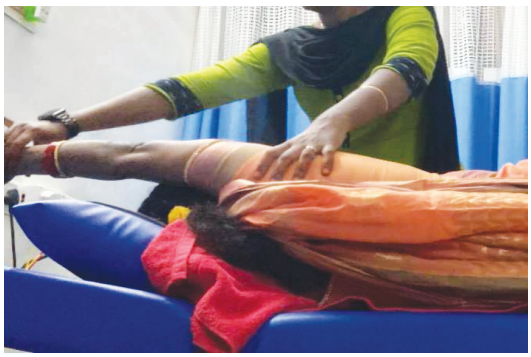

Figure 2: STEP 2 of spencer technique (mobilisation shoulder forward flexion movement)

Figure 3: STEP 3 of spencer technique (mobilisation performed passive adduction and internal rotation movements)

Figure 4: STEP 5 of spencer technique (shoulder circumduction with maintained compression)

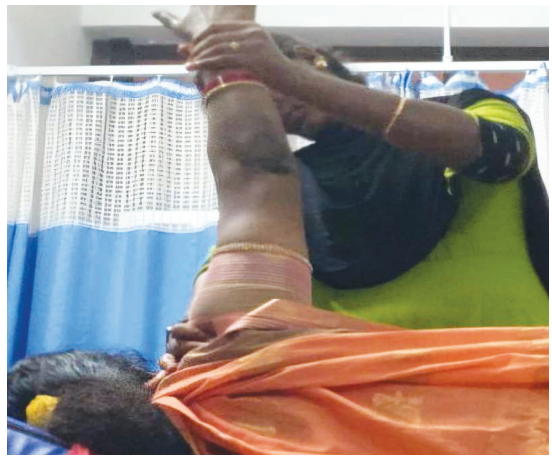

Figure 5: STEP 6 of spencer technique (circumduction with maintained distraction force over joint)

Activity Oriented Exercise Approach Group: (AOEA group)

Subjects were initially treated with hot pack (hot water bag) application 7 to 10 minutes twice a day. They were then instructed to perform ADL exercises 13 as follows-wearing shirt/jacket, bed rolling activities, combing hair, plating hair, putting on T-shirt, wearing pin on saree, taking object from upper shelf and shoulder active range of motion exercises – repetitions of 10 times each exercise - twice a day daily for eight weeks after which the post-test outcome measure values were recorded and analysed for results.

Table 1. Aoea Group-Pre & Post Intervention Values (Paired T-Test)

Outcome Measure	Pre-Intervention	Post-Intevention	95% Of Ci	P-Value
	Mean (Sd)	Mean (Sd)		
SPADI SCORE	55.46 ± 6.61	21.48 ± 3.09	31.160 to 36.794	<0.0001
SHOULDER-ABDUCTION	84.54 ± 7.93	132.77 ± 8.39	–52.80 to –43.66	<0.0001
SHOULDER-EXTERNAL ROTATION	21.45 ± 4.079	64.27 ± 7.55	–46.50 to –39.13	<0.0001
SHOULDER-INTERNAL ROTATION	36.36 ±8.69	70.95 ± 8.0206	–39.83 to –29.35	<0.0001

Table 2. Spencer Group-Pre & Post Intervention Values (Paired T-Test)

Outcome Measure	Pre-Intervention	Post-Intevention	95% Of Ci	P-Value
	Mean (Sd)	Mean (Sd)		
SPADI SCORE	56.50 ± 6.78	33.27 ± 7.69	20.65 to 25.82	<0.0001
SHOULDER-ABDUCTION	84.04 ± 8.12	107.65 ± 8.64	–26.51 to –20.71	<0.0001
SHOULDER-EXTERNAL ROTATION	21.87 ± 5.22	40.48 ± 8.29	–20.98 to –16.24	<0.0001
SHOULDER-INTERNAL ROTATION	35.61 ± 9.44	52.65 ± 7.17	–21.97 to –12.12	<0.0001

Table 3. Post Test Comapison Between The Groups

Outcome Measure	Aoea Group	St Group	P-Value
	Mean (Sd)	Mean (Sd)	
SPADI SCORE	21.48 ± 3.09	33.27 ± 7.69	<0.0001
SHOULDER-ABDUCTION	132.77 ± 8.39	107.65 ± 8.64	<0.0001
SHOULDER-EXTERNAL ROTATION	64.27 ± 7.55	40.48 ± 8.29	<0.0001
SHOULDER-INTERNAL ROTATION	70.95 ± 8.0206	52.65 ± 7.17	<0.0001

Results

Total numbers of subjects were 45 of mean age group (56.84 ± 6.20) and with a diabetic history of mean years (7.8 ± 3.615) and mean BMI of (28.03 ± 2.358). The mean blood sugar level postprandial was (282.84 ± 40.93). Thorough statistical analysis, involved paired tests for pre and post-test values, demonstrated a notable enhancement in SPADI scores and goniometric measurements (abduction, internal rotation, and external rotation) after applying the AOEA. The study highlighted the promising potential of the AEOA as a valuable intervention for managing this complex condition, paving the way for additional investigations and practical applications. The subjects were highly interested in performing

exercises that is part of their Daily living in the AEOA group. The results strongly implied that AOEA in improving functional ability and joint range in subjects with diabetic adhesive capsulitis was more effective.

Discussion

Adhesive capsulitis is a progressive condition that has various treatment options for management. Literature have proved the efficacy of treatment options like Codman's exercise protocol, electrotherapy, acupuncture therapy, corticosteroid injections, and mobilization techniques, stretching and strengthening exercises, open and closed chain exercise protocols for adhesive capsulitis [8,9,10.]

Physical therapy has been proven to reduce pain by improving shoulder joint range in subjects with adhesive capsulitis. There were also other medical management options like oral cortisone therapy, joint glucocorticoids injection therapy, and anti-inflammatory drug.[5]

Chao Yang, TaoTao Lv et al., explained in detail about the studies done on acupuncture therapy effect on adhesive capsulitis. Acupuncture is an ancient therapy method working on specific acupuncture points for specific regions. There were clinical studies proving the applicability and efficacy of acupuncture needle application and its best outcome results from the treatment.[16]

Oliva et al., explained that the micro-structural organization of collagen fibres is altered by advanced glycation end-products through non-enzymatic oxidative interactions between glucose and collagen may be the cause of an increase in connective tissue stiffness in diabetes mellitus[17]. Studies suggest that subjects with adhesive capsulitis had higher rates of incidence of trigger fingers, carpel tunnel syndrome, Dupuytren's disease, reduced joint mobility and other joint problems which could be associated with their age, duration of diabetes.[11] Spencer's approach facilitates pain-free movement and enhances joint mobility by altering the circulatory pain indicators and also lymphatic movement, improved by releasing the capsule and constricting soft tissues around the shoulder joint. The technique resets the neural reflexes and the joint range restored. Greater auxiliary movement—like gliding—allows the Osteo-kinematic glenohumeral rotation return to normal biomechanics of the shoulder joint.[14]

Activity based designing of exercises makes the subject being more interested in performing the exercises and thereby facilitating mobility and their occupational or ADL related movement improvement.

Limitations and Recommendations

This study included only female subjects which may depict gender bias, follow ups was not being followed and addressed. Future studies can be carried out with larger sample size, with a long duration of treatment period with frequent review assessments. Further follow ups sessions can also be carried out according to need for the study.

Conclusion

Therefore, according to the findings of the present study it was concluded that Activity Oriented Exercise Approach leads to significant improvement in pain and functional ability in subjects with Type-2 diabetic adhesive capsulitis. This study contributes to understanding the potential benefits of the Spencer technique and AOEA in managing adhesive capsulitis in individuals with Type 2 diabetes, providing valuable insights into effective physiotherapeutic interventions for this challenging condition.

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