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Effect of rotator cuff strengthening as an adjunct to standard care in subjects with adhesive capsulitis: A randomized controlled trial

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ABSTRACT

Study Design: Randomized controlled trial.*Purpose of the Study:* To study the effect of adding rotator cuff (RC) muscles strengthening to joint mobilization and transcutaneous electrical nerve stimulation (TENS) in patients with adhesive capsulitis. *Methods:* A prospective, parallel-group, randomised clinical trial was conducted on 42 patients. One group received TENS and joint mobilization and in the other group RC muscles strengthening was added. Treatment was given for 12 sessions within 4 weeks.*Results:* When compared between the groups statistically significant changes were seen in all the outcome measures in the group that received RC muscle strengthening exercises vs TENS and mobilization. VAS 12.76 ± 1.04 vs 4.05 ± 1.32 ; SPADI 34.66 ± 6.69 vs 54.29 ± 12.17 ; PFPS 3.06 ± 0.80 vs 4.70 ± 0.81 ; and ROM (elevation >125 vs >110 degrees and rotations >70 vs >48 degrees).*Conclusions:* Addition of a structured RC strengthening program to TENS and joint mobilization in the treatment of adhesive capsulitis resulted in improvement in pain, ROM and function.*Level of Evidence:* 1b.

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Introduction

Adhesive capsulitis is a condition characterized by functional restriction of both active and passive shoulder motion for which radiographs of the glenohumeral (GH) joint are unremarkable except for the possible presence of osteopenia or calcific tendinitis.^{1,2} Despite extensive research, the etiology of adhesive capsulitis is not completely explained, possibly involving a nonspecific chronic inflammatory reaction of subsynovial tissue and resulting in capsular and synovial thickening affecting the function of the GH joint. Onset of adhesive capsulitis is usually gradual and idiopathic, but it may also be acute and associated with a history of minor injury to the shoulder joint.^{3–6} Adhesive capsulitis is seen most commonly in patients with diabetes mellitus (27%), previous myocardial infarction (5%), immobilization (5%), stroke, and sedentary workers (4% each) with age of the subjects ranging from 25–70 years and duration of symptoms average of 3.66 ± 2.36 months. It is also found that left shoulder is more commonly involved (54%) and 2% has bilateral involvement.⁷

Adhesive capsulitis is divided into 3 stages: the painful stage, the stiffening stage, and the thawing stage.^{8,9} In the painful stage, gradual onset of shoulder pain lasts from weeks to months. Pain, which can be severe, may cause pronounced sleep disturbance.¹⁰ The stiffening stage is characterized by progressive loss of active and passive ranges of motion (ROMs) that may last up to 1 year.¹¹ Most patients lose ROM in GH external rotation, abduction, and internal rotation during this stage, considered as the “capsular pattern.” The final, thawing phase is characterized by the gradual recovery of ROM.¹⁰

Shoulder joint being the most mobile joint of the body, articular surface movements of the shoulder rely on the coordinated control of the surrounding muscles. Any impaired muscular performance may influence shoulder movements and then contribute to joint dysfunction. Therefore, the frequently observed pain-induced muscle spasm and muscle weakness around the affected shoulder may also cause pain and restricted movements in individuals with adhesive capsulitis.¹⁰ The supraspinatus, infraspinatus, teres minor, and subscapularis muscles compose the rotator musculotendinous cuff. These muscles are considered to be part of a “cuff” because the inserting tendons of each muscle of the cuff blend with and reinforce the GH capsule. More importantly, all have action lines that significantly contribute to the dynamic stabilization of the GH joint.^{9–11} Adhesive capsulitis may be related to rotator cuff tendinitis and rotator cuff repair is indicated if symptoms do not improve with extensive shoulder rehabilitation.¹²

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According to Sahrman, impairment in the strength of rotator cuff muscles in adhesive capsulitis is commonly seen which should be identified to optimize the proper biomechanics of the shoulder in the treatment of adhesive capsulitis. Emphasis should also be given to rotator cuff strengthening in secondary adhesive capsulitis which may be due to rotator cuff weakness following any injury to the shoulder or rotator cuff tear.^{13,14}

Physical therapy interventions used in patients with frozen shoulder frequently include modalities, manual techniques, and therapeutic exercise. Exercises given in the treatment of adhesive capsulitis consists of active ROM, Codman's exercise, wall walks, shoulder wheel, pulley, active and passive stretching, and rotator cuff and scapular strengthening.^{1,4,6,8,15–30}

Strengthening exercises for rotator cuff and scapular stabilizers is recommended in the treatment of adhesive capsulitis.²⁶ Iso-kinetic strength of the internal and external rotators of the shoulder joint is affected in adhesive capsulitis and the need to incorporate its strengthening is emphasized.¹⁰ Scapular stabilizer exercises were given in one study,⁸ and in another study, 4 weeks of rehabilitation was given, but no details about the type of exercises given were elucidated.²⁸ At the time of design of this study, no other study could be retrieved that studied the effect of adding rotator cuff muscle strengthening to mobilization and pain management in the treatment of adhesive capsulitis. Hence, there was a need to study the effect of rotator cuff strengthening in patients with adhesive capsulitis and compare it with the usual care given which consists of mobilization and electrical modalities for pain management. We hypothesized that rotator cuff muscle strength training in adhesive capsulitis will help to improve the function of the shoulder joint by improving the ROM and restoring joint function. The specific aims were to find out the effects of strength training program of rotator cuff in adhesive capsulitis on pain, ROM, and functional outcome and to compare these results with the group receiving electrical modalities and mobilization only. Secondary aim was also to compare the strength of rotator cuff muscles between the 2 groups.

Method

Design

A prospective, parallel-group, randomized clinical trial was conducted, with concealed allocation, intention-to-treat analysis, and blinded outcome assessors. People with adhesive capsulitis referred for physiotherapy were recruited from the outpatient and inpatient departments of Kasturba Medical College, Hospitals, Mangalore. The method of generating random sequence was permuted block randomization and concealment was by sequentially numbered, sealed, opaque envelopes which were done by the second author. Following baseline measurement, participants were randomly allocated via block randomization into 2 groups; one group received transcutaneous electrical nerve stimulation (TENS) and mobilization, whereas the other group received strengthening of the rotator cuff muscles in addition to the treatment given to the first group. Participants were measured at baseline and after 4 weeks of intervention (week 4). Qualified assessors who were blinded to group allocation conducted the measurements at baseline and week 4.

Participants and therapists

Patients were included if they had 1–3 month of onset of pain and stiffness, restriction of ROM in external rotation, abduction, and flexion less than 50% in comparison to the other shoulder, pain during sleep, difficulty with grooming, dressing activities, and

reaching activities— to the shoulder level, behind the back, and overhead. Exclusion criteria was osteoarthritis or signs of bony damage due to trauma on the radiographs of the affected shoulder, hypermobility and instability, neurological disorder causing muscle weakness in the shoulder, any local (inflammation or infection) or systemic (cerebrovascular accident or myocardial infarction) disease, upper limb nerve tension testing reproduces the reported symptoms and shoulder pain can be increased or decreased with altering nerve tension positions or shoulder pain is reproduced with palpatory provocation of the relevant peripheral nerve entrapment site.

The intervention was given by a postgraduate student (henceforth mentioned as therapist) under the guidance of an experienced therapist with doctorate qualification and experience of more than 15 years in musculoskeletal physiotherapy.

Intervention

All participants underwent 4 weeks of rehabilitation. It consisted of 3 sessions per week for 4 weeks (total of 12 sessions). Rehabilitation was aimed at increasing ROM, decreasing pain, and improving the functional outcome. Pendular and free ROM and stretching exercises for the shoulder were taught as home program.

The difference between the experimental group and control group was the addition of strengthening exercises to the rotator cuff to the experimental group. Both the groups received GH joint mobilizations (GH caudal glide to increase abduction, GH posterior glide to increase flexion and to increase internal rotation, and GH anterior glide to increase external rotation). To increase scapular motions of elevation, depression, protraction, retraction, and rotation, scapular mobilization was given (10–15 repetition of intensive mobilizations were given for all the techniques). The detailed methodology of mobilizations is given in [Appendix 1](#). The electrotherapy modality used was TENS (ACU TENS-4). Two pairs of rubber electrodes were placed over the shoulder, electrode was sited over the place where the most intense pain was felt or the greatest tenderness was elicited and the tissue was separated from the electrodes with the help of conducting jell. Stimulation duration was set at 15 minutes at a frequency of 150. The intensity of the current was set at a comfortable level as determined by the subjects and it ranged from 25 to 35 mA. During stimulation subject experienced paresthesia and mild twitches, the current was turned up if the subjects accommodated to the current 5 minutes into the stimulation.

Strengthening exercises to the rotator cuff muscles were given to the experimental group. Strengthening exercises included isometric and isotonic exercise using a pragmatic approach. When the pain did not allow isotonic strengthening exercise, pendular and isometric exercises to the rotator cuff muscles were given. The “shoulder sling” exercise was used to help retrain the initial setting phase of the rotator cuff when initiating abduction. The shoulder sling exercise for a “rotator cuff set” is considered analogous to a “quad set” exercise in the lower extremity.²⁸ Later, as per the tolerance of the patient within pain limits, strengthening exercises were started with red Theraband and 1- to 2-kg dumbbells. About 8–12 repetitions for 3 sets were given in each session for total of 12 sessions (thrice a week). All the exercises were performed under the supervision of the treating therapist. The details of the exercises are given in [Appendix 2](#). The intervention was monitored to ensure safety and adverse events.

Outcome measures

The primary outcomes were impairments (pain, shoulder ROM, and functional disability). Secondary outcomes were impairment

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