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EFFECT OF THERAPEUTIC ULTRASOUND WITH END RANGE MOBILIZATION VS CRYOTHERAPY WITH STRETCHING IN IMPROVING ACTIVE RANGE OF MOTION IN PATIENTS WITH ADHESIVE CAPSULITIS OF SHOULDER – A RANDOMIZED CLINICAL TRIAL

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ABSTRACT

Background: Effectiveness of any individualized therapeutic modality in improving the range of motion of shoulder in adhesive capsulitis is questionable and the combination of therapies has contradictory results. **Objectives:** The purpose of this study was to check the effectiveness between the treatment modalities of Ultrasound and End range mobilization over Cryotherapy and Stretching as a treatment program in improvement of active range of motion in patients with adhesive capsulitis of shoulder. **Methods:** Forty subjects diagnosed to have adhesive capsulitis were randomly assigned to two groups. Subjects in Group I received Ultrasound and End range mobilization of shoulder while subjects in Group II got Cryotherapy and Stretching of shoulder. Both the groups were treated for 6 days a week for 4 weeks. ROM's of shoulder in abduction and external rotation were the outcome measures considered. **Results:** Statistical analysis was done considering $p<0.05$ as statistically significant and the't' values were estimated. It was found that ultrasound when combined with end range mobilization had a value of 3.4498 in comparison to 1.7773 of cryotherapy combined with stretching group. **Conclusion:** Ultrasound with end range mobilization produced a better result than cryotherapy with stretching and therefore can be recommended in the treatment of second stage adhesive capsulitis of shoulder.

Key words: Adhesive capsulitis, ultrasound, end range mobilization, cryotherapy, stretching, abduction, external rotation.

INTRODUCTION

Adhesive capsulitis has been described as a condition of "unknown etiology characterized by gradually progressive, painful restriction of all joint motion with spontaneous restoration of partial or complete motion over months to years"[1]. Its clinical course is divided into stages of freezing, lasting from onset to between 10 and 36 weeks, characterized by severe pain and a gradual diminution of articular volume, frozen stage lasting between 4 and 12 months when pain decreases gradually but without appreciable improvement in motion and thawing stage which is marked by gradual return of motion and may last between 12 months to few years [2].

Ultrasound therapy (UST), one of the modalities used to treat adhesive capsulitis elevates tissue temperature to depths of more than 5 cm causing increased collagen tissue extensibility, pain threshold, and enzymatic activity. It also changes nerve

conduction velocity, contractile activity of the skeletal muscle.[3] Cryotherapy is another important modality which controls pain by directly and rapidly modifying the sensation of pain and controlling the pain transmission with the activity of cutaneous thermal reception [4]

Mobilization techniques applied close to the articular surface in ventral, dorsal and inferior directions of the gleno-humeral joint are frequently used by physical therapists as an intervention for limited joint range of motion.[5] Passive stretching is a therapeutic maneuver designed to lengthen pathologically shortened soft tissue by using an external force, applied either manually or mechanically for about 30 seconds and thereby facilitate increase in range of motion.[6]

There are various studies supporting the individual effects of ultrasound, mobilization, cryotherapy and capsular stretching in patients with adhesive capsulitis. However, combination of modalities has been less explored. This study attempts to find out the combined effect of Ultrasound therapy (UST) and End range mobilization (ERM) over cryotherapy and capsular stretching in improvement of active range of motion in patients with adhesive capsulitis of shoulder.

METHODOLOGY

Forty patients of either gender aged between 30 to 60 years and diagnosed to have Stage II adhesive capsulitis (Frozen stage and a SPADI rating between 5 -6) since 2 months were randomized to two groups of 20 using block randomization after an initial screening for inclusion and exclusion criteria. Participants in group I underwent UST along with ERM and those in group II were given cryotherapy with capsular stretching as treatment strategies. Study was conducted at Goutham Physiotherapy & Rehabilitation Centre and Employee State Insurance (ESI) Hospital, Rajajinagar, Bangalore during the year 2006.

All the participants in the study signed an informed consent form and the variables were recorded prior and after 4 weeks of intervention. Abduction and external rotation range of motion of shoulder in supine lying position using a universal goniometer and pain & disability rating using SPADI were recorded pre and post treatment. Participants known to have uncontrolled diabetes mellitus, orthopedic abnormalities around the shoulder and neuromuscular disorders have been excluded.

Procedure:

Participants of group I were given pulsed ultrasound in sitting with a pulse ratio of 1:4 and an intensity of 1.5 W/cm^2 for 10 minutes following all the standard protocols. After UST a brief warm up followed by end range mobilization (ERM) in loose pack position of the joint with participant in supine lying for a period of 20 minutes was given. The direction of mobilization was altered by varying the degree of rotation. Maitland mobilization grade 3–4 was administered for 2 minutes interspersed with a rest period of 30 seconds for 10-15 repetitions once a day, 6 days a week for 4 weeks [7].

Participants of group II were given cryotherapy using ice packs in the anterior, superior and posterior aspect of the shoulder for a period of 10 minutes followed by a brief warm up to shoulder joint. Capsular stretching and general stretching exercises of the shoulder for 20 minutes followed cryotherapy and this was

administered once a day, 6 days a week for 4 weeks.

DATA ANALYSIS

Data was analyzed using SPSS package version 10 for statistical measures. Independent't' test was administered and a P value <0.05 was considered statistically significant for this study. Pre and post test measures between groups were analyzed using acquired't' parameter and dependent 't' test was performed to analyze the efficacy of treatment within the groups. The mean differences of shoulder abduction and external rotation of both groups were compared and the actual pattern of variation in both the categories was observed.

RESULTS

In this study, the authors found a significant difference between the two groups to infer the effectiveness of UST and ERM over Cryotherapy and stretching in the treatment of patients with adhesive capsulitis of shoulder. Forty participants with a mean age of 53.7 years and diagnosed with adhesive capsulitis of shoulder were enrolled for the study. Participants in group I (15 men & 5 women) had a mean age of 53.8 ± 3.9 and those in group II (15 men & 5 women) were of 53.6 ± 4.8 years.

Data was analyzed for the homogeneity between groups amongst the variables of Shoulder Abduction ROM (SAB ROM) and Shoulder External Rotation ROM (SER ROM) using an independent't' test. Analysis at p <0.05 revealed 't' values of 0.239 & 0.4636 for SAB ROM and SER ROM respectively which are not statistically significant (1.697) showing no difference between the groups for the said parameters.

Table 1 shows the pre-post analyses of SAB ROM and SER ROM within the groups using a dependent't' test. Analysis showed statistically significant difference in the pre-post values in both groups and the difference within groups with p <0.05 was found to be more in UST + ERM group.

Table 2 shows the comparison of SAB & SER ROM values pre and post therapy between the two groups at p<0.05. Analysis shows a statistically significant difference between the pre – post values of the two groups both in SAB & SER.

Table 1: Pre & post comparison of SAB and SER ROM within groups

Description	SHOULDER ABDUCTION						SHOULDER EXTERNAL ROTATION					
	Group I (n=20)			Group II (n=20)			Group I (n=20)			Group II (n=20)		
	Pre	Post	't'	Pre	Post	't'	Pre	Post	't'	Pre	Post	't'
Mean	79.5	130.9		80.0	118.4		25.9	40.1		26.8	38.5	
SD	6.11	9.29		8.4	13.45		5.98	4.08		6.4	5.12	
Difference (D)	-51.45		28.5*	-38.4		14.5*	-14.2		14.2*	-11.65		15.2*
d^2	2708.7			1606.9			219.05			146.9		

*p < 0.05

** 't' value as per the standard table is 1.729

Table 2: Pre & post comparison of SAB and SER ROM between groups

Description	SHOULDER ABDUCTION					SHOULDER EXTERNAL ROTATION				
	Group I (n=20)		Group II (n=20)		't'	Group I (n=20)		Group II (n=20)		't'
	Pre	Post	Pre	Post		Pre	Post	Pre	Post	
Mean	79.5	130.9	80.0	118.4	3.44*	25.9	40.1	26.8	38.5	1.77*
SD	6.11	9.29	8.4	13.45		5.98	4.08	6.4	5.12	
Difference (X)	51.45		38.4			13.9		11.65		

*p < 0.05

** 't' value as per the standard table is 1.697

DISCUSSION

This study done to investigate the effectiveness of Ultrasound therapy (UST) combined with End range mobilization (ERM) over Cryotherapy and capsule stretching showed an improvement in the parameters of Shoulder Abduction (SAB) ROM and Shoulder External Rotation (SER) ROM in patients with adhesive capsulitis of Shoulder.

Literature states that adhesive capsulitis affects the joint which reduces the mobility as well as flexibility of the individual and the symptoms of develop over 6 months, may last 2 years, and then gradually disappear ("selflimiting character").[8,9,10] Sometimes, there may be long lasting pain and restricted motion.[3] Reeves [2] described the natural history of adhesive capsulitis and found a mean duration of the disease of 30 months (range 12–42). As our patients' symptoms were present for at least 2 months, there is an indication that the changes seen after 2 months of treatment with EMTs could be attributed to the mobilization techniques rather than to the natural history of adhesive capsulitis. Vermeulen HM et al[7] also opined that end range mobilization (Maitland "Grade 3-4") plays a major role to get optimum movement of shoulder in conditions associated with adhesive capsulitis.

The intention of giving EMTs in our patients was to stretch contracted peri articular structures as the authors believe that the exact time span for developing capsular contracture with adhesions is not known. End-range mobilization techniques can only be performed without causing too much pain if the inflammatory (first) phase has disappeared. The techniques authors used were mostly performed at the end of the ROM with a moderate, sometimes painful, intensity. In comparison to the observations made by other authors, [9,11-14] we saw no adverse effects on the recovery of patients with adhesive capsulitis treated with such mobilization technique. However the data should be interpreted with caution as there was no control group or measurements of the opposite shoulder for comparison.

Robertson VJ et al[15] reported the usage of ultrasound therapy (UST) clinically in rehabilitation of patients with adhesive capsulitis. According to him, active therapeutic ultrasound is used for treating people with pain and musculoskeletal injuries to promote soft tissue healing. Both thermal and non-thermal effects of UST are proven beneficial in reducing inflammation and improve tissue extensibility, pain

threshold, and enzymatic activity. The increased pliability of the tissue along with the reduction of inflammation as a part of thermal effects of UST paves way for aggressive mobilization of shoulder with low perception of pain. The non-thermal effects of UST have shown to reduce the recurrence of the symptoms also reducing the in-house rehabilitation duration. However, in the review by Robertson VJ et al, the author found that there is no substantial evidence for the therapeutic usage of UST in adhesive capsulitis. Hence authors of this study explored the combined effects of UST with ERM to enhance rehabilitation outcomes.

Research regarding connective tissue stretch duration and intensity has shown that high intensity, short duration stretching aids the elastic response, while low intensity, prolonged duration stretching aids the plastic response. There has been a direct correlation found between the resulting proportion of plastic, permanent elongation and the duration of a stretch and also the degree of either trauma or weakening of the stretched tissues and the intensity of a stretch. With these into consideration, authors opted to treat group II with capsular stretching along with cryotherapy.

Cryotherapy, as had been well proven to be a modality in controlling pain by directly and rapidly modifying the perception and controlling the transmission to the higher centers can be used to treat painful shoulder syndromes like adhesive capsulitis. The beneficial effect of ice therapy on reducing the inflammatory response adds on value to this modality as it primarily works by activating cutaneous thermal reception [4].

The combination of therapies gave positive results in comparison to the individualized therapy which the authors attribute to the summative contribution of the physiological effects of each therapy in treating adhesive capsulitis. Authors feel that the duration of rehabilitation can be brought down by incorporating the combination therapies especially in a multifaceted pathology like adhesive capsulitis.

Authors in this study reported a statistically significant improvement in SAB and SER ROM parameters pre and post therapy in both the groups. However, the extent of improvement was better in Group I (UST + ERM) compared to Group II (Cryotherapy + Capsular stretching). They suggest that both combinations could be satisfactorily used to increase the ROM of shoulder based on the availability of resources in the rehabilitation facility and the combination of UST & ERM stands the suggested treatment.

CONCLUSION

Study concludes that the subjects treated with Ultrasound therapy (UST) along with End range mobilization (ERM) showed better improvement in the abduction and external rotation ROM of shoulder compared to those who received cryotherapy & stretching.

The alteration in the extensibility parameters of the soft tissues around the joint due to cryotherapy could have contributed to the lower improvements in ROM both in SAB and SER of group II. This study was limited in its scope due to small sample size, lack of control group, shorter duration of treatment and only abduction and external rotation movements being estimated which the authors believe were less to comment on the prognosis of the patient. Future studies with longer treatment duration and subjects of stage III also included and the ROM measured using electro goniometer are recommended.

However, this is just authors' hypothesis and could be investigated in detail by doing future trials involving larger sample.

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