Original Article

Effects of Short Wave Diathermy Therapy in Patients with Adhesive Capsulitis of Shoulder (ACS)

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Abstract

There are varieties of management option for Adhesive capsulitis of shoulder (ACS) also known as Periarthrosis and in general population commonly known as Frozen Shoulder. Short Wave Diathermy (SWD) is one of the important therapeutic option for frozen sholder. The aim of the study is to determine effectiveness of SWD in order to improve the pain and range of motion in Adhesive Capsulitis. A total 56 subjects were selected for this non-randomized controlled trial in the Department of Physical Medicine and Rehabilitation, Chattogram Medical College Hospital with adhesive capsulitis in a period of 6 months. The subject were divided into two intervention groups; group-A with conventional treatment plan with SWD and group-B with conventional treatment only. Tool used for assessment were Visual Analogue Scale (VAS) to measure pain with Tenderness Grading (TG) and Shoulder Pain and Disability Index Score (SPADI). The analysis was done to measure the difference of effectiveness of both interventions by independent t-test with SPSS-20. Among 56 patients regarding analysis of sex in both groups male and female were matched (p>0.05) and male - female ratio was 1.66: 1. Considering socioeconomic status, poor was 21.4%, middle class was 44.6% and rich was 33.9%. Among all patients 35.7% were housewives, 16.1% were service holder, farmers were 12.5%, businessmen were 16.2% and laborers were 3.6%. In total patients, 48.2% had right shoulder involvement, 50.0% had left side involvement and one patient had both sided disease. There were 92.7% patients who had localized pain and only 7.3% had radiation. Majority of the exparienced pain in the evening was 56.4% and rest had pain at night was 43.6%. About half of the patients in both groups had constant and intermittent type of pain 47.5% and 45.5% respectively other types were sharp and dull. Significant difference between Group A and Group B was found at week 2, week 4 and week 6 follow-up (p<0.05) whereas initial follow-up was non-significant in VAS analysis (p>0.05). Significant difference between Group A and Group B was found at week 2, week 4 and week 6 follow-up (p<0.05) regarding change of tenderness grading in Group A, then Group B patients. Significant difference between Group A and Group B was found at week 2, week 4 and week 6 follow-up (p<0.05) regarding SPADI. When SWD is combined with conventional management of adhesive capsulitis it gives better reduction in pain and disability. Conventional teeatment plan with SED is more effective in the management of pain and reduce disabilities in patients with ACS.

Keywords: *Short wave diathermy, adhesive capsulitis, shoulder pain, frozen shoulder.*

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INTRODUCTION

Adhesive capsulitis is a condition characterized by painful and limited active and passive range of motion of the shoulder.[1] The American Shoulder and Elbow Surgeons Society agreed on the following definition of FS by consensus: a condition of uncertain etiology that is characterized by clinically significant restriction of active

and passive shoulder motion that occurs in the absence of a known intrinsic shoulder disorder.[2]

Adhesive capsulitis has a prevalence of 2-5% in the normal population. In diabetic patients this is increased, with a prevalence of 10% in type I and 22% in type II.It is more common between the ages of 40 and60years.[3] The incidence of this condition is higher in women than in men. Approximately 70% of patients presenting with adhesive capsulitis are women.[4]

The pathology of adhesive capsulitis remains unclear. The disease process particularly affects the anterosuperior joint capsule and the coracohumeral ligament. Evidence shows a synovial inflammation with subsequent reactive capsular fibrosis. A dense matrix of type I and type III collagen is laid down by fibroblasts and myofibroblasts in the joint capsule. Subsequently, this tissue contracts. Growth factors, cytokines, and matrix metalloproteinases are involved in the inflammatory and fibrotic cascades seen in frozen shoulder.[5]

Adhesive capsulitis is usually classified into two etiological varieties. Primary or idiopathic adhesive capsulitis is not associated with a systemic condition or history of injury[1]. Secondary adhesive capsulitis is most commonly associated with diabetes mellitus. Secondary adhesive capsulitis may also be associated with conditions such as hyperthyroidism, hypothyroidism, and hypoadrenalism, Parkinson's disease, cardiac disease, pulmonary disease, and stroke.[6]

Reeves has described 3 stages of adhesive capsulitis.[7]

1. Stage I It is mainly characterized by pain usually lasting 2-9 months.
2. Stage II *(*frozen stage); pain gradually subsides but stiffness is marked lasting 4-12 months.
3. Stage III (thawing phase); pain resolves and improvement in range of motion appears.

Diagnosis of adhesive capsulitis is mainly clinical. A diagnosis of FS is made in 75% of external rotation test positive patients and glenohumeral arthritis is the only other diagnosis (which can be excluded by radiograph) that produces a positive external rotation test.[8] Codman discussed this entity describing a slow onset of pain, felt near the insertion of the deltoid, inability to sleep on the affected side, and restriction in both active and passive elevation as well as external rotation.[9] Idiopathic adhesive capsulitis is a common medical diagnosis for patients seeking physical therapy. Modalities used to treat adhesive capsulitis were dichotomized by pain predominant and stiffness-predominant classifications, which may be more useful than existing classifications.[10] Deep heat modalities like Shortwave diathermy (SWD) are frequently used as an adjuvant treatment to exercise therapy in order to help the patient regain ROM and restore function to the affected shoulder. Studies have shown that a significant drop in tensile stress occurs with a rise in the temperature of soft tissues to between 40°C and 45°C, compared with that recorded at room temperature (25°C) and also findings suggest that deep heating (using SWD) is effective than superficial heating (using Hot packs)or stretching alone in improving shoulder pain and function in stage II adhesive capsulitis.[11] In this study an attempt has been made to see the effects of SWD in the treatment of adhesive capsulitis and their outcome. The information thus gathered may provide useful guidelines for further study about various aspects on adhesive capsulitis.

Adhesive capsulitis has an incidence of 3–5% in the general population and up to 20% in those with diabetes. This disorder is one of the most common musculoskeletal problems seen in physical medicine. Adhesive capsulitis is a poorly understood musculoskeletal condition that can be disabling.[12] Also in Bangladesh adhesive capsulitis is the commonest shoulder problem. There is no definite/ specific treatment for the condition but many options exist. Few studies showed the beneficial effects of physical agents including superficial and deep heat modalities with shoulder exercises on adhesive capsulitis.In fact SWD is a good modality of treatment in physical medicine especially to provide specific local analgesic effect for various musculoskeletal pains including adhesive capsulitis, in patients with peptic ulcer disease, bronchial asthma and renal impairment. To see the effect of SWD, if this study can show the beneficial effects on this disease in our country, then many patients will be benefitted from many physical medicine and rehabilitation centers of Bangladesh.

It's important to note that dosing the intensity of SWD is based on patient feedback and tolerance. The qualitative method of dosing intensity is widely accepted. The four dose levels are.[16]

Dose I: Just below any sensation of heat;
Dose II: Mild perception of heat;
Dose III: Moderate (comfortable) perception of heat;
Dose IV: Vigorous heating (no pain or burning). If pain threshold is reached, immediately decrease output.

Draper et al have led the way in SWD research in the United States. Their work focuses on using pulsed shortwave diathermy (PSWD) as a heating agent. It often seems counterintuitive to clinicians that PSWD can heat, but it's clear from the research that it can heat efficiently and, when used in combination with a heating and stretching regime, it can improve flexibility in subjects with tight hamstrings and plantar flexors.[17,18]

Draper et al have been able to obtain this 4° Celsius increase using pulsed short-wave diathermy (induction drum) for 15 to 20 minutes (pulse width of 400 microseconds, pulse rate of 800 pps, average output of 48 W).Thermal SWD can serve as an efficient, safe deep heating agent that can enhance the effectiveness of passive stretching, joint mobilization or soft tissue manipulation.[19]

SWD is a modality that produces deep heating via conversion of electromagnetic energy to thermal energy. Oscillation of high frequency electrical and magnetic fields produces movement of ions, rotation of polar molecules, and distortion of nonpolar molecules with resultant heat generation.[20,21] The Federal communications commission limits industrial, scientific and medical use to 13.56MHz,27.12MHz,40.68MHz.67 The 27.12MHz frequency is most commonly used. The heating pattern produced depends on the type of shortwave unit and on the water content and electrical properties of the tissue. Tissues can be grossly divided into those with high water content(muscle,skin,blood) and those with low water content (bone,fat).[22]

SWD units can be inductive or capacitive. Inductive applicators use inductive coils that apply a magnetic field to induce circular electrical fields in the tissue[21]. They achieve higher temperatures in water rich tissues with higher conductivity. These applicators typically have a cable or drum configuration.[23] Cables are semi flexible.Induction coils that can be formed to the contour of the area to be treated. Drum applicators consist of induction coils enclosed in a rigid housing or drum. For a capacitive applicator, the patient is placed between two metal condenser plates. The plates and the patients intervening tissue act as a capacitor and heat is generated by rapid oscillations in the electric field from one plate to the other. Capacitive applicators might achieve higher temperatures in water poor tissues such as subcutaneous adipose tissue.[21,23]

The aim of this study is to evaluate the effect of SWD in adhesive capsulitis.To measure and compare the improvement of pain of affected shoulder using visual analogue scale before and after treatment.

MATERIALS AND METHODS

Study design was Randomized clinical trial.

Study place was department of Physical Medicine & Rehabilitation, Chattogram Medical College Hospital, Bangladesh.

The duration of the study was 6 (Six) months from 01/07/2015 to 31/12/2015.

Patients of shoulder pain attending the Department of Physical Medicine & Rehabilitation outpatient department of Chattogram Medical College Hospital.

Sampling technique was Purposive sampling.

Selection criteria:

Inclusion criteria: a) Patients of adhesive capsulitis b) Age between 30 yrs to 70 yrs. c) Painful restricted movement of shoulder less than 3 months. d) Involvement of right or left or both shoulder's.

Exclusion criteria: a) Skin diseases around the affected shoulder. b) History of fracture or dislocation of shoulder joint, stroke and other neurological deficits. c) Pregnant women. d) Patients on treatment for adhesive capsulitis. e) Patients with co-morbidity e.g. uncontrolled Diabetes, Hypertension, Asthma, Heart diseases, malignancy, neck pain or radiculopathy and rheumatologic diseases.

After taking the informed consent from the patient, details history was taken and a preset data form was filled up for every patient. Past history of illness &any systemic disease was inquired cautiously.A complete physical examination including general physical examination, examination of shoulder joint and neck was done.Base line investigationswas done.

e.g. CBC,2HABF,Urine R/M/E, X-ray of cervical Spine A/P & Lateral View,CXR P/A & lateral view, X-ray of the right/left shoulder B/V was also done. All reports were properly recorded in the data sheet.

For therapeutic trial patients was divided into two groups. Group A (SWD,exercise and analgesic) and Group B (Exercise and analgesic only).

All included patients of both groups was given home shoulder mobilizing exercises – Codman/ pendulum, wall

climbing, pulley and wand exercise 5 repetitions each type 3 times daily for consecutive 6 weeks following demonstration on 1st day of enrollment in the study and subsequent follow up was done whether they were doing the exercise properly. In addition, Group A patients were treated with SWD over the affected shoulder for 20 minutes daily for consecutive 10 days except holidays.

There were three visits and these evaluations were always performed by the same examiner. In each visit patients wereassessed by the following parameters :

1. Visual Analogue Scale (VAS)
2. Tenderness index
3. Shoulder Pain and Disability Index (SPADI)

Use of Analgesics, shoulder mobilizing Exercises and SWD during treatment.

Analgesic (NSAIDS): Tab. Naproxen (250mg) twice daily after meal for pain relieve with Cap. Omeprazole (20mg) coverage for six weeks.

Randomization and blinding methods

Immediately after the examination, the patient was randomized by drawing lottery. Each patient has an equal chance of being allocated to any one of the assigned group.

Grouping :

Treatment Group -

Group A: SWD + NSAIDs + shoulder mobilizing exercises (Codman/ Pendulum, wall climbing, Pulley, Wand exercise)

Control Group -

Group B: NSAIDs + shoulder mobilizing exercises (Codman/ Pendulum, wall climbing, Pulley, Wand exercise).

Ethical clearance was taken from the ethical committee of Chattogram Medical College.

After collection of information, these data was checked, verified for consistency and edited for finalized result. After editing and coding, the coded data was directly entered into the computer by using SPSS 20 version. Data cleaning validation and analysis was performed using the SPSS and graph and chart by MS excel. The result was presented in tables in mean, standard deviation (SD) and percentages. Statistical tests for significance of difference were done using unpaired t test. A "P" value <0.05 was considered as significant.

RESULTS

Table I shows occupation of the study patients**:** among all patients 35.7% were housewives, 16.1% were service holder, farmers were 12.5%, business were 16.2% and laborer were 3.6%.

Table I: Occupation

			Group		Total
			Group A	Group B	
Occupation	House wife	Count	11	9	20
		% within Group	39.3%	32.1%	35.7%
	Service	Count	4	5	9
		% within Group	14.3%	17.9%	16.1%
	Farmer	Count	2	5	7
		% within Group	7.1%	17.9%	12.5%
	Businessmen	Count	4	5	9
		% within Group	14.3%	17.9%	16.1%
	Laborer	Count	2	0	2
		% within Group	7.1%	0.0%	3.6%
	Unemployed/Retired	Count	2	2	4
		% within Group	7.1%	7.1%	7.1%
	Other	Count	3	2	5
		% within Group	10.7%	7.1%	8.9%
	Total	Count	28	28	56
		% within Group	100.0%	100.0%	100.0%

Table II shows site of involvement of the diseases: Among all subjects 48.2% had right shoulder involvement, 50.0% had left side involvement and one patient had both sided disease.

Table II: Site of involvement of shoulder

			Group		Total
			Group A	Group B	
Site of involvement of shoulder	Right	Count	15	12	27
		% within Group	53.6%	42.9%	48.2%
	Left	Count	12	16	28
		% within Group	42.9%	57.1%	50.0%
	Both	Count	1	0	1
		% within Group	3.6%	0.0%	1.8%
	Total	Count	28	28	56
		% within Group	100.0%	100.0%	100.0%

Table III shows analysis of VAS at different follow up data in both group**:** Significant difference between Group A and Group B was found at week 2, week 4 and Week 6 follow-up (P<0.05) whereas initial follow-up was non-significant in VAS analysis (p>0.05)

Table III: VAS score at different follow up

VAS	Group	N	Mean	Std. Deviation	p value
W0 VAS	Group A	28	7.79	1.548	0.677
	Group B	28	7.96	1.644	
W2 VAS	Group A	28	5.79	1.686	0.011
	Group B	28	6.86	1.627	
W4 VAS	Group A	28	4.46	1.753	0.001
	Group B	28	6.32	1.634	
W6 VAS	Group A	28	2.14	1.880	0.001
	Group B	28	5.43	1.834	

* P value calculated by independent sample t test

Table IV shows Analysis of tenderness grading at different follow up data in both group**:** Significant difference between Group A and Group B was found at week 2, week 4 and week 6 followup (p<0.05) regarding change of tender grading in Group A then Group B patients.

Table IV: Analysis of TG at different followup

	Group	N	Mean	Std. Deviation	p value
W0 T.G	Group A	28	2.93	.663	0.443
	Group B	28	3.07	.604	
W2 T.G	Group A	28	2.07	.716	0.001
	Group B	28	2.93	.716	
W4 T.G	Group A	28	1.64	.731	0.001
	Group B	28	2.68	.723	
W6 T.G	Group A	28	.68	.723	0.001
	Group B	28	2.18	.670	

TG: Tenderness grading * p value calculated by independent sample t test

Table V shows Analysis of pain and disability index (SPADI) at different follow up data in both group: Significant difference between Group A and Group B was found at week 2, week 4 and Week 6 followup (p<0.05) regarding SPADI.

Table V: Evaluation of SPADI at different follow-up

	Group	N	Mean	Std. Deviation	p value
W0 SPADI	Group A	28	68.97	14.517	0.289
	Group B	28	73.32	15.866	
W2 SPADI	Group A	28	51.6957	12.32563	0.001
	Group B	28	66.3821	14.67031	
W4 SPADI	Group A	28	39.9621	11.48095	0.001
	Group B	28	61.3604	14.33536	
W6 SPADI	Group A	28	29.1654	12.35642	0.001
	Group B	28	56.7671	13.99734	

DISCUSSION

This present study was done in the Department of Physical Medicine and Rehabilitation ofChattogrammedical College Hospital on 56 patients of adhesive capsulitis. These patients were grouped into two. One group got SWD +NSAIDs + shoulder mobilizing exercises (Codman/ Pendulum, wall climbing, Pulley, Wand exercise) who were grouped as A. Another group was given NSAIDs + shouldermobilizing exercises (Codman/ Pendulum, wall climbing, Pulley, Wand exercise) who were grouped as B. Randomization was done by lottery method andthey were followed up for next six weeks and data were analyzed as intension to treat basis means those who were randomized included in the analysis at all weeks although some were dropped out during subsequent follow up.

Regarding analysis of gender in both groups male and female were matched (p>0.05) and male to female ratio was 1.66: 1. Majority of my participants were males (62.5%) which contradict international studies where females are predominantly sufferers from adhesive capsulitis.[5] This reverse result is most probably due to more male patients seeking medical help than females suggested by unpublished data of patients in our department.

Socioeconomic status was found different in both groups where poor was 21.4%, middle class was 44.6% and rich was 33.9%. Here sampling was purposive and only those patients were taken who visited the OPD of Chattogram medical college hospital. So this socioeconomic scenario may not represent the actual scenario of Bangladesh.

Among all patients 35.7% were housewives, 16.1% were service holders, farmers were 12.5% businessmen were 16.2% and laborers were 3.6%. Despite male participants are slightly higher, most common occupation of the patients is Housewife. It is not clear from my study why housewives are so prone to develop adhesive capsulitis. This present scenario of occupational status of the study patients may not represent the actual scenario of Bangladesh as sampling technique was purposive and taken patients attending in a tertiary care hospital.

Among all subjects 48.2% had right shoulder involvement, 50.0% had left side involvement and one patient had both sided disease. As it has no specific prediction to site both the limb can be affected. There were 92.7% patients who had localized pain and only 7.3% had radiation. Most of the pain in the evening (56.4%) and rest had pain at night (43.6%). Most of the patients in both groups had constant and intermittent type of pain (47.5% and 45.5%) other types were sharp and dull. Different study[13,14,15] support that findings regarding pain analysis.

Significant difference between Group A and Group B was found at week 2, week 4 andWeek 6 followup (P<0.05) whereas initial followup was non-significant in VAS analysis(p>0.05) .Significant difference between Group A and Group B was found at week 2, week 4 and week 6 followup(P<0.05) regarding change of tender grading in Group A then Group B patients. Significant difference between Group A and Group B was found at week 2, week 4 and Week 6 followup(P<0.05) regarding SPADI.

The result from 4th session assessment showed further reduction in pain both groups with patients reported mild pain with movement. Change in VAS was reported in the assessment in all the patients in group B from baseline assessment The result from independent t-test showed significant difference between the 2 intervention groups (all $p < 0.05$) at 95% confidence interval for both the dependent variables i.e. degree of pain and change in range of motion. Study suggest that the use of modalities with the mobilization and stretching exercise can increase the functional capacity of the shoulder joint as early as compared with the patient who only taking electrical modalities, similar study comparing the effectiveness of

short wave diathermy (deep heating agent) and superficial heating in combination with stretching exercise suggested that using heating modalities in conjunction with stretching lead to early increase in range of motion.[13]

CONCLUSIONS

Shoulder mobilizing exercises along with SWD use in adhesive capsulitis has better outcome in terms of pain and disability reduction in subsequent follow up.

RECOMMENDATION:

SWD can be routinely used in the pain and disability management of adhesive capsulitis.

LIMITATIONS:

a) Single center study b) Small sample size

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