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Research Article

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

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Abstract

Introduction: There are several options for the management of adhesive capsulitis. Short Wave Diathermy (SWD) is also an important option for adhesive capsulitis management, but very few data are available to support SWD use in adhesive capsulitis. Therefore, we studied the effectiveness of SWD to improve the pain and range of motions in frozen shoulder.

Methods: A total 56 patients with adhesive capsulitis were selected in this randomized controlled trial for a study period of 6 months. The subjects were divided into two intervention groups; one group with conventional treatment plan plus SWD and second group with conventional treatment alone. Visual Analogue Scale (VAS) with Tenderness Grading (TG) and Shoulder Pain And Disability Index scoring (SPADI) were used to measure the pain and disability, The SPSS (version 20) was used for the statistical analysis; differences between the intervention groups were determined by independent t-test.

Results: Among 56 patients, male and female gender were matched ($p>0.05$) and male to female ratio was 1.66: 1. Only one patient had both shoulders involvement, 48.2% of subjects had right sided and 50.0% had left sided involvement. There were 92.7% of patients who had localized pain and only 7.3% had radiating pain. About 56.4% of the patients had evening time of onset of the pain and 43.6% at night. Most of the patients in both groups had constant and intermittent type of pain, 47.5% and 45.5% respectively, and other types were sharp and dull. Significant differences were observed in VAS, TG and SPADI analysis in between Group A and Group B at week 2, 4 and 6 ($P<0.05$), whereas initial follow-up was non-significant in VAS and TG analysis ($p>0.05$).

Conclusion: We conclude that when SWD is combined with conventional management of adhesive capsulitis, it gives better reduction in shoulder pain and disability.

Keywords: Adhesive capsulitis; Short wave diathermy; stretching exercise; NSAIDs

Introduction

Adhesive capsulitis is a clinical condition, which is characterized by painful and restricted active and passive shoulder motion [1]. The prevalence of adhesive capsulitis is about 2-5% in the normal population, whereas, in patients with diabetes it is increased to 10% in type IDM and 22% in type IIDM. Adhesive capsulitis is commonly occurred in the ages of 40 to 60 years [2-4]. Higher incidence of this condition has been reported in women compared to men. Approximately, 70% of adhesive capsulitis patients are women [5].

Although the etiology of adhesive capsulitis remains unclear yet, this condition is basically classified into two different etiological categories such as, idiopathic and secondary. Idiopathic or primary adhesive capsulitis, which is not linked to any systemic disease or injury [1]. Most common etiology of secondary adhesive capsulitis is diabetes mellitus. It may also be linked to other conditions such as parkinson's disease, pulmonary disease hyperthyroidism, hypothyroidism, and hypoadrenalism, cardiac disease, and stroke [6].

Adhesive capsulitis has been staged in 3 stages [7].

1. Stage I: this is a painful stage and usually lasts for 2-9 months.

2. Stage II / frozen stage: pain subsides at this stage but stiffness is marked that lasts for 4-12 months.

3. Stage III / thawing phase: shoulder motion improves and pain appears to resolve

Diagnosis of adhesive capsulitis is made by clinical observation [8]. There are many treatment options for treating adhesive capsulitis, but only few have high level of evidence to support them [9]. The effective adhesive capsulitis treatment is undefined yet. Nonsurgical treatments for this condition are Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), short-term oral corticosteroids, intra-articular corticosteroid injections, hydro-dilation, physiotherapy, and acupuncture [10]. Physical therapy has been shown to play a principal role in the treatment of many painful shoulder conditions including adhesive capsulitis [11]. Clinical studies fail to demonstrate any clear effect of specific treatment; this may be affected by the placebo effects and the patient characteristics and methodological weaknesses of the

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trials evaluated [12].

SWD is a treatment modality, which yields deep heat by changing electromagnetic energy into thermal energy. High frequency magnetic and electrical fields oscillation produces rotation of polar molecules, and distortion of nonpolar molecules, and movement of ions with subsequent heat generation [13,14]. Industrial, scientific and medical uses are limited to 13.56MHz, 27.12MHz and 40.68MHz by the federal communications commission [15]. The most commonly used frequency is 27.12MHz14. Short Wave Diathermy (SWD) is commonly used as an adjuvant therapy to exercise for helping the patient to regain ROM and restore function of the affected shoulder. Alteration of the viscoelastic properties of connective tissues by heating is the basis to attain the therapeutic goals. Studies have shown that tensile stress is significantly dropped with a rise of temperature of soft tissues in between 40°C and 45°C compared to that recorded at room temperature (25°C) [16]. Findings also suggest that deep heating (using SWD) is more effective than the stretching or superficial heating (using hot packs) alone for improving shoulder pain and function in stage II adhesive capsulitis [16]. Although many people in the community have been suffering from adhesive capsulitis in our country (Bangladesh), not many studies have done in this field. A paucity of information exists in our country regarding the exact role of SWD and Exercise therapy in the management of adhesive capsulitis. In this study, an attempt has been made to see the effects of SWD in the management of adhesive capsulitis and its outcome.

Materials and Methods

A randomized controlled clinical trial was carried out among 56 patients at the Department of Physical Medicine & Rehabilitation, Coxsbazar medical college, Coxsbazar, Bangladesh, for 6 months. Study populations were the patients, who attended the outpatient department of Physical Medicine & Rehabilitation. Purposive sampling was used for this trial.

A sample size calculation was performed based on assumptions that 65% can respond to treatment group & 95% to control group. Sample size was calculated as follows: [17]

$$n = \frac{P_1(1-P_1)+P_2(1-P_2)}{(P_1+P_2)^2} \times (Z_\alpha + Z_\beta)^2$$

$$= \frac{0.95(1-0.95+0.65(1-0.65)}{(0.95-0.65)^2} \times (1.96+0.85)^2$$

= 28 for each group

N= Sample size for each group.

P_1 = control group response = 95% = 0.95 (Anticipated probability of case)

P_2 = treatment group response = 65% = 0.65 (Anticipated probability of control).

Z_α = Z- Value at a definite level of significance.

e.g.1.96 at 5% level of significance [18].

Z_β = Z- Value at a definite power.

0.85 at 80% of power(when b = 0.2) [19].

28 subjects in each group (56 in total) was given the power of 80% to detect significance at a probability level of P=0.05.

Selection Criteria

Inclusion Criteria

1. Patients of adhesive capsulitis.

2. Age between 30 and 70 years.

3. Painful restricted movement of shoulder less than 3 months.

4. Involvement of right or left or both shoulders.

Exclusion Criteria

1. Skin diseases around the affected shoulder.

2. History of fracture or dislocation of shoulder joint, stroke and other neurological deficits.

3. Pregnant women.

4. Patients on treatment for adhesive capsulitis.

5. Patients with co-morbidity e.g. uncontrolled Diabetes, Hypertension, Asthma, Heart diseases, malignancy, neck pain or radiculopathy and rheumatologic diseases.

Pain and Disability Index (SPADI) [20-22]

A shoulder pain and disability index (SPADI) was used to assess pain & disability in adhesive capsulitis. It basically consists of 13 items and is divided into two subtypes: pain (5 items) & disability (8 items). (Appendix-1).

Scoring Instruction [20,21]

Patients were asked to answer some questions; where patients placed a mark on a 10cm visual analogue scale (VAS) for each question. Verbal anchors for the pain dimension are 'no pain at all' and 'worst pain imaginable', and those for the functional activities are 'no difficulty' and 'so difficult that it required help'. The scores from both dimensions were averaged to derive a total score.

Interpretation of Scores [20,21]

- Total pain score: __/50 x 100 = %.
- Total disability score: __ /80 x 100 = %.
- Total SPADI score: __ /130 x 100 = %.
- Note: If a person does not answer all questions, divide by the total possible score, e.g. in pain score, if 1 question missed divide by 40; similarly in total score if 1 question missed divide by 120.
- The means of the two subscales are averaged to produce a total score ranging from 0 (best) to 100 (worst).
- Minimum Detectable Change (90% confidence) = 13 points.

(Change less than this may be attributable to measurement error)

Visual Analogue Scale (VAS) [17]

1	2	3	4	5	6	7	8	9	10

In VAS, patient (he/ she) was described the visual impression of their pain. Where zero denotes no pain at all, and 10 means extreme level of pain as it is not bearable by the patient. Thus, they pointed out the actual point of pain in the scale and it was documented in the data schedule.

Tenderness Measurement by Tenderness Grading

Tenderness grading [23]:

Grade-1: Patient states that the joint is tender,

Grade-2: Patient winces,

Grade-3: Patient winces and withdraws the affected part,

Grade-4: Patient does not allow the joint to be touched.

Study Procedure

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 investigations such as, 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 were also done. All reports were properly recorded in the data sheet.

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

Patients of both groups were given home shoulder mobilizing exercises including codman / pendulum, wall climbing, pulley and wand exercise 3 times daily with 5 repetitions of each type for consecutive 6 weeks. Demonstration on exercise was given on 1st day of enrollment in the study and subsequent follow up was done whether they were doing the exercise properly or not. Moreover, analgesic (NSAIDS), Tablet Naproxen (250mg) with Capsule. Omeprazole (20mg) were given twice daily to relieve the pain for six weeks.

On the other hand, Group A patients were treated with SWD therapy in the affected shoulder (20 minutes daily) for consecutive 10 days except holidays in addition to shoulder mobilizing exercises and analgesic. Patients were followed up for six weeks and data were analyzed as intension to treat basis means those who were randomly included in the analysis for 6 weeks of follow up, though some subjects were dropped out during follow up.

There were three visits and each visit was evaluated by the same examiner. In each visit patients were assessed on the following parameters:

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

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.

Data Analysis

After collection of the information, data was checked, verified for consistency and edited for finalization of result. After editing and coding, the coded data was directly entered into the computer by using SPSS, version 20. Data cleaning, validation and analysis were 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, where "P" value <0.05 was considered as significant.

Ethical Implication

1. Study was carried out according to the rules of the ethical committee of Cox'sbazar Medical College and Hospital.
2. Participation was voluntary.
3. Consent was obtained after a brief of the study in Bangla or local language to all respondents.
4. It was made clear to them that they are free to take part or withdraw from any part of the study at any stage.
5. All answers were kept confidential and will not be disclosed without prior permission of patient.
6. Interview was taken in a suitable time and place, which was convenient to the responder.
7. Refusal to take part or withdrawal from the study was not hampered his/her treatment

Results

Gender distribution of the patients: Gender distribution study showed that in both groups male and female gender were matched (p>0.05), and male ratio was higher compared to female (1.66: 1) as shown in (Table 1).

Site of involvement of the diseases: Among all subjects 48.2% had right shoulder involvement, 50.0% had left shoulder involvement and one patient had both sided disease as mentioned in (Table 2).

Distribution of site of pain: Our study showed that most of the pain of adhesive capsulitis is localized in nature. There were 92.7% patients who had localized pain and only 7.3% had radiating pain as mentioned in (Table 3).

Time of occurrence: Most of the patient's pain was found to be raised in the evening (56.4%) and rest had elevated pain at night (43.6%) as mentioned in (Table 4).

Characters of pain of the study subjects: Most of the patients in

Table 1: Gender distribution of study patients.

Gender		Group		Total
		Group A	Group B	
Male	Count	16	19	35
	% within Group	57.1%	67.9%	62.5%
Female	Count	12	9	21
	% within Group	42.9%	32.1%	37.5%
Total	Count	28	28	56
	% within Group	100.0%	100.0%	100.0%

Chi square value = 0.85, p= 0.913

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

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

Table 2: 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%

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

Table 3: Distribution of site of pain.

Site of pain		Group		Total
		Group A	Group B	
Localized	Count	25	26	51
	% within Group	89.3%	96.3%	92.7%
Radiation present	Count	3	2	4
	% within Group	10.7%	3.7%	7.3%
Total	Count	28	28	55
	% within Group	100.0%	100.0%	100.0%

Chi square value = 1.004, p= 0.415
Group A: SWD + NSAIDs + shoulder mobilizing exercises (Codman/ Pendulum, wall climbing, Pulley, Wand exercise).
Group B: NSAIDs + shoulder mobilizing exercises (Codman/ Pendulum, wall climbing, Pulley, Wand exercise)

Table 4: Time of occurrence.

Time of occurrence		Group		Total
		Group A	Group B	
Evening	Count	13	16	29
	% within Group	50.%	55.6%	56.4%
Night	Count	15	12	27
	% within Group	50.0%	44.4%	43.6%
Total	Count	28	28	56
	% within Group	100.0%	100.0%	100.0%

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

both groups had constant (47.5%) and intermittent (45.5%) type of pain. Some of them had sharp and dull type of pain and that was 3.6% for each group as mentioned in (Table 5).

Analysis of VAS at different follow-up data in both groups: Patients were followed up at 4 different sessions. VAS score of all sessions were analyzed using SPSS. Significant differences in between Group A and Group B were found at 2, 4 and 6 week of follow-up where P value were 0.011, 0.001 and 0.001 respectively, whereas analysis from initial follow-up did not show any significant result (p>0.677) as shown in (Table 6).

Table 5: Characters of pain.

			Group		Total
			Group A	Group B	
Characters of pain	Constant	Count	11	15	26
		% within Group	42.9%	51.9%	47.3%
	Intermittent	Count	11	14	25
		% within Group	42.9%	48.1%	45.5%
	Sharp	Count	2	0	2
		% within Group	7.1%	0.0%	3.6%
	Dull	Count	2	1	3
		% within Group	7.1%	3.6%	3.6%
Total		Count	28	28	56
		% within Group	100.0%	100.0%	100.0%

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

Table 6: 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	

Group A: SWD + NSAIDs + shoulder mobilizing exercises (Codman/ Pendulum, wall climbing, Pulley, Wand exercise).
Group B: NSAIDs + shoulder mobilizing exercises (Codman/ Pendulum, wall climbing, Pulley, Wand exercise)
*p value calculated by independent sample t test

Table 7: Analysis of TG at different follow-up.

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

Analysis of TG at different follow-up data in both groups: TG was also analyzed from 4 sessions. Similar to VAS, Group A and Group B showed significant differences in TG changes at week 2, 4 and 6 (P<0.001 for each) as shown in (Table 7).

Table 8: 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	

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

Analysis of SPADI at different follow-up data in both groups: All 4 sessions showed significant differences in SPADI in group A compared to Group B at 0, 2, 4 and 6 weeks of follow-up (P<0.289 - 0.001) as shown in (Table 8).

Discussion

Adhesive capsulitis is one of the most common musculoskeletal health problems that are seen in physical medicine [24]. It is a poorly understood musculoskeletal condition that can make people disable. In Bangladesh, adhesive capsulitis is the commonest shoulder problem. There is no definite / specific treatment for this condition, although many options exist. Study showed the beneficial effects of physical agents including superficial and deep heat modalities with shoulder exercises on adhesive capsulitis [16]. In fact, SWD is a good modality of treatment in physical medicine for providing specific local analgesic effect for a range of musculoskeletal pains including adhesive capsulitis, especially in patients with bronchial asthma, peptic ulcer disease, and renal impairment. Therefore, the effect of SWD on adhesive capsulitis has been determined in this study.

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 of the pain. Most of the pain was evening rising (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% respectively) other types were sharp and dull. Different studies [16,25,26] also support these findings regarding pain analysis.

Based on VAS and RG analysis, significant difference in between Group A and Group B was found at 2, 4 and 6 weeks of follow-up (P<0.05), whereas initial follow-up was non-significant in VAS and TG analysis (p>0.05) Moreover, SPADI was significantly lower (P<0.05) in Group A in comparison to Group B during the follow up. The result from independent t-test showed significant difference in between two intervention groups throughout the follow up (all p < 0.05) at 95% confidence interval for both the dependent variables i.e. degree of pain and change in range of motion. Similarly, study also support our findings as superficial heating and short wave diathermy (deep heating agent) in combination with stretching exercise lead to early increase in different range of motions [16]. Study also shows that deep heating without stretching intensify the tissue extensibility more compared to superficial heating or in absence of heating [26]. Above findings imply that electrical modality SWD could be used clinically to improve the treatment of musculoskeletal pathologies, especially adhesive capsulitis. Information that gathered here may provide useful guidelines for further study about various aspects of adhesive capsulitis.

Conclusion

We conclude from this clinical trial that use of SWD along with shoulder mobilizing exercises and NSAIDs in adhesive capsulitis management has better outcome in terms of pain and disability reduction compared to conventional management. However, more randomized controlled trials are needed to decisively determine whether any particular treatment modality is superior.

Limitations

1. Single center study.
2. Small sample size.

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