

Effectiveness of Cryokinetics in Comparison with Effectiveness of Ultrasound Therapy in Treatment of Acute Supraspinatus Tendonitis

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To compare the effectiveness of Cryokinetics and Ultrasound therapy in treating supraspinatus tendinitis as measured by Visual analogue Scale (VAS) and 1 RM (Repetition Maximum). A sample of 60 patients with acute supraspinatus tendinitis with an experimental comparative study design. Patients who visited out patient department of Kempegowda Institute of Medical Sciences and Research Centre, Bangalore were included in the study based on inclusion and exclusion criteria. Both the groups were treated 5 times per week for three weeks. Patients were evaluated with VAS and 1RM on day 1st, 15th day and end of third week. The values are statistically analyzed to determine their effect in reducing pain and improving muscle strength. The two-intervention group showed significant improvement when the pre and post values were analyzed for VAS and 1RM with significant p value ($p < 0.05$). But inter group comparisons showed cryokinetics group to be more effective ($p < 0.05$) than ultrasound therapy group for all outcome parameters.

Keywords: Acute Supra Spinatus Tendinitis; Cryo Kinetics; Ultra Sound Therapy.

Supraspinatus tendinitis was proposed by NEER in 1972 as a clinical entity in which the rotator cuff was pathologically compressed against, anterior structure of coraco- acromial arch, anterior third of the acromion, the coraco acromial ligament and a acromino clavicular joint. Supraspinatus can be affected by trauma but also undergoes chronic degenerative changes leading to tendinopathies and rupture¹, it is a painful lesion of the supraspinatus tendon, here the pain is located over the lateral aspect of arm with well defined trigger points on the muscle belly over the supraspinatus notch and at the insertion. A narrowing of the subacromial outlet by spur

formation in coraco acromial ligament and the under surface of the anterior third of acromion define the relative progression of the impingement syndrome².

Rotator cuff muscles blend with and reinforce the glenohumeral capsule, most importantly all these have action lines that significantly contribute to the dynamic stability of glenohumeral joint³. The SST canal forms a rigid and inextensible ring, if the muscle increases in size as a result of scar or an inflammatory process, it cannot glide through the canal without sticking, which causes pain⁴. Shoulder pain is the 3rd most common cause of musculoskeletal

disorder after low back pain and cervical pain. The annual incidence is estimated at 10 cases per 1000 population, peaking at 25 cases per 1000 population in a age category of 42-46 years⁵⁻⁷. Medical interventions like Non steroidal anti inflammatory drugs (NSAIDS), Subacromial corticosteroids and Bupivacaine suprascapular nerve block are done. Many physiotherapy treatments are in use for treatment of Supraspinatus tendinitis. Some of them are: Hot/Cold pack application, ultra sound therapy, Iontophoresis / phonophoresis, deep friction massage, low level laser therapy, short wave diathermy. Cryokinetics is a systematic combination of cold application to numb the injured body part and graded progressive active exercises⁸. Using cold application during rehabilitation of acute sprains, strains, contusions and muscle injuries appear to have begun at Brooke Army Hospital in early 1960's. In 1964 Grant and Hayden described their treatment for some musculoskeletal injuries with a new method that they termed Cryokinetics referring to a combination of cold and exercise. Ice was used to anesthetize the injured body part, this took from 3 to 20 minutes and was ceased when patient reported numbness. Once numbed the body part was exercised with active movements, if discomforts recurred the ice was reapplied. In 1967 Moore et al,⁹ presented case studies involving athletic rehabilitation with Cryokinetics and discussed possible mechanics to account for quicker rehabilitation and concluded that the success of Cryokinetics was due to early exercise's and that the role of cold was only to decrease pain and thereby allow earlier and more intense normal active exercise. Cryotherapy is thought to decrease edema formation via induced vasoconstriction, reduce secondary hypoxic damage by lowering the metabolic demand of the injured tissue¹⁰⁻¹¹. Cooling skin surface temperature to below approximately 15°C from normal body temperature is also thought to exert a localized analgesic effect by inhibiting the nerve conduction velocity¹²⁻¹³. Thus facilitating earlier and more aggressive therapeutic exercise after muscle injury.¹⁴⁻¹⁵ Cold application diminishes pain so that active exercise is possible¹⁶. Exercise increases blood flow to the injured area vital in healing. Exercise re-establishes neuromuscular function. With this technique exercise is possible much earlier than normal. Muscle atrophy is not allowed

to set in. Swelling is reduced dramatically through the combination of cooling and exercise. If the exercise during Cryokinetics becomes so vigorous that further damage may result, the body responds with a pain sensation. Thus Cryokinetics has a built in safety value. Cryokinetics allows rehabilitation to begin much sooner than traditional thermo therapy and can reduce rehabilitation time by days or even weeks^{17,19}.

In ultrasound treatment a stream of sonic waves is transmitted to a small volume of the tissue, which causes the muscles of the tissue to vibrate. The mechanical pressure waves of ultrasound is applied to the tissues at a level of intensity that is too low and at a frequency that is too rapid that the person receiving it cannot detect the pressure^{18,20}.

This therapy has been found effective in relieving the muscular pain by resolving, inflammation, removal of waste products,¹⁹ altered permeability of cell membrane to sodium, which may alter the electrical activity or pain threshold, increased blood supply, increased WBC count²¹. Ultrasound therapy is used as a standard treatment for supraspinatus tendinitis. There is lack literature comparing cryokinetics and ultrasound. hence in this study Cryokinetics and ultrasound therapy is used and comparison between the effectiveness of both the interventions is done.

Aims and objective: To evaluate the effect of cryokinetics as compared to ultrasound therapy in treatment of acute supraspinatus tendonitis.

METHODOLOGY

Design and Study Setting

This study was randomized clinical trial with Random sampling method. Ethical clearance for the study was obtained by Institutional Ethical Review Committee of Kempegowda Institute of Medical Science and research center, following which participants were screened according to inclusion and exclusion criteria. The study was conducted in Physiotherapy department of tertiary care center of Bangalore city, India.

Participants

Participants were assessed for eligibility for inclusion and exclusion criteria. Inclusion criteria were (1) Subjects with supraspinatus tendinitis who are under analgesics (2) Age group: 30-50 yrs.

Participants were excluded if they had(1) Adhesive capsulitis, (2) Cervical disorders,(3) Fibromyalgia, (4)Rheumatoid Arthritis, (5) Hemiplegia, (6) Thoracic outlet syndrome, (7) Cold hyper-sensitivity, (8)haemoglobineuria, (9) Anesthetic skin, (10) Cardiac conditions, (11) Cold utricaria.

Randomization:Samples are selected through random sampling by using chit method.

Intervention

Group A received Cryokinetics. In this group, pre-application precautions were given to all the patients. Patients were asked not to consciously attempt to overcome the pain. The patients were given explanation of the three types of pain that they would be experiencing during the treatment.

1. Residual pain- which is caused by injury (damaged tissue or swelling). This will be neutralized by the numbness from the ice pack.
2. Cold pain- caused by the ice, until the patient adapts to it.
3. Re-injury pain- caused if the patient stresses the tissue to the point of re-injury. Such pain will not be covered up by the numbness.

The subject is in comfortable supine position. Cryo pack is applied around the involved shoulder covering posterior, superior and anterior aspects, and treatment was given for 20 minutes following which active exercises were given for 5-7 minutes. Again cryo pack was applied for 5 minutes then another set of active exercises were given. Exercises include active flexion, extension and abduction of the involved shoulder, 10 repetitions.

Group B-received UltrasoundTherapy. In U.S group, the subject is in comfortable sitting position in a chair with the proper back support. Skin and transducer was coated with acoustic gel. U.S was then applied to superior-anterior aspect of involved shoulder by the therapist. The applicator is moved in small concentric circular movements. The

transducer head was applied to the therapy region at right angle to ensure maximum absorption. Pulsed ultrasonic waves with a ratio of 1:1 with 1 MHZ frequency and 0.8 W/cm²are applied with a 3cm diameter applicator. Ultrasound therapy lasted for 8 minutes in each session.

Both the treatments were given 5 times a week for 3 weeks.

Study variable

VASThe VAS has been shown to be a reliable valid outcome measure for pain²². The score was obtained from the subjects using 10 cm scale, before the start of the treatment, on 15th day and at the final session of the treatment after 3 weeks.

1RM, 1 repetition maximum was used to measure the strength of supra spinatus muscle.^{17,23}This was obtained with the patient in standing position and shoulder in internal rotation. The patient was asked to lift the hand in abduction with the weight cuff tied around his hand. Maximum weight that patient can perform with was noted. Starting weight was 0.5 kg up to maximum 3 kgs. This was recorded on day 1, day 15 and endof third week.

RESULTS

Statistical Analysis was done using SPSS 15.0. Descriptive statistical analysis has been carried out in the present study.

- Shows the group A and group B in different age groups.
- Group A has 3 number of samples at the age of 20 to 30 years , 15 number of samples at the age of 31-40 years and 12 number of samples at the age group of 41-50- years.
- A total of 60 subjects were evaluated with 30 of subjects in each group. Group A (Cryokinetics)

Table 1. Age distribution of patients studied

Age in years	Group A		Group B	
	No	%	No	%
21-30	3	10.0	5	16.7
31-40	15	50.0	14	46.7
41-50	12	40.0	11	36.7
Total	30	100.0	30	100.0

Samples are age matched with P=0.876

Table 2. Gender distribution of patients studied

Age in years	Group A		Group B	
	No	%	No	%
Male	14	46.7	16	53.3
Female	16	53.3	14	46.7
Total	30	100.0	30	100.0

Samples are gender matched with P=0.605

had 14 number of males (46.7%) & 16 number of females (53.3%). Group B (Ultrasound therapy) had 16 number of males (53.3%) and 14 number of females (46.7%).

• In inter group analysis there was decrease in VAS in group A at the end of 3rd week, [Table no.3a] there were 6 patients with no pain ((20.0%)), 24

with mild pain (80.0%). In group B at the end of 3^{ed} week, there were 12 patients with mild pain (40.0%) and 17 patients with moderate Pain (56.7%) and 1 with severe pain (3.3%). When both the groups were compared [Table no.3b] at the end of 3rd week group A had 1.23+/-0.86 and group B had 4.03+/-1.38 with a P value of <0.001

Table 3a. Comparison of VAS score between two groups of patients (n=30)

VAS	Day 1	Day 15	3 rd week	% change at 3 rd week
Group A				
No pain	0	0	6(20.0%)	+20.0%
Mild Pain	0	15(50.0%)	24(80.0%)	+80.0%
Moderate pain	12(40.0%)	14(46.7%)	0	-40.0%
Severe pain	18(60.0%)	1(3.3%)	0	-60.0%
Group B				
No pain	0	0	0	0.0
Mild Pain	0	3(10.0%)	12(40.0%)	+40.0%
Moderate pain	12(40.0%)	24(80.0%)	17(56.7%)	+16.7%
Severe pain	18(60.0%)	3(10.0%)	1(3.3%)	-56.7%

Table 3b. Comparison of VAS score in two groups of patients

VAS	Group A	Group B	P value
Day 1	6.90±1.58	6.70±1.51	0.619
Day 15	3.73±1.17	5.20±1.29	<0.001**
3 rd week	1.23±0.86	4.03±1.38	<0.001**

• There was increase in 1RM [Table 4a] in group A at the end of 3rd week, there was only one patient with weak muscle(3.3%), 22 patients with moderate strength (73.3%) and 7 with good muscle strength (23.3%). In group B at the end of 3rd week there were 9 patients with weak muscle(30.0%), 20 patients with moderate muscle strength(66.7%) and

Table 4a. Comparison of repetitions maximum between two groups of patients (n=30)

RM	Day 1	Day 15	3 rd week	% change at 3 rd week
Group A				
Weak muscle	23(76.7%)	6(20.0%)	1(3.3%)	-73.4%
Mod. strength	7(23.3%)	24(80.0%)	22(73.3%)	+50.0%
Good	0	0	7(23.3%)	+23.3%
Group B				
Weak muscle	20(66.7%)	14(46.7%)	9(30.0%)	-36.7%
Mod. strength	10(33.3%)	15(50.0%)	20(66.7%)	33.4%
Good	0	1(3.3%)	1(3.3%)	+3.3%

Table 4b. Comparison of Repetitions maximum in two groups of patients

RM	Group A	Group B	P value
Day 1	0.90±0.40	1.05±0.49	0.204
Day 15	1.45±0.27	1.30±0.43	0.111
3 rd week	1.97±0.39	1.47±0.39	<0.001**

1 patient with good muscle strength(3.3%). When both the groups were compared [Table 4b] at the end of 3rd week group A had 1.97+/-0.39 and group B had 1.47+/-0.39 with p value of <0.001.

• The intergroup analysis demonstrated statistical significant values for both VAS and 1RM in both groups, but statistically significant improvement

is seen in group A as compared to group B in intra group analysis.

DISCUSSION

Rotator cuff disease is one of the occupational health problems on orthopedics ambulatory with high functional damages to its carrying. A comparative evaluation study with 60 patients with acute supraspinatus tendinitis was undertaken. 60 patients were divided into two groups, group A and group B. Each group consisting of 30 patients. Group A received Cryokinetics therapy and group B received ultrasound therapy. This study was undertaken to study the effectiveness of cryokinetics in comparison with effectiveness of ultrasound therapy. Between the patients interviewed, both males and females in both groups are almost equally affected with supraspinatus tendinitis. With 46.7% of males in group A and 53.3% in group B. 53.3% of females in group A and 46.7% in group B. In relation to age this study is showing that the patients incidence with SST is more in the age group of 31-40 years. % distribution of patients with regards to age in group A is 10.0% at the age group of 21-30 years, 50.0% at the age group of 31-40 years, 40% at the age group of 41-50 years. In group B it is 16.7% at the age group of 21-30 years, 46.7% at the age group of 31-40 years and 36.7% at the age group of 41-50 years.

Discussing techniques of physiotherapeutic treatment Souza(1994) believes that modalities as cry therapy, electro therapy and exercise can have great value on shoulder lesions treatment.

Cryokinetics is a systematic combination of cold application to numb the injured body part and graded progressive active exercise¹⁰. This is the most effective form of cry therapy for the rehabilitation of ligament sprains and muscle injuries the success of Cryokinetics was due to early exercises and that the role of cold was only to decrease the pain and thereby allow earlier recovery¹²⁻¹³. US has been used widely for more than 40 years in the treatment of musculoskeletal disorders, such as tendinitis, tenosynovitis, bursitis and muscle injury. US converts electrical energy into acoustic wave forms which is converted into heat as it passes through tissues of varying resistance. US can be used as thermal agents to increase the temperature of deep tissues²⁴. Raising

the tissue temperature accelerates the metabolic processes including increasing enzymes activity, increasing the rate of ion exchange, increasing the rate and volume of diffusion across cell membranes US decreases pain and stiffness²⁴⁻²⁵. The aim of this study is to compare these two interventions in reducing pain and increasing muscle strength and enhancing functional performance in SST. Group A was treated with cry kinetics and group B was treated with US therapy. Group A has been shown more improvement than group B, which is proved statistically.

The data revealed that Cryo kinetics is significantly more efficient in reducing pain. These results are consistent with those of Moore et al (1967)⁹ who presented a case study on athletic rehabilitation with Cryo kinetics and discussed possible mechanics for a quicker rehabilitation, and with those of Grant and Hayden (1964) who discussed benefits of Cryo kinetics.¹⁴

In group A the VAS score at pre assessment was 6.90 and was decreased to 1.24+/-0.86. In group B the VAS score at pre assessment was 6.70+/-1.51 and was decreased to 4.03+/-1.38 at the end of 3rd week. The out come based on % change was found to be more in group A.

According to Lex B Verdijk (2009) I RM is a valid tool to measure shoulder strength²³. In group A the 1RM score at pre assessment was 0.90+/-0.40 and was increased to 1.97+/-0.39 at the end of 3rd week. In group B the 1RM score at pre assessment was 1.05+/-0.49 and was increased to 1.47+/-0.39 at the end of 3rd week. Outcome based difference of pre and post assessment score is more in group A when compared to group B.

CONCLUSION

The improvement in VAS and 1RM was seen in cryokinetics group, showing it is better than ultrasound therapy for supraspinatus tendinitis.

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