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Effect of additional laser modality along with exercises on range of motion and quality of life in non-diabetic frozen shoulder patients

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Abstract
Objective: The objective of this study was to check the effect of additional laser modality along with exercises on range of motion and quality of life in non-diabetic frozen shoulder patients by the end of 2 weeks.
Subjects and Methods: 35 male and female non- diabetic frozen shoulder patients were assigned purposively into a single group. Additional laser modality along with strengthening exercises for affected ranges of shoulder using therabands and some free exercises were given therapeutically to this group for 2 weeks that is 6 days per week summing up for 12 sessions. Before and after interventions that is goniometry ranges of shoulder and WORCQOL questionnaire scores were taken.
Result: Mean range of motion was improved from 110^0 to 153.8^0 for flexion, from 42.857^0 to 65.286^0 for extension, from 81.714^0 to 132.86^0 for abduction and from 37^0 to 59.857^0 for external rotation of affected shoulder, WORCQOL score improved from 19.382% to 31.014%.
Conclusion: Additional laser modality along with exercises showed significant effect on both range of motion and quality of life in non-diabetic frozen shoulder patients by the end of 2 weeks.

Keywords: laser, strengthening, range of motion, quality of life, non-diabetic, frozen shoulder

1. Introduction
Frozen shoulder is also known as Adhesive Capsulitis which is characterised by pain and restriction in shoulder movements [4]. The syndrome is important due to its limiting effect on work capacity, its frequent resistance to treatment and progression to severe capsulitis resulting in prolonged severe disability before resolution occurs. Total duration of the illness usually lasts 1-3 years. The pathology does not appear to affect joints other than shoulder [4].
A triphasic natural history is characteristic; an initial phase of shoulder pain, a second phase of shoulder immobility and the last phase of gradual improvement. After passing through the stages of pain, stiffness and recovery it does not leave any disability after an average period of 30 months from the period of onset [4].
Cyriax and others define frozen shoulder as the glenohumeral stiffness that results from restriction of the anterosuperior joint capsule and the coracohumeral ligament. It is estimated that frozen shoulder affects 2-5% of the general population. Pain is usually the first symptom, and it makes the patient reluctant to move the affected arm. This lack of movement leads to involuntary stiffness. Surprisingly, the non-dominant shoulder is affected more frequently than the dominant one [1].
There is some disagreement about whether the underlying pathological process is an inflammatory condition, a fibrosing condition, or even an algoneurodystrophy process. Evidence points to 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 [1].
Many protocols have been advocated for the treatment of frozen shoulder, though only randomized controlled trials are available. Two reviews concluded that there was not enough data to either support or refute the efficacy of any of the commonly used interventions for this condition including laser modality [1].
So our study aims to find the effect of laser modality in combination with exercises to improve range of motion and quality of life.

2. Methodology
2.1 Purpose
The purpose of this study was to check the effect of additional laser along with exercises on range of motion and quality of life in non diabetic frozen shoulder patients by the end of 2 weeks.

2.2 Selection of subjects
35 male and female subjects were included in the study on the basis of range of motion of these individuals. Patients having limited active range of flexion, extension, abduction and external rotation were selected. Subjects with diabetes were excluded as primary frozen shoulder has not been taken into research very often. Along with that patients with Systemic inflammatory joint conditions such as rheumatoid arthritis, Corticosteroid injection treatment, Uncontrolled hypertension, Surgery, dislocation or fracture of shoulder, Shoulder joint calcification, Pregnancy, Complete rotator cuff tear and non co-operative patients were also excluded to exclude their added effects on the treatment and thus to maintain uniformity in the treatment.

2.3 Procedure
The study was begun with an approval after presentation of its synopsis to an ethical committee in P.E.S. Modern college of Physiotherapy. Study was conducted in and around Pune. The subjects were selected on the basis of inclusion and exclusion criteria. The subjects were well explained about the study and consent was taken from each

patient who wished to participate in the study. Subjects were assured that the collected information will not be misused in any form. Intervention outcomes like Goniometry and quality of life questionnaire were taken pre and post intervention. Intervention was conducted for 2 weeks that is 6 days a week.

Treatment protocol

- Theraband strengthening exercises (yellow Theraband – 10 repetitions 10 sec hold per movement)
  - Flexion
  - Extension
  - External rotation
  - Abduction
- Active Range of motion exercises (10 repetitions per movement)
  - Flexion
  - Extension
  - External rotation
  - Abduction
- Coman's pendular exercises (10 repetitions per exercise)
  - Clockwise
  - Anti-clockwise
  - Front and back
  - Side to side
- LASER MODALITY- 30 sec per point as indicated by the patient [1].

2.4 Findings- Mean values of goniometry and WORCQOL questionnaire score

Table 1

Goniometry Pre		
Movement	Ranges	Worcqol Pre 19.382
Flexion	110^0	
Extension	42.857^0	
Abduction	81.714^0	
External rotation	37^0	
Goniometry Post		
Movement	Ranges	Worcqol Post 31.014
Flexion	153.8^0	
Extension	65.286^0	
Abduction	132.86^0	
External rotation	59.857^0	

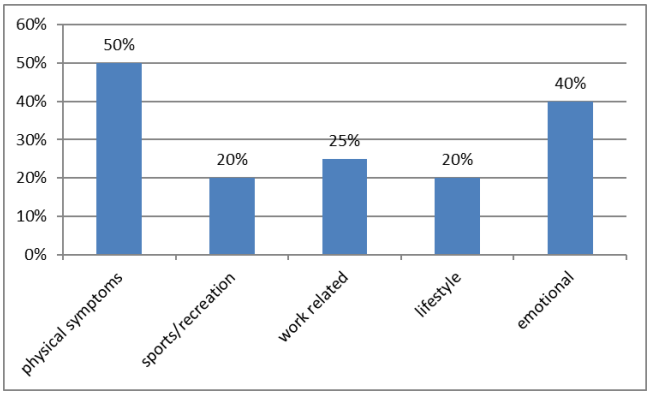

Fig 1: Pre and post treatment mean values of goniometry ranges

Interpretation of differences in mean pre-treatment and post-treatment values of goniometry and WORCQOL questionnaire score

Table 2

Goniometry		Worcqol
Movement	**Ranges**	
Flexion	43.8^0	11.632
Extension	22.429^0	
Abduction	51.143^0	
External rotation	22.857^0	

Interpretation for quality of life using western on tario rotator cuff quality of life questionnaire: pre and post treatment score analysed by paired *t*-test.

Table 3

Scale	Mean	t-value	p-value	Significance
Worcqol PRE	19.382	18.442	<0.0001	Extremely significant
Worcqol post	31.014			

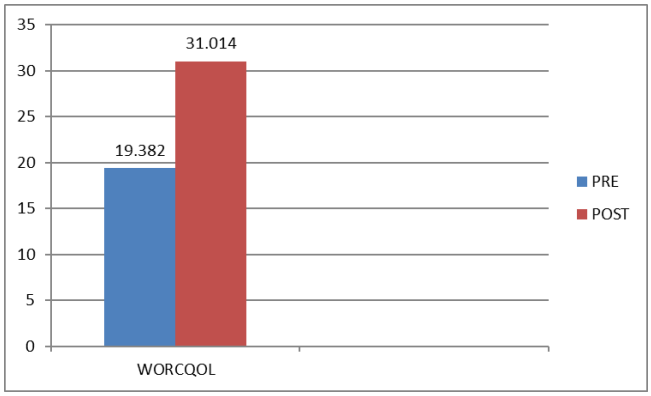

Fig 2: Interpretation for quality of life using WORCQOL questionnaire component wise graphical representation:

Interpretation for range of motion using standard universal goniometer: pre and post treatment score analysed by paired *t*-test.

Table 4

Range of motion	Mean	t-value	p-value	Significance
Flexion PRE	110	20.676	<0.0001	Extremely Significant
Flexion Post	153.8			
Extension PRE	42.857	29.923	<0.0001	Extremely Significant
Extension Post	65.286			
Abduction PRE	81.714	14.574	<0.0001	Extremely Significant
Abduction Post	132.86			
external rotation pre	37.000	24.169	<0.0001	Extremely Significant
External Rotation Post	59.857			

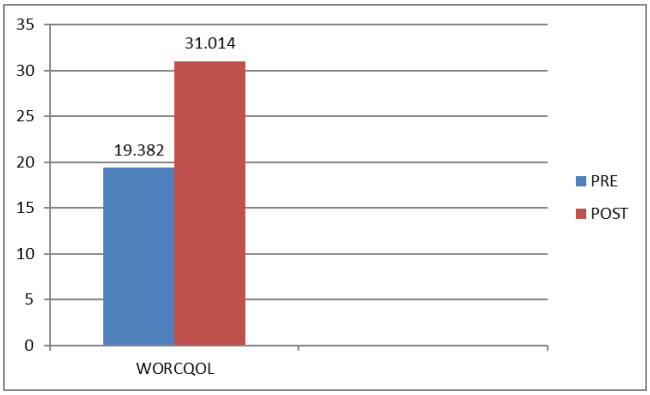

Fig 3: Pre and post treatment mean values of WORC Quality of life questionnaire score:

3. Result

- The difference between PRE and POST were compared and analysed using paired '*t*-test' for both the components.
- Goniometry measures: shows that the p-value <0.0001 which is significant and hence additional laser modality along with the exercises is effective in improving range of motion in non diabetic frozen shoulder patients. (t-values for flexion, extension, abduction and external rotation are 20.676, 29.923, 14.574 and 24.169 respectively).
- Western Ontario rotator cuff quality of life questionnaire score: shows that the p-value <0.0001 which is significant and hence additional laser modality along with the exercises is effective in improving quality of life in non diabetic frozen shoulder patients. (t-value-18.442).

4. Discussion

The present study was done to check the effect of additional laser modality along with exercises on range of motion & quality of life assessed using goniometry score & WORCQOL score respectively in non-diabetic patients with frozen shoulder. In this study both males and females were chosen to be a part of the study since the condition is seen in both genders with greater no. of females compared to males according to article written by Rauoof MA, Lone NA, Bhat BA, Habib S considering Indian patient population. Our present study had participation of total 35 candidates having frozen shoulder among which 12 were male and 23 were female. Since there are various articles along with the one written by Rauoof MA, Lone NA, Bhat BA, Habib S suggesting frozen shoulder secondary to diabetes mellitus we avoided the diabetic group and focussed on patients with primary frozen shoulder since treatment plan for this particular non-diabetic group was not present currently. We found that Laser modality is effective in improving range of motion & quality of life in non-diabetic subjects with frozen shoulder.

In our study Laser modality is significant effective in improving range of motion in non-diabetic subjects with frozen shoulder. Low level laser therapy also known as (LLLT) was given to individuals on the painful points around the shoulder joint capsule which is affected. All the painful points were covered under laser focus for 30 seconds to each point in one session for 2 weeks that is 6 days a week. Laser modality has been proven to be one of the non invasive, thermal modality to reduce pain and disability in various musculoskeletal conditions including frozen shoulder according the article written by Stergioulas A. Stergioulas says that laser gives analgesic effect to the painful points, thus reduces pain. Hence the modality was combined with protocol of strengthening exercises and codman's pendulum exercises and active range of motion exercises. Ranges affected were flexion, extension, abduction and external rotation & thus were performed using resistance of the theraband. Each movement was carried out with 10 sec. Hold & for 10 times per session along with pendular exs. Including shoulder clockwise, anticlockwise, front and back side to side movements. All these exercises were selected as they made shoulder joint move in all possible directions required for individual's daily needs or activities of daily living, and with strengthening by therabands the muscles required for shoulder movements were activated and strengthened. Though exercises were part of the treatment they alone did not show any statistically significant improvement in the past studies as quoted by Carette S, Moffet H, Tardif J, Bessette L, Morin F, Frémont P, Bykerk V, Thorne C, Bell M, Bensen W, Blanchette C where they have said that only exercises did not show any statistical improvement. There are many other articles supporting this statement hence the present study has been done on a single group of subjects for ethical reason of insignificant results obtained with only exercises in a control group.

We have done this study for 2 weeks duration i.e. 6 sessions per week. Hence, to check the long term effects of Laser along with exercises is the future scope for our study. With such few limitations we have completed our study.

Thus, overall findings of this study suggests that two weeks of additional laser modality along with exercises in subjects with frozen shoulder within the age group of 40-60 yrs shows significant effect on range of motion & quality of life. Quality of life of individual was improved under these

five categories according to the questionnaire that is, Physical symptoms (related to affected shoulder), Sports/ recreational activities of an individual, Work or profession related limitations, Lifestyle changes and comfort and Emotional and social aspect. In these five domains physical symptoms were mostly relieved (50%) followed by emotional and social aspect (40%) of the patient. Rest all the components that is Sports/ recreational activities of an individual, Work or profession related limitations, Lifestyle changes and comfort were also improved by 20%, 25% and 20% respectively. The overall WORCQOL score improved from 19.382% to 31.014% with p-value <0.0001 which is considered extremely significant in terms of statistics.

Individual's ranges of motion were also improved. Patients with frozen shoulder mainly have affected four ranges namely flexion, extension, abduction and external rotation according to study done by Rauoof MA, Lone NA, Bhat BA, Habib S. These four ranges play a major role in activities of daily living of an individual. article written by Stergioulas A suggested that laser was effective significantly for reduction of pain and disability but not for improvement of range of motion when used alone. He further asked to check the result for range of motion by using laser with exercises. The result of this combination was mean of range of motion was improved from 110^0 to 153.8^0 for flexion, from 42.857^0 to 65.286^0 for extension, from 81.714^0 to 132.86^0 for abduction and from 37^0 to 59.857^0 for external rotation of affected shoulder. And the values of difference got statistical significance.

Both the necessities of improving range of motion and quality of life of an individual got good results in terms of statistical values as well as patient satisfaction thus considered to be significant with p-value <0.0001.

5. Conclusion

After 6 months of research we have found that, in this study additional laser modality along with exercises show significant effects on range of motion & quality of life in non diabetic frozen shoulder patients since p-values for both the components were <0.0001 which is statistically considered as significant and hence H_1 hypothesis is accepted.

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