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### Comparison of Paraffin Wax Therapy Versus Low Level Laser Therapy in Patients with Trigger Point in Tennis Elbow-A Pilot Study

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#### ABSTRACT

##### Background

Lateral Epicondylitis also known as tennis elbow affects the wrist extensor muscles .Pain occurs due to repetitive microtrauma between 30 and 55 years. It affects 1%-3% of the population and mostly involves the dominant hand with no gender predisposition.

##### Aim

The purpose of the study is to compare Paraffin Wax Therapy (PWT) and Low Level Laser Therapy (LLLT) on pain and grip strength in patients with trigger point in tennis elbow.

##### Method

20 subjects randomly recruited into 2 groups,Group1 given PWT and group 2 given LLLT and both groups also received supervised exercise protocol for 5 days .Pre - Post assessment was carried .Pain and grip strength were assessed using NRS and Hand held Dynamometer .

##### Results

Wicoxon test was used to find pre- post treatment values of NRS. NRS at rest for both the groups p=0.0078 and NRS on activity for group1 was p=0.0039, group 2 p=0.0078 showing significant results .Paired t test assessed pre- post treatment values of grip strength with p=0.2668 of group1 showing no significant results and 0.0009 of group2 suggesting significant results .Mann-Whitney U test compared NRS between the groups with p=0.4401NRS at rest p=0.3236NRS on activity with no significant results .Unpaired t test compared grip strength between the groups with p=0.0432 giving significant results .Conclusion-PWT and LLLT both are equally effective in reducing pain and LLLT alone is effective in improving grip strength in patients with trigger point in tennis elbow.

**Keywords:** Numerical Rating Scale (NRS), Hand Held Dynamometer, Lateral epicondylitis, Grip strength.

## INTRODUCTION

Lateral Epicondylitis commonly known as tennis elbow affects the wrist extensor muscles that originate from the lateral epicondyle of the humerus .Pain occurs as a result of repetitive microtrauma to the musculotendinous unit which results into inflammatory and degenerative tissue damage [1]. It affects 1-3% of the population [2]. It commonly affects the dominant hand [3]. Ninety-five percent of tennis elbow occurs in non-tennis players and ten – fifty percent occurs in regular tennis players [4].This condition occurs mostly in between 30 and 55 years, with risk factors like (playing tennis, playing an instrument, twisting a screw driver or any manual work which includes twisting action of forearm, lifting heavy luggage with the palm down, typing, raking leaves, playing baseball and golfing, gardening and bowling) [2, 4, 5]. Extensor carpi radialis brevis (ECRB) is the most commonly affected muscle [4, 5]. Wrist extensors such as extensor carpi radialis longus, extensor digitorum, extensor digiti minimi and extensor carpi ulnaris and supinators can also get affected in tennis elbow [5]. It is usually a self-limiting condition, with a normal course of 12 and 18 months [4, 5]. In Tennis elbow when the applied load to a tendon increases, the tendon gradually stretches and when the applied load exceed the capacity of the tendon to stretch then microtear occurs in tendon [5].

Trigger points are characterized by hypersensitive, discrete, focal, hyperirritable spots located in a taut band of skeletal muscles [6, 7]. These trigger points are painful on compression and produce referred pain, motor dysfunction, and autonomic phenomena [6, 7, 8] .Active myofascial trigger points are specialized soft tissue restrictions which prevent smooth contraction of the muscle throughout its length [6]. These active trigger points occur in a muscle due to repetitive strain [6]. Tennis elbow occurs due to overuse of the wrist extensors and supinators and thus trigger points commonly occur in supinators and brachioradialis in tennis elbow [6]. Sometimes grip is reduced because of pain [9] and trigger points in supinators, brachioradialis, scalene, infraspinatus produce painful weak grip [8]. Hence there is significant pain, reduced grip strength and loss of function which impairs day to day activities of the patient [1,5,9]. In most of the patients, symptoms resolve with non-operative treatment, physiotherapy and activity modification and patients having persistent symptoms due to a failed well-performed non-operative program has to undergo operative treatment [4, 5, 10]

Tennis elbow is diagnosed clinically as

- Point tenderness at lateral epicondyle [11].
- Any of the following 2 tests are positive- Cozen’s, Mills OR Maudsley’s Test [12].

### Trigger Points vs. Tender Points [7]

<i>Trigger points</i>	<i>Tender points</i>
Local tenderness, taut band, local twitch response, jump sign	Local tenderness
Singular or multiple	Multiple
Occur in any skeletal muscle	Occur in specific locations that are symmetrically located
Produces specific referred pain pattern	Do not produce referred pain, but often cause a total body increase in pain sensitivity.

Kushner and Reid suggested that the force overload implicated in tennis elbow is due to the repetitive strong synergic and fixator role played by wrist extensors during gripping [13]. In 1980, WHO classified tennis elbow as a disability which often limits the work capacity of the affected individual [14] Recent electromyographic studies have supported the concept that ECRB, EDC, ECRL muscles are all activated during gripping and over activation of these muscles in day to day

activities is one of the reasons of reduced grip strength and pain in tennis elbow [13, 14]

### Low Level Laser Therapy (LLLT)

**LASER** is an acronym for “Light Amplification By Stimulated Emission Of Radiation” [15]. The LLLT are used in physical therapy. Diode lasers are commonly made from semiconductive material Gallium and aluminum arsenide which has wavelength from 630 to 1550nm of red to infrared

radiation [15]. In MTP areas, LLLT improves the local microcirculation, increases the supply of oxygen to hypoxic cells and helps to remove cellular metabolic by-products [16, 17, 18, 19, 20]. Once stabilized, the microcirculation breaks the vicious cycle of pain-spasm-pain and patient has relief [16, 17, 18, 19, 20]. Studies have proved that laser is effective in reducing pain in tennis elbow [9, 21, 22, 23] and is effective in improving grip strength in tennis elbow [9, 22]. Studies conclude that laser may be effective in reducing pain in patients with trigger point in tennis elbow [24].

### Paraffin Wax Therapy

PWT is one of the most convenient, reasonable and efficient method of applying conducted heat to the extremities [25]. It produces reflex vasodilatation in the skin as it stimulates superficial capillaries and arterioles [25, 26]. It also has a sedative effect on sensory nerves that gives a soothing effect, increases blood supply to the tissues which provides oxygen and nutritive material and waste products are removed. Hence paraffin wax is the most efficient and reasonable way of applying conducting heat to the distal extremities that reduces swelling, inflammation [25, 26].

### MATERIALS AND METHODOLOGY

Type of study was Pilot study with Simple random sampling method. The study was carried out at Bhausahab Sardesai Talegaon Rural Hospital. 20 men and women were selected for the study with diagnosed tennis elbow with pain at lateral epicondyle, trigger points with positive jump sign found in any of the following muscles-brachioradialis, ECRB, ECRL, EDC, any 2 of the following tests are positive –Cozen's, Mills or Maudsley's test, in the age group 21-55 years. Patients with -Trauma, Cervical Spondylosis, Fracture of the affected hand 1 year back, Rheumatoid Arthritis, Neurologic condition, Radial tunnel syndrome, Frozen shoulder, Cervical radiculopathy, Limitation in the ROM of affected hand, Impairment of sensations, Any skin condition, Any wound at the site where treatment is to be given were excluded from the study. Informed consents were taken from all the subjects and no additional treatment was given during the study period. Subjects were equally divided into two groups: group1 (10 patients PWT was given) group2 (10 patients LLLT was given). On first day, pretreatment NRS and grip strength were measured and then on fifth day post treatment NRS and grip strength were measured and recorded.



(Fig.1) Hand Held Dynamometer

Grip Strength is measured using a Saehan Hand Held Dynamometer. The Saehan Hydraulic Hand Dynamometer is a valid and reliable instrument which is used to measure grip strength. This dynamometer displays grip strength in kilograms and pounds (200 pounds or 90 kilograms is the maximum grip strength). This dynamometer retains the highest reading on peak-hold needle which will remain on the gauge until it is reset. This dynamometer is isometric in use with no perceptible motion of the handles regardless of grip strength which ensures accurate results. The handle adjusts to five grip positions from 3.5cm to 8.6cm, in half inch increments so as to accommodate various size hands.

#### **Standard procedure to measure grip strength**

- Set the adjustable handle to the desired spacing. The handle clip is located at the

lower (furthest) post from the gauge before moving the handle from one position to another.

- Rotate the red peak hold needle counter clockwise to 0.
- Use the wrist safety strap to minimize the chance of dropping the instrument accidentally.
- Test the normal hand followed by the injured hand. Allow the patient to see the readings.
- Patient should sit or stand comfortably with shoulder adducted, elbow flexed to 90 degrees, forearm in neutral position and wrist in neutral position.
- Take three readings with a rest of five minutes in between the each reading and then record the average.



(Fig. 2) Assessment of grip strength using a hand held dynamometer.

#### **Paraffin Wax Therapy [15, 25]**

The temperature of wax is checked with a thermometer in the deeper central part of the bath. The area to be treated is washed and then dried thoroughly to keep water and skin flakes out of wax. The patient is positioned so that the wax can be applied in a comfortable way. Apply few drops of molten wax on dorsal surface of your hand before the wax is applied to the patient so that patient can prepare psychologically and fear of heat

is reduced. 8-10 coats of wax are applied to the area to be treated with a paintbrush using even and rapid strokes in direction medio-laterally and supero-inferiorly. The area is then wrapped in a plastic sheet and then in a towel for 15 minutes. After 15 minutes of application, the wax is removed, cleaned in a purifier and reused. After removal of wax inspect the area for adverse conditions if developed.



(Fig. 3) Paraffin wax applied to the subject by brush method.

### Low Level Laser Therapy [15]

The nature of treatment and the need to wear goggles are explained to the patient. Position the Tech Laser Therapy 302 apparatus and have goggles ready for the patient and operator. Clean the surface of the skin to be treated with an alcohol wipe to remove any material that might absorb or reflect the radiation. Support the part being treated so the patient is comfortable throughout the treatment. The laser applicator is applied to the skin surface before switching on the output. The laser applicator is kept in direct contact with the tissues (1-2 trigger points are treated) and held so that the beam is applied at right angles to achieve maximal

penetration. Switch the device off before removing the applicator from skin contact. Any patient response such as an immediate increase or decrease in pain, are noted and recorded.

Dosage [15, 27]

Duration-11min

Mode-Pulsed

Area-2cm

Length -2cm

Breadth -2cm

Tissue Depth-2cm

Energy Density-3.5j/cm square

Frequency-50Hz



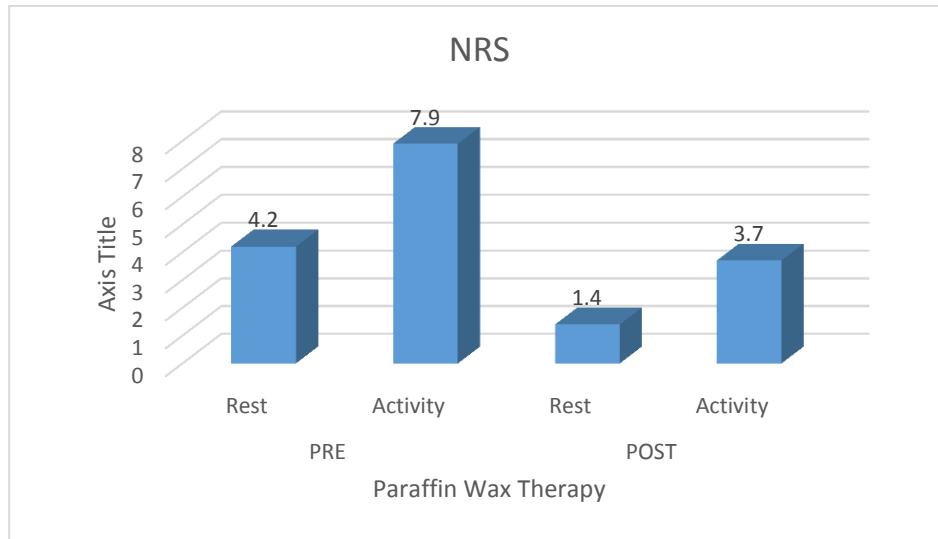
(Fig. 4) Low Level Laser applied to the subject by direct contact method.

Both the groups received supervised exercise protocol [28] - Wrist isometrics Wrist extensors, Wrist flexors radial deviators, Ulnar deviators- Each exercise was given for 5 repetitions with 10seconds hold, Elbow Extensor stretching with 5 repetitions and 30seconds hold.

**RESULTS**

Total of 20 (3males and 27females) subjects were taken which were divided into two groups, group 1 received Paraffin Wax Therapy and group

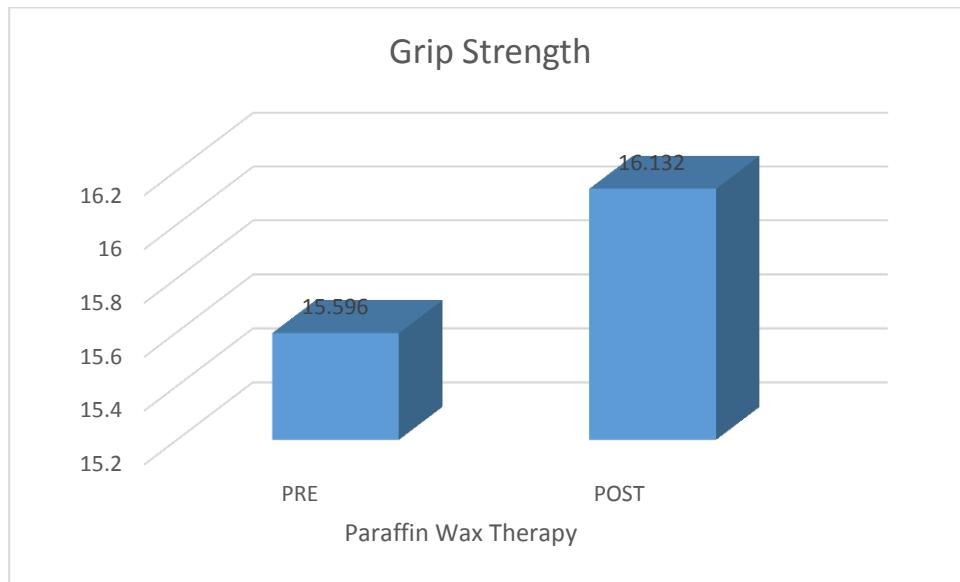
2 received Low Level Laser Therapy. The statistical analysis of pre and post treatment values for NRS within both the groups were calculated using Wilcoxon matched-pairs signed ranks test and comparison between the groups were done using Mann-Whitney U test .The statistical analysis of pre and post treatment values of grip strength within both the groups were done using Paired t test and comparison between the groups were done using Unpaired t test.



**Graph 1: shows Numerical Rating Scale, comparing pre and post treatment NRS score of the group 1 who received Paraffin Wax Therapy.**

NRS		REST	ACTIVITY
Mean	PRE	4.2	7.9
	POST	1.4	3.7
SD	PRE	2.741	2.331
	POST	1.578	1.703
p value		0.0078	0.0039
Results		very significant	very significant

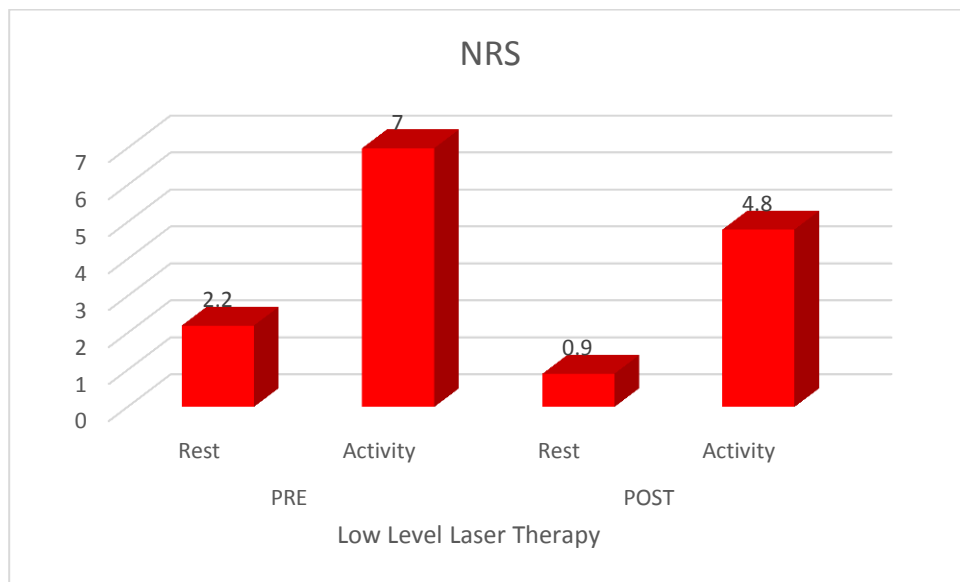
This shows that Paraffin Wax Therapy is effective in reducing pain in patients with Trigger Point in tennis elbow.



**Graph 2: shows Grip strength, comparing mean of pre and post treatment of group1 that received Paraffin Wax Therapy.**

Grip strength	PRE	POST
Mean	15.596	16.132
SD	7.7688	7.4365
P value		0.2668
t value		1.1839
RESULTS		Not significant.

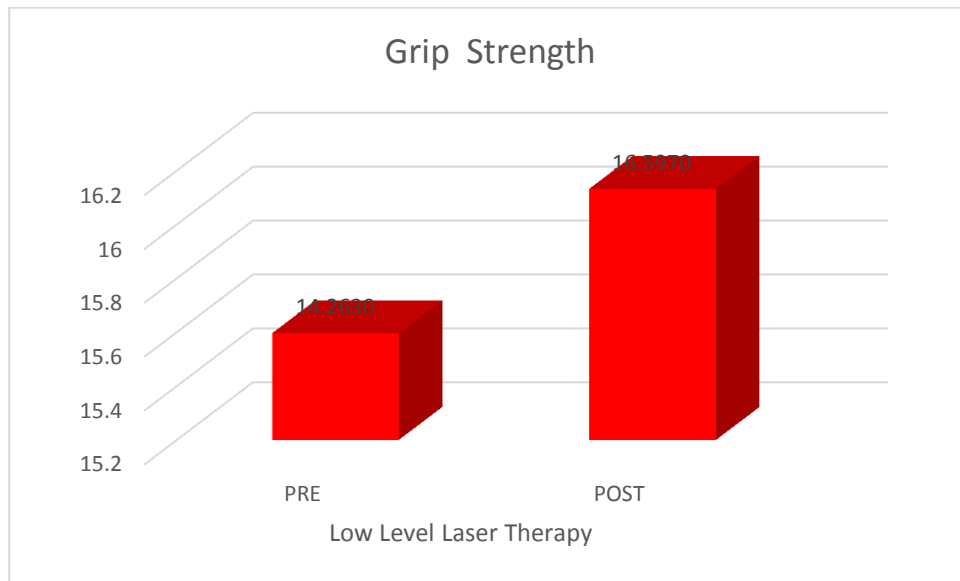
This concludes that Paraffin Wax Therapy did not improve grip strength in patients with trigger point in tennis elbow.



**Graph 3: shows Numerical Pain Rating Scale, comparing pre and post treatment NRS values of group2 that received Low Level Laser Therapy.**

<b>NRS</b>		<b>REST</b>	<b>ACTIVITY</b>
Mean	PRE	2.2	7
	POST	0.9	4.8
SD	PRE	2.044	2.449
	POST	1.663	2.573
p value		0.0078	0.0078
Results		Very significant	Very significant

This concludes that Low Level Laser Therapy is effective in reducing pain in patients with trigger point in Tennis elbow.



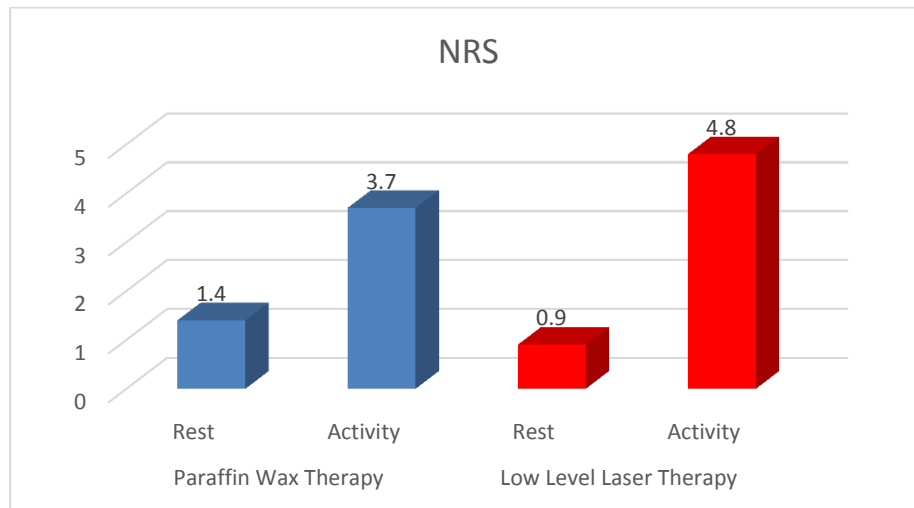
**Level Laser Therapy**

**Graph 4: Shows Grip Strength comparing pre and post treatment of group 2 that received low level laser therapy**

<b>Grip strength</b>	<b>PRE</b>	<b>POST</b>
Mean	14.2630	16.5970
SD	3.8131	3.6324
p value		0.0009
t value		4.8738
Results		significant

This concludes that Low Level Laser Therapy is effective in increasing grip strength in patients with trigger point in tennis elbow.



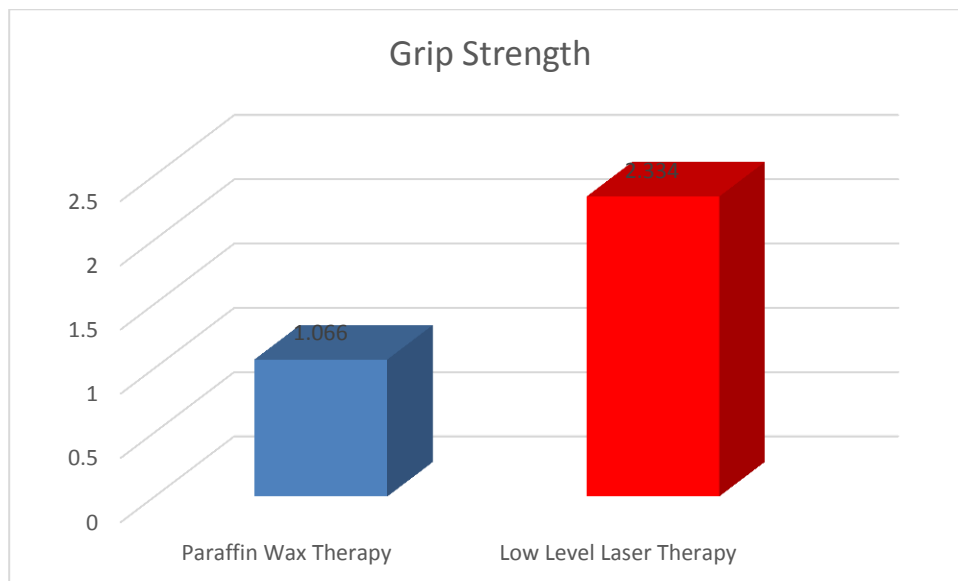


**Graph 5: shows Numerical Rating Scale, comparing post treatment values between the group 1(Paraffin Wax Therapy) and group 2 ( Low Level Laser Therapy).**

		Paraffin Wax Therapy	Low Level Laser Therapy
Mean	Rest	1.4	0.9
	Activity	3.7	4.8
SD	Rest	1.58	1.66
	Activity	1.7	2.57
p value	Rest		0.4401
	Activity		0.3236
Results			not significant

This concludes that Paraffin Wax Therapy and Low Level Laser Therapy both are equally

effective in reducing pain in patients with trigger point in tennis elbow.



**Graph 6: shows grip strength, comparing the difference of mean of post treatment in between both the groups.**

Grip Strength	Paraffin wax	Low Level Laser
Mean	1.0660	2.3340
SD	1.0518	1.5144
p value		0.0432
t value		2.1747
Results		significant

This concludes that Low Level Laser Therapy is better than Paraffin Wax Therapy in increasing grip

## DISCUSSION

PWT and LLLT both along with supervised exercises are equally effective in reducing pain and LLLT along with supervised exercises is alone effective in improving grip strength in patients with trigger point in tennis elbow. The results of the present study show that, the pre and post-treatment scores of NRS on rest, of group 1  $p=0.0078$  and of group 2  $p=0.0078$  showing significant results and the pre and post treatment scores of NRS on activity, group 1  $p=0.0039$  and that of group 2  $p=0.0078$  which are significant showing that both are effective in reducing pain in patients with trigger point in tennis elbow. NRS values were compared between the groups shows no significant results concluding the null hypothesis for pain. As stated in the book Forster and Palastanga Clayton's Electrotherapy theory and practice eighth edition paraffin wax has following physiological effects - A marked increase in skin temperature in the first two minutes and later in subcutaneous fascia and superficial muscles respectively occurs at the end of treatment. This heat vasodilates the superficial capillaries and arterioles in skin causing local hyperemia. The hyperemia occurs due to the response of skin to its heat regulation and reflex heating occurs in the joints. The moist heat of wax has sedative effect on sensory nerves which is soothing to the patient and exercise after the application of wax helps in increasing muscle circulation. These physiological effects of wax support the results of the study that paraffin wax alone is effective in reducing pain in patients with trigger point in tennis elbow [25, 26].

The pre and post treatment values of grip strength was measured with  $p=0.2668$  for group 1 which is not significant and  $p=0.0009$  for group 2 which is significant concluding that Paraffin wax

strength in patients with trigger point in tennis elbow.

Therapy is not effective but Low Level Laser Therapy is effective in improving grip strength. When both the groups were compared for grip strength  $p=0.0432$  shows significant results suggesting that low level laser therapy is only effective in improving grip strength. The photon penetration is less as there is high water content in blood [29]. When laser is applied directly by contact method, firm pressure is created which displaces capillary blood flow temporarily, this helps in more photon penetration [29]. Laser improves local microcirculation, supplies oxygen to hypoxic cells in the trigger point, removes metabolic by-products and thus helps in soft tissue repair and relieving pain. It also stimulates decrease in Bradykinin along with activity in 'c' fibers which results in pain relief. [23]. Trigger points usually demonstrate lower skin resistance as compared to the surrounding tissue, application of 904nm laser significantly increased pain thresholds when given over trigger points which concluded that laser is effective in reducing pain and improving grip strength in patients of tennis elbow [9]. LLLT is effective in reducing pain and improving grip strength in lateral epicondylitis [22]. Application of LLLT on myofascial trigger points in lateral epicondylitis could effectively improve therapeutic effects [24]. As stated in the book Electrotherapy for Physiotherapists Virendra Khokkar second edition, Infrared light is absorbed at the cell membrane. Laser stimulates increase in macrophages, fibroblasts, endotheliocytes, Keratinocytes that helps in repair of the tissues. It also stimulates increase in serotonin resolving inflammation and pain. Laser helps in repair of the tissues by angiogenesis, collagen synthesis and increase in myofibroblast activity. These may be the reasons due to which Low Level Laser Therapy was equally effective in reducing pain and was

better than Paraffin Wax Therapy in improving grip strength in patients with trigger point in tennis elbow.

## CONCLUSION

As per the statistical analysis, interpretation and results obtained from the present study it is concluded that Paraffin Wax Therapy and Low Level Laser both are equally effective in reducing pain and Low Level Laser Therapy is only effective in improving grip strength in patients with trigger point in tennis elbow.

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## List of abbreviations

- PWT-Paraffin Wax Therapy.
- LLLT-Low Level Laser Therapy.
- NRS-Numerical pain rating scale.
- ECRB-Extensor Carpi Radialis Brevis.
- ECRL-Extensor Carpi Radialis Longus.
- EDC-Extensor Digitorum Communis.

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**Conflicts of Interest-** None

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