



Original Research Article

Early Effects of Dry Needling and Low Level Laser Therapy in Chronic Tennis Elbow- An Experimental Study

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ABSTRACT

Background: Tennis elbow or lateral epicondylalgia is a common painful condition of elbow which leads to pain over common extensor origin, muscle weakness, and reduction in upper limb function.

Objective: To study and compare the early effects of dry needling and low level laser therapy in chronic tennis elbow.

Methods: 36 patients diagnosed with unilateral tennis elbow were equally allocated in two groups. 18 patients were treated with dry needling and another group of 18 patients were treated with low level laser therapy for two weeks duration. Patient rated tennis elbow evaluation questionnaire was used to evaluate the pain and disability of elbow joint.

Statistical Methods and Results: Qualitative data was described in form of median and percentiles and quantitative data was described in mean and standard deviation and analysed using Paired and Independent 't' test. Paired 't' test results for PRTEE score in dry needling and low level laser therapy shown reduction pain and disability of elbow ($p=.000$). The between group comparison using independent 't' test was not suggested any significant difference ($p=.517$) between the dry needling and low level laser therapy intervention.

Discussion: Both dry needling and low level laser therapy patients was considered to be equally effective in tennis elbow. However, after the first week of intervention dry needling group was subjectively reported quick reduction tenderness over extensor origin. Further study with repeated measures may need to report the early effects of dry needling over LLLT.

Conclusion: Dry needling and low level laser therapy may produce early therapeutic effects in chronic tennis elbow.

Key words: dry needling, tennis elbow, lateral epicondylalgia, low level laser therapy.

INTRODUCTION

Tennis elbow or lateral epicondylalgia is a painful and debilitating musculoskeletal condition and about seven out of 1000 population per year attending general practitioners. [1,2] The term tennis

elbow was first used over century ago to describe a painful condition observed in English lawn tennis players, [3] and it (lateral epicondylitis) was reported to be 6 times more common than medial epicondylitis, and also right sided epicondylitis was found

to be twice as common as left sided epicondylitis. [4] prevalence for tennis elbow of 1% in men and 4% in women for the population aged between 20 and 80, [2] and the incidence of tennis elbow has been reported in the general population to be 1-3%, [1,5-7] and it has been reported to be four time more common in the fourth decade of life. [8] Chronic tennis elbow is probably the most common problem treated in the orthopaedic office, [9] and physiotherapy department and it can produce a long lasting and severe medical condition, [9,10] which may lead to economic consequences. [11]

The common causes for occurrence of tennis elbow have been reported by various researchers. The onset of symptoms may be preceded by overextension of the wrist extensor muscles due to repetitive gripping and twisting motion, which are beyond the adaptive capacity of the tissue. [12] Cyriax has reported that these painful contractions will result in irritation and partial tears of the involved musculature and also he has hypothesized that the site of maximal tenderness is the site of injury and muscle ruptures most easily at its attachment to the bone rather than at the musculo-tendinous junction or the muscle belly. [13] Goldie found that degenerative tear of the attachment of the extensor carpi radialis brevis to the distal aspect of the lateral epicondyle to be the primary cause of tennis elbow. [14]

Histopathology examination of samples obtained from patients with chronic refractory lateral epicondylitis showed vascular proliferation and focal hyaline degeneration which is consistent with a degenerative rather than an inflammatory process. [15] Recent studies have been reported that myofascial trigger point formation in wrist extensor muscles may produce referred pain down the extensor aspect of the forearm and it may alter the

biomechanical aspect of the elbow and upper limb function in chronic tennis elbow.

Patients with lateral epicondylitis have tenderness over the lateral epicondyle of the elbow or over the origin of the extensor carpi radialis brevis. [6,10,16] Patients may often complain of burning pain radiating to the forearm, [3] and is usually increased in response to extension of elbow, by gripping, heavy lifting and simple tasks of daily life. [11,17] On clinical examination of tennis elbow shows tenderness over palpation at the anterior aspect of the lateral epicondyle, pain on passive stretching at the wrist with the elbow held in extension and the forearm prone, and pain on persisted extension of the wrist while the elbow held in extension and forearm in prone. [18]

Lateral epicondylitis is treated with both conservative and surgical treatment methods based on the clinical and pathological findings. Conservative treatment of tennis elbow mainly focussed on the basis of control of inflammation, promotion of healing, rehabilitation, prevention of recurrence. [16,19] Cryotherapy, pharmacological agents has been widely used as a conservative method to reduce pain and active inflammation. Therapeutic ultrasound is one of the commonest accepted conservative physiotherapeutic treatment methods to reduce pain and promote healing in lateral epicondylitis. Ultrasound is used as effective deep heating modality to increase extensibility of collagen tissue, reduce muscle spasm, increase blood flow, and assisting in mobilisation of inflammatory infiltrates, oedema and exudates. Laser therapy has been used to treat the tennis elbow to accelerate collagen synthesis, increase vascularisation, and reduction of pain and inflammation. The effects of low power laser are occurring at a cellular level. [20]

Oral anti inflammatory agent, classical acupuncture, local superficial

needle insertion, deep friction massage, trigger point therapy are used as treatment methods to treat tennis elbow. Studies were proven that classical acupuncture treatment is more effective than steroid injection. [21] The analgesic effects of acupuncture can be attributed partly to the release of endorphins, [22,23] and increased 5-hydroxy tryptamin level in the cerebrum. [24]

Dry Needling is a physical therapy modality used in conjunction with other interventions to treat myofascial pain and dysfunction caused by trigger points. Myofascial trigger points (MTrPs) are defined as hyperirritable nodules located within a taut band of skeletal muscle. [25] Palpation of a MTrPs produces local pain and sensitivity, as well as diffuse and referred pain patterns away from the affected area. Painful MTrPs activate muscle nociceptors that, upon sustained noxious stimulation, initiate motor and sensory changes in the peripheral and central nervous systems. [26]

Dry needling is a minimally invasive treatment technique used mainly to deactivate myofascial trigger points in different parts of the muscle and it can be used to achieve one of three objectives. First, trigger point dry needling can confirm a clinic diagnosis by relieving the patient's pain or symptoms of nerve entrapment. Second, inactivation of MTrPs by needling can rapidly eliminate pain in an acute pain condition. Third, inactivation of the MTrPs through needling can relax the taut band for hours or days in order to facilitate other therapeutic approaches such as physical therapy and self stretching. [27]

The advantages of dry needling are increasingly documented and it is helpful in immediate reduction of local, referred, and widespread pain, [28,29] restoration of range of motion and muscle activation patterns. [30,31,33] Deep Dry Needling has been shown to inactivate TrPs by eliciting local twitch

responses, [32,35] which are modulated by the central nervous system. [36,37] A Local Twitch Response is a spinal cord reflex that is characterized by an involuntary contraction of the contracted taut band [34] which can be elicited by a snapping palpation or penetration with a needle. [38] A retrospective pilot study result shown standalone trigger point dry needling is more effective in reducing pain symptoms compared to dry needling with autologous plasma injection in refractory lateral epicondylitis.

Low-Level Laser Therapy (LLLT) is the use of red and near-infrared monochromatic light to enhance the body's natural healing processes. The light source is placed in contact with the skin, allowing the light energy (photons) to penetrate tissue where it interacts to increase circulation and help restore normal cellular function. LLLT does not break the skin as do surgical lasers. The low-energy laser pulses can be adjusted to penetrate more deeply and more aggressively into the skin tissue, depending on the condition and goals of treatment. The light energy, which can be delivered by either a large device that emits multiple laser panels at once or a hand-held device for smaller targeted areas, will pass through the skin layers to reach the cells and tissue causing the reduction in pain and inflammation. The laser device is held against the skin over the area being treated. The light energy is absorbed and converted to biochemical energy, which stimulates the cells. That activates the natural healing process of the cells, which reduces pain, increases blood flow, and stimulates repair of the tissue. [39]

LLLT is a laser or LED light therapy that improves tissue healing in case of skin wounds, muscle, tendon, bone, nerves injuries and it helps in reduces inflammation, [40] and pain. Treatments duration typically range between take 1 - 10

minutes and should be applied two or more times a weeks. The World Association of Laser Therapy (WALT) guidelines suggest daily treatment for 2 weeks or treatment every alternative day for 3-4 weeks to reduce inflammation. There are a few contra-indications and precautions to consider prior to under-going low level laser therapy. Some of the contra-indications include laser to the eyes (eye protection is required), pregnancy (laser over the uterus area), tumours, haemorrhage, and laser to the cardiac region of patients with heart disease. Precautions include infections, history of epilepsy, altered or impaired sensation, and the testicular region.

Low level laser therapy works predominately on a protein in mitochondria to increase ATP and reduce oxidative stress. A cascade of mitochondrial and intracellular downstream effects leads to improved tissue repair and reduced inflammation. Higher power density LLLT $>300\text{mW}/\text{cm}^2$ inhibit fibroblast activity, ^[41] collagen fibre production, ^[42] and also it reduces ATP production in C and A delta fibre resulting in an immediate neural blockade lasting up to approx 24 hr and high power density is necessary for analgesia and deep tissue targets, low power density ($< 100\text{mW}/\text{cm}^2$) is necessary to promote healing and reduce inflammation in superficial wounds, tendons and joints. There are researches studies were suggest low level laser therapy is an effective intervention to achieve therapeutic effects like reducing pain and promote healing. ^[43] Laser therapy combined with bracing, therapeutic exercises also helpful in reducing symptoms of tennis elbow. ^[44,45] A Meta analysis study results suggesting low level laser therapy and trigger point dry needling are effecting in treating lateral epicondylalgia. ^[46]

Aims and objectives:

In several studies dry needling technique and low level laser therapy were applied combined with other physical therapy interventions. But very few studies were reported the effects of standalone trigger point dry needling and low level laser therapy in tennis elbow. The aim of this study was conducted to study and compare the early effects of standalone dry needling over low level laser therapy in relieving pain and improve elbow function in individuals with chronic tennis elbow.

MATERIALS AND METHODS

36 subjects diagnosed as lateral epicondylitis were selected using convenient sampling method during the period between September 2013 and September 2014 from the department of physiotherapy, Justice K.S. Hedge Charitable Hospital, Mangalore, India. After fulfilling the inclusion and exclusion criteria, all 36 subjects were given consent form for their willingness to participate in the study and they were randomly allocated in two groups, 18 subjects in each group. Patients in group one (7 male, 11 female) received dry needling intervention 2-3 session per week for two consecutive weeks and patients in the group two (6 male and 12 female) have received low level laser therapy 5 session in a week for two weeks duration. Pre and post intervention assessment was taken on day one and at the end of two weeks respectively for pain and elbow function using patient rated tennis elbow questionnaire.

Selection criteria:

Inclusion criteria:

- Individuals diagnosed with lateral epicondylitis
- PRTEE score minimum 30 out of 100
- Age between 20-80 years irrespective of gender

Exclusion criteria:

- Recent history of fracture and dislocation of ipsilateral upper limb

- Recent orthopaedic surgeries
- Degenerative arthritis of the elbow joint
- Infection and tumour in the elbow joint
- Cervical nerve root compression
- Restricted neck movement
- Radial tunnel syndrome
- Entrapment neuropathies of forearm and wrist joint
- Diabetic neuropathies
- Rheumatoid arthritis
- Post stroke hemiplegics
- Needle phobia
- Haemophilia
- Immune compromised individuals
- Pregnancy
- Epilepsy

Outcome measurement: pain and elbow function was measured by the PRTEE, formerly known as the Patient-Rated Forearm Evaluation Questionnaire (PRFEQ), is a 15-item questionnaire designed to measure forearm pain and disability in patients with lateral epicondylitis. The PRTEE allows patients to rate their levels of tennis elbow pain and disability from 0 to 10, and consists of 2 subscales. PAIN subscale (0 = no pain, 10 = worst imaginable) has 5 items and FUNCTION subscale (0 = no difficulty, 10 = unable to do) measure both Specific activities (6 items) and Usual activities (4 items). In addition to the individual subscale scores, a total score can be computed on a scale of 0-100 (0 = no pain and disability, 100 is worst pain and maximum disability of elbow), where pain and functional problems are weighted equally. Elbow pain and disability of patients in the dry needling and low level laser therapy group measured by PRTEE questionnaire on the day one before starting of intervention and at the end of two weeks post intervention.

Procedure of interventions: *Dry needling:* Patients those who are allotted for dry needling intervention were positioned in

supine or sitting and the forearm mid prone position. Maximum tender part of the elbow extensor origin was selected and a sterilised 1 inch length thin solid acupuncture dry needles were inserted into the muscular attachment just few cm distal to the lateral epicondyle. The dry needle was kept remain for 1-2 minutes and then it was removed from the muscle. This procedure was carried out for two or three days in a week for consecutive two weeks. Apart from the static dry needle manipulation over the extensor muscle origin we palpated the entire length of the muscle to identify myofascial trigger points and those trigger points were deactivated with myofascial trigger point dry needling technique. After the dry needling procedure over the muscle attachment and myofascial trigger points of muscle belly and musculo-tendinous junction the areas were examined for post needling bleeding. But, we didn't find any adverse effects like external bleeding from the needle insertion area in all 18 patients treated with dry needling intervention.

Low level laser therapy: 18 Patients in another group was treated with low level laser therapy 5 days in a week for two consecutive weeks. All subjects participated in low level laser therapy intervention group were explained the precaution and benefits of the laser therapy. After the precautionary measures the patient's elbow was positioned in prone and adequately supported by pillows underneath the forearm. Maximum tender spots over common extensor origin were selected for the laser beam application. In 12 patients we found tender spots over 2-3 cm distal to the common extensor origin while doing physical examination. And also we found tender spots over the lateral epicondyle and 1 cm distal to the common extensor origin in 6 patients. After the selection of tender spots the laser beam with help of handheld probe device or applicator was applied over the common extensor

origin of elbow joint few centimetres distal to the lateral epicondyle of humerus. The following treatment parameters are used.

Instrument and dosage selection:

Type of laser equipment: LASERMED 2100
 Type of laser: low level laser therapy (100% pulsed)
 Frequency: 1000 Hz (2mW)
 Time duration: 3-5 minutes (0.15J/cm²)
 Frequency of intervention: weekly 5 days for 2 consecutive weeks.

Statistical Analysis:

The description of data was expressed in mean and standard deviation for quantitative variables and median and percentiles was used for qualitative variables. Because of normal distribution of sample data the Paired and Independent ‘t’ tests (Parametric Test) were selected for within and between group data analysis for patient rated tennis elbow evaluation questionnaire score respectively. Paired and independent ‘t’ test were performed at 95% confidence interval and 5% alpha level.

RESULTS

There are 36 patients with mean age of 43.55 and 41.22 were treated with dry needling and low level laser therapy respectively. Among 36 patients, 18 individuals (38.88% male, 61.12 female) treated with dry needling and another 18 individuals (33.33% male, 66.67% female) treated with low level laser therapy. Descriptive statistics of pain score in patients treated with dry needling shown the difference (29.33±4.74) in between pre (35.83±4.73) and post intervention(6.50 ±.85) and subjects treated with low level laser therapy also shown the difference (28.33± 6.18) in between the pre (37.50± 5.59) and post intervention (9.16±3.12). Functional score in dry needling group showed the difference (22.91±3.55) in between the pre (28.97±4.20) and post

(6.05±1.92) intervention and functional score in LLLT group also shown the difference (22.36±3.51) between pre (30.75±3.14) and post (8.38±1.33) intervention. Total PRTEE score in patients treated with dry needling shown the absolute difference (52.25±6.64) between pre (64.80±7.56) and post (12.55±2.52) intervention and patients treated with low level laser therapy also shown the reduction (50.66±7.80) in the post intervention functional score (17.55±3.48) from pre (68.22± 6.84) intervention.(Table 1)

Table 1: Descriptive characteristics of variables

Variables n=36	Dry Needling (N=18) Mean ± SD	Low Level Laser Therapy (N=18) Mean ± SD
Age	43.55 ± 10.67	41.22 ± 10.90
Gender	Male	7(38.88%)
	Female	11 (61.12%)
Side	Right	10 (55.56%)
	Left	8 (44.44%)
Pain	Pre	35.83 ± 4.73
	Post	6.50 ±.85
	Pre-Post	29.33 ± 4.74
Function	Pre	28.97± 4.20
	Post	6.05 ±1.92
	Pre-Post	22.91 ± 3.55
PRTEE	Pre	64.80 ± 7.56
	Post	12.55 ± 2.52
	Pre-Post	52.25 ± 6.64

Inferential statistical results of within group comparison in between the before and after treatment shown the mean difference of 29.33 for pain score, 22.91 for functional score and 52.25 for total score of PRTEE. These statistical mean difference shown the statistical significance (p=0.000) for 95% confidence interval in patients treated with dry needling intervention. And the results of within group comparison of before and after treatment in the low level laser therapy also shown the mean difference of 28.33 for pain score, 22.36 for functional score and 50.66 for the total score of PRTEE also shown the statistical significance (p=0.000) for 95% confidence interval. (Table 2)

Table 2: inferential statistics of Paired ‘t’ test for patient rated tennis elbow questionnaire in subjects treated with dry needling (DN) and low level laser therapy (LLLT).

Paired variable (Pre – Post)	Mean difference	Standard deviation	95% CI		t- value	p-value	
			Lower	Upper			
DN	Pain	29.33	4.74	26.97	31.69	26.25	.000
	Function	22.91	3.55	21.14	24.68	27.36	.000
	PRTEE	52.25	6.64	48.94	55.55	33.33	.000
LLLT	Pain	28.33	6.18	25.25	31.40	19.44	.000
	Function	22.36	3.51	20.61	24.11	26.96	.000
	PRTEE	50.66	7.80	46.78	54.54	27.55	.000

Inferential statistical results of between group comparisons of pain score in dry needling (22.91) and low level laser therapy (22.36) was shown the mean difference of .555. Comparison of functional score between dry needling (29.33) and low level laser therapy (28.33) shown the mean difference (1.00). Inferential statistical results of between group comparisons of total score of PRTEE questionnaire in dry

needling (52.25) and low level laser therapy (50.66) was shown the mean difference of 1.58. Therefore, very minimal difference were observed between the two groups and there was no statistical significance detected for pain (p=.545), function (p=.545), and total PRTEE score (p=.517) when these two interventions were compared using Independent ‘t’ test (Table 3).

Table 3: Inferential statistics of Independent ‘t’ test for comparing scores of patient rated tennis elbow questionnaire in subjects treated with dry needling and low level laser therapy.

Variable	Group	Mean	Standard Deviation	Mean Difference	95% CI		T- Value	P-Value
					Lower	Upper		
Pain	DN	22.91	3.55	.555	-1.83	2.95	.471	.640
	LLLT	22.36	3.51					
Function	DN	29.33	4.74	1.00	-2.73	4.73	.545	.590
	LLLT	28.33	6.18					
PRTEE	DN	52.25	6.64	1.58	-3.32	6.49	.655	.517
	LLLT	50.66	7.80					

DISCUSSION

Tennis elbow or lateral epicondylitis is more common in female than male population and the occurrence of tennis elbow in the dominant upper extremity side which is correlates with previous studies.^[2,4] Both male and female individuals are developing tennis elbow in late 30’s and early 40’s of their life span. Pre and post intervention mean scores of pain and functional subscale as well as total PRTEE questionnaire in patients those who treated with dry needling and low level laser therapy were suggesting both intervention are effective in reducing pain and improving elbow function for the two weeks of intervention. Moreover, 13 out of 18 patients were treated with dry needling have experienced immediate pain relief and

functional recovery after the 2-3 session (1 week) of dry needling procedure. But after the two weeks of intervention the study results did not show any significant difference between the dry needling and low level laser therapy treatment. So, it’s essential to conduct a further study with lesser duration or longer duration with repeated measurement to confirm the early effects of dry needling over low level laser therapy in individuals with chronic tennis elbow.

CONCLUSION

Based on this study results we conclude that both dry needling and low level laser therapy are equally effective in reducing pain and functional recovery in

patients with tennis elbow after the two weeks of intervention.

Limitation of the study:

1. Even though this study results shows the positive results of dry needling and low level laser therapy in treating tennis elbow, still further larger sample size studies with repeated measurement is needed to study the early effects of dry needling over low level laser therapy.
2. This study was not carried out the follow-up assessment to know the sustainability of obtained therapeutic effects after the dry needling and low level laser therapy intervention.
3. This study also conducted with single outcome measure (PRTEE) which consists of pain and functional components of elbow, but wrist extensor muscle strength and hand grip power were not measured and analysed.

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