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Comparative Study to Assess Effectiveness of Local Corticosteroid Injection Therapy V/S Low Intensity Ultrasound Therapy in Treating Refractory Lateral Epicondylitis

Mithilesh AN[1]*, Priyambada K[2] and Nitin SP[3]

[1]Senior Resident, Department of Orthopaedics, Krishna Institute of Medical Sciences, India

[2]Senior Resident, Department of Orthopaedics, Krishna Institute of Medical Sciences, India

[3]Professor, Department of Orthopaedics, Krishna Institute of Medical Sciences, India

***Corresponding author:** Dr. Mithilesh A Nikam, Senior Resident, Department of Orthopaedics, Krishna Institute of Medical Sciences, NH4, Pune - Bangalore Highway, Agashivnagar, Malkapur, Maharashtra 415539, India, Email: mithinikam@gmail.com

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Abstract

Introduction: Although the name "tennis elbow" is widely used (albeit informally), the ailment is not limited to tennis players. It usually manifests between the ages of 35 and 50 years, and shows no sex predilection. Extensor carpi radialis brevis muscle fibrosis and microtears are noted due to overuse or recurrent wear and tear at its tendinous origin. The most common complaint in individuals with lateral epicondylitis is pain over the lateral aspect of the elbow. The choice of therapy for each case is based on the patient's needs and the physician's protocol. The core of treatment is conservative care, with improvements recorded in up to 95% of cases. In cases of recalcitrant lateral epicondylitis, local corticosteroid injections and regenerative techniques such as low intensity ultrasound therapy (LIUST) are becoming increasingly popular. The goal of this trial was to assess the effectiveness of Low Intensity Ultrasound therapy (LIUST) and local corticosteroid injection in treating refractory cases of lateral epicondylitis.

Materials and Methods: 52 patients, fulfilling the inclusion and exclusion criteria were included in the study, and were randomly divided in to two groups; Group I received local corticosteroid injection (n=26) while Group II was treated with locally directed low intensity ultrasound therapy (n=26). Patients were evaluated at 2, 6 and 12 weeks after treatment. Evaluation was done using VAS score and Patient Related Tennis Elbow Evaluation (PRTEE). Intergroup comparisons were made using the unpaired student's t-test for normally distributed variable. All hypothesis tests were two-tailed. A value of $p<0.05$ was considered statistically significant.

Results: In the steroid group, mean VAS score at 2 week, 6 weeks and 12 weeks was 4.38, 4.92 and 5.77 respectively. In LIUST group, mean VAS score at 2 weeks, 6 weeks and 12 weeks post treatment was 1.43, 1.83 and 2.07 respectively. The mean VAS score was significantly better in the LIUST group at all three follow ups ($p <0.05$). The mean PRTEE score in steroid group was 51.69, 55.96 and 61.80 at 2 weeks, 6 weeks and 12 weeks post treatment and that in the LIUST group was 41.07, 43.57 and 45.77 at 2weeks, 6 weeks and 12 weeks post completion of treatment. The mean PRTEE score was thus significantly better in the LIUST group as compared to steroid group ($p<0.05$).

Conclusion: It is safe to conclude from the present study that both corticosteroids and low intensity ultrasound therapy are effective modalities in treating refractory lateral epicondylitis. However, as steroid injection works by alleviating symptoms only, its benefits are short lasting as compared to LIUST.

Keywords: Tennis Elbow; Lateral Epicondylitis; Corticosteroids; LIUST; VAS Score; PRTEE Score

Abbreviations: LIUST: Low Intensity Ultrasound Therapy; PRTEE: Patient Related Tennis Elbow Evaluation; MRI: Magnetic Resonance Imaging; OCD: Osteochondritis Dissecans; PIN: Posterior Interosseous Nerve; PRP: Platelet Rich Plasma; SD: Standard Deviation.

Introduction

Although the name "tennis elbow" is widely used (albeit informally), the ailment is not limited to tennis players. The medical name "lateral epicondylitis" has been most widely used to describe the ailment. It is a common musculoskeletal condition that affects 1-3% of the adult world population, with 2-23% of those affected belonging to the working class who engage in activities that require extensive extension motions at the wrist [1]. It usually manifests between the ages of 35 and 50 years, and shows no sex predilection [2]. As the specific cause is unknown, numerous theories implying the involvement of ageing, chemical, vascular, hormonal, and genetic variables have been proposed [3]. Extensor carpi radialis brevis muscle fibrosis and microtears are caused by overuse or recurrent wear and tear at its tendinous origin [4]. In cases of lateral epicondylitis, Nirschl [5] divided lesions secondary to tendinous microtrauma into four stages. The first stage showed typical inflammatory changes that were reversible. Irreversible angiofibroblastic degeneration characterises the second stage. The third stage was characterised by tendinosis along with rupture of the ECRB origin. Chronic secondary changes such as fibrosis and calcification marked the fourth stage. The most common complaint in an individual with lateral epicondylitis is pain over the lateral aspect of the elbow, which occurs more frequently in the dominant upper limb, and worsens with activities involving wrist extension, gripping, or lifting heavy weight. The pain may range from a little throbbing to excruciating anguish, although passive movements are usually pain-free [6]. Diagnostic clinical tests such as The Thompson test, the chair test, and decreased grip strength are commonly used to identify lateral epicondylitis [7]. In some circumstances, imaging modalities such as musculoskeletal ultrasonography have been used [8].

One of the most important methods for diagnosing or ruling out LE is ultrasound. Structural changes in the affected tendon (most commonly ECRB) can be visualised; such as thickening, thinning, intra-substance degenerative regions, and tendon rips, as well as bone irregularities and calcific deposits. Colour Doppler exploration can also be used to assess neovascularization [9]. Magnetic resonance imaging (MRI) is more consistent, minimises inter-operator variability, and provides more information on intra-articular abnormalities. Unfortunately, the severity of clinical symptoms is not well correlated with MRI findings, and it is an expensive modality to employ routinely for such a common ailment. T2 weighted MRI scans in an acute setting of tendinitis demonstrates oedema around the inflamed tendon insertion [10]. Pathologies that resemble the symptoms of lateral epicondylitis, such as cervical radiculopathy, osteochondritis dissecans (OCD), intra-articular plica, radio-capitellar arthritis and radial tunnel syndrome, must be identified and differentiated [11]. Cervical radiculopathy causes pain in the arm, elbow, and forearm, and the compressive pathology can be verified by magnetic resonance imaging (MRI) [12]. Posterior interosseous nerve (PIN) entrapment, also known as radial tunnel syndrome, causes neuropathic pain in the lateral forearm. However, pain is not reproduced by wrist extension. As the supinator is one of the possible locations of PIN compression, resisted supination might cause pain. An anaesthetic block of PIN can be considered diagnostic of the pathology, albeit it is primarily an excluding diagnosis. Nerve conduction investigations in these patients are almost always normal [12,13].

The choice of therapy for each case is based on the patient's needs and the physician's protocol. During stressful activities, excessive internal tendon strain must be avoided. It is possible to achieve this by enhancing tissue extensibility. Until the muscular tendon complex is sufficiently extensible, no intense activities are permitted. Tennis Elbow is treated using RICE Therapy, which consists of Rest, Ice, Compression, and Analgesics. The primary line of management in the therapeutic treatment of this ailment is NSAIDs, or Non-Steroidal Anti-inflammatory Drugs. The core of treatment is conservative care, with improvements recorded in up to 95% of cases [14]. However, nonsteroidal anti-inflammatory pharmacotherapies can have a detrimental effect on soft tissue repair as well as the gastrointestinal and renal systems. For several patient lifestyles, traditional rest, and time-off, continuous use of an epicondylar counterforce brace and elevation therapy may not be practical. In refractory cases, percutaneous radiofrequency thermal treatment [15] has been explored. Under ultrasound guidance, a radiofrequency electrode is inserted percutaneously and activated, causing a heat deformation that causes a microtenotomy and the removal of all diseased tissue. However, the procedure's intrusive aspect makes it less appealing.

Another innovative technique that has recently come to light is ultrasound guided local injection of platelet rich plasma (PRP) [16-18]. High concentrations of growth factors are thought to be present in these preparations, which could possibly aid tendon recovery. However, the time-consuming procedure of extracting the concentrate, as well as the associated ethical and regulatory obligations, has limited the technique's adoption. In cases of recalcitrant lateral epicondylitis, local corticosteroid injections and regenerative techniques such as locally focused extracorporeal shock wave therapy and low intensity ultrasound therapy (LIUST) are

becoming increasingly popular. Local corticosteroid injection is a simple, cost-effective treatment for reducing pain and other symptoms associated with inflammatory diseases. Corticosteroids suppress the immune system and lower the number of inflammatory cells and mediators like lymphocytes, macrophages, and mast cells [19]. Corticosteroid injections, but at the other extreme, enhance protein catabolism, reduce type I collagen and glycosaminoglycan synthesis, and hence impede healing [17].

Ultrasound waves directed locally to the lateral portion of the elbow stimulate cellular activity, triggering a healing response by boosting growth factors to activate the tendons' reparative process [20]. Therapeutic ultrasound, a deep warmer agent, is efficacious with vibration but primarily through heat. It improves local metabolism, blood flow, soft tissue flexibility and regeneration, membrane permeability, and nerve conduction through its heat and mechanical actions. It relieves pain and improves joint mobility [21]. Patients with chronic pain and disability following a course of well-executed conservative treatment should be evaluated clinically and, if necessary, treated surgically. There have been open, percutaneous, and arthroscopic techniques used. However, the aggressive nature of this line of therapy makes it less appealing to the majority patients. Debriding the angio-fibrotic tissue of the ECRB with or without posterior tendon restoration is the core idea of open surgery [3]. The goal of this trial was to assess the effectiveness of Low Intensity Ultrasound therapy (LIUST) and local corticosteroid injection in treating refractory cases of lateral epicondylitis.

Materials and Methods

52 patients, fulfilling the inclusion and exclusion criteria were included in the present study after taking informed written consent in the prescribed format. The diagnosis of was established clinically with pain and tenderness at the elbow that is maximal over the lateral epicondyle, increases with pressure on the lateral epicondyle, and resists dorsiflexion of the wrist and/or middle finger [22]. All procedures were performed by a senior orthopaedic consultant who was adequately trained in using and administering ultrasound therapy. The results were independently recorded and analysed by two orthopaedic residents training under the consultant. Ethical clearance was obtained from the Institutional Ethical Committee.

Inclusion Criteria

1. All patients above 18 years of age
2. Patients of any sex
3. Lateral epicondylitis which was diagnosed clinically with pain that is elicited by two or more of these diagnostic exams[23]:

- Palpation of the lateral epicondyle
- Resisted wrist extension (Thompson test)
- Chair test. With the shoulder flexed to 60° and the elbow extended, the patient attempts to lift a chair weighing 3.5 kg

4. Patients who have received 3 cycles of analgesics and anti-inflammatories (each cycle of 7 days) but have not reported any symptomatic improvement.
5. Patients who have not received any prior local corticosteroid injection or ultrasonic therapy in the last 6 months

Exclusion criteria

Patients below 18 years of age
Established cases of cervical radiculopathy and/or radial tunnel syndrome (diagnosed clinically or with X-ray/MRI)
Patients who have received any form of physical therapy or injectable intervention in the past 6 months.
Patients with documented neuromuscular or metabolic disorders.
Patients operated for fractures of ipsilateral upper limb.
Patients diagnosed with uncontrolled diabetes mellitus
Patients having local skin infection over the elbow

Patients were randomly divided in to two groups; Group I received local corticosteroid injection (n=26) while Group II was treated with locally directed low intensity ultrasound therapy (n=26). Patients were evaluated at 2, 6 and 12 weeks after treatment. Evaluation was done using VAS score and Patient Related Tennis Elbow Evaluation (PRTEE).

1ml triamcinolone acetate (10 mg/ml) and 1ml 2% lignocaine were administered near the lateral epicondyle, at the point of maximal tenderness (Figure 1), using a peppering technique in the local steroid injection therapy group (Group I). For the process, strict aseptic measures were observed, and the drug was administered using a no-touch technique. The medication was given as close to the tendon's origin as possible.

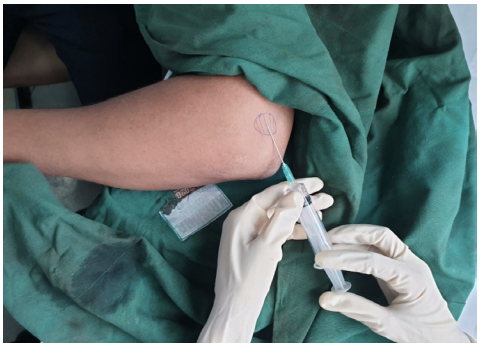

Figure 1: 1ml triamcinolone acetate (10 mg/ml) and 1ml 2% lignocaine being administered at the point with maximal tenderness in the lateral epicondyle area.

The ultrasound probe was placed over the lateral epicondyle, at the region of maximal discomfort (Figure 2) in patients belonging to Group II, and low-intensity ultrasound (1.5MHz) waves were administered for 20 minutes at weekly intervals for three settings.

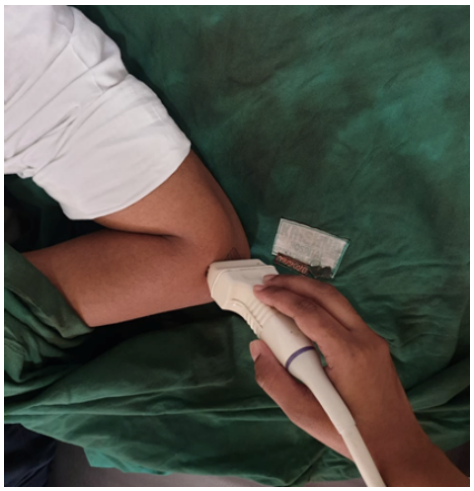

Figure 2: Low intensity ultrasound (1.5MHz) waves being delivered by an ultrasound probe placed over the lateral epicondyle at the point of maximum tenderness for a period of 20 minutes.

During the therapy period, all patients wore a lateral epicondyle brace; no analgesics, anti-inflammatory medicines, or exercise programme were provided to them. All data was entered in Microsoft Excel spreadsheet and variables were analysed using SPSS software. Continuous variables are presented as mean±standard deviation [SD]. Intergroup comparisons were made using the unpaired student's t-test for normally distributed variable. All hypothesis tests were two-tailed.

A value of $p<0.05$ was considered statistically significant.

Observations and Results

Patients ranging from 18-69 years were included in the present study. 26 males and 26 females were enrolled for the study. No sex predilection was noted. Right sided predominance was noted. There were no significant differences in age, gender and affected side between the two groups ($p>0.05$, for all).

The age distribution in both groups is depicted in Figure 3. In both groups, maximum number of patients belonged to the age group 26-35 years.

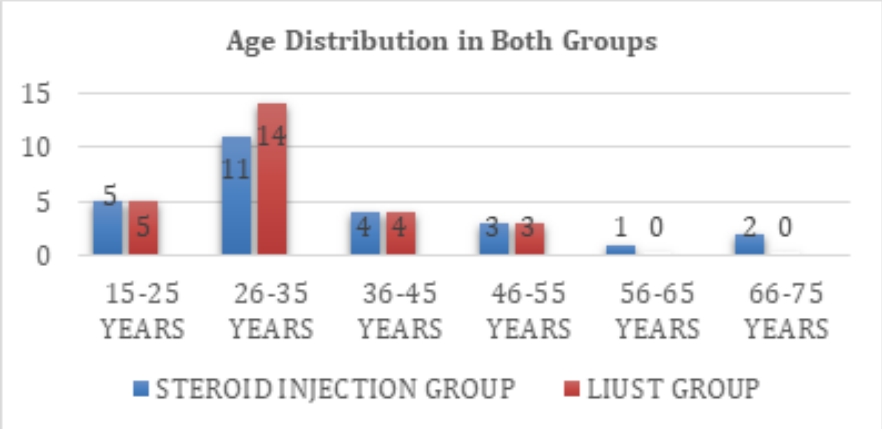

Figure 3: Age distribution.

Distribution of side affected in both groups is depicted in Figure 4.

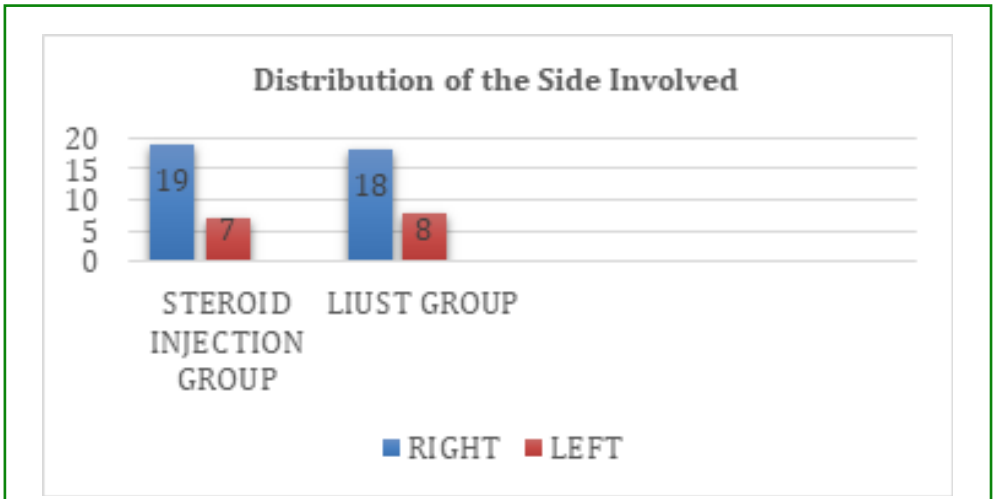

Figure 4: Side distribution.

Majority of the patients involved in the present study were those engaged in activities requiring persistent extension movements at the wrist, wringing , gripping or lifting heavy weights; Housewife(40%), manual labourers(21%) and farmers(23%)(Figure 5).

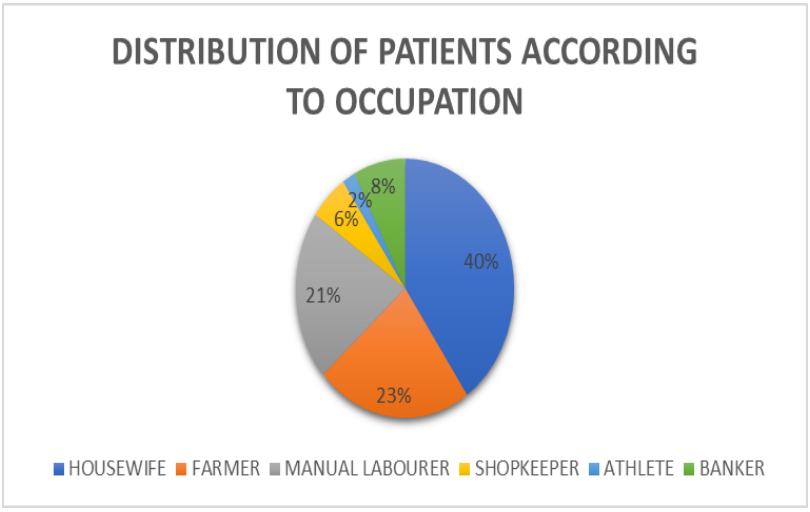

Figure 5: Distribution of patients according to occupation.

In the steroid group, mean VAS score at 2 week, 6 weeks and 12 weeks was 4.38, 4.92 and 5.77 respectively. In LIUST group, mean VAS score at 2 weeks, 6 weeks and 12 weeks post treatment was 1.43, 1.83 and 2.07 respectively. The mean VAS score was significantly better in the LIUST group at all three follow ups ($p < 0.05$). The mean PRTEE score in steroid group was 51.69, 55.96 and 61.80 at 2 weeks, 6 weeks and 12 weeks post treatment and that in the LIUST group was 41.07, 43.57 and 45.77 at 2weeks, 6 weeks and 12 weeks post completion of treatment. The mean PRTEE score was thus significantly better in the LIUST group as compared to steroid group ($p<0.05$). Table 1 and Table 2 depict the pre-treatment and post treatment (at each follow up) VAS and PRTEE scores in the steroid group and LIUST group of patients.

Additionally, it was noted that in steroid group, the mean VAS score and PRTEE score started to significantly rise by the end of the third follow up i.e. at 12 weeks.

	Steroid Injection Group (N=26)		Low Intensity Ultrasound Therapy (LIUST) Group (N=26)		T- Statistic	P Value
	MEAN VAS	SD	MEAN VAS	SD		
Pre Treatment	8.27	0.72	8.57	0.5		
2 Weeks Post Treatment	4.38	0.49	1.43	0.5	21.36	<0.0001
6 Weeks Post Treatment	4.92	0.48	1.83	0.4	25.26	<0.0001
12 Weeks Post Treatment	5.77	0.51	2.07	0.48	26.667	<0.0001

Table 1: Steroid group, the mean VAS score started to significantly rise by the end of the third follow up i.e. at 12 weeks.

	Steroid Injection Group (N=26)		Low Intensity Ultrasound Therapy (LIUST) Group (N=26)		T-Statistic	P Value
	MEAN PRTEE	SD	MEAN PRTEE	SD		
Pre Treatment	89.77		89.57			
2 Weeks Post Treatment	51.69	3.05	41.07	2.24	13.8	<0.0001
6 Weeks Post Treatment	55.96	2.69	43.57	1.73	19.29	<0.0001
12 Weeks Post Treatment	61.8	2.53	45.77	1.72	26.48	<0.0001

Table 2: Steroid group, the mean PRTEE score started to significantly rise by the end of the third follow up i.e. at 12 weeks.

Hypopigmentation of the skin and fat atrophy leading to indentation of the skin locally at the site of injection was reported in 10 out of 26 cases in Corticosteroid group. No such such incidences were reported in the LIUST group.

Discussion

During a 12-week follow-up period, the effectiveness of LIUST and local corticosteroid injection therapy was compared in the present study. When compared to pre-treatment values, both the LIUST and corticosteroid injection treatments demonstrated statistically significant improvements in VAS and PRTEE scores over time. There appears to be no consensus on the best treatment modality because the specific aetiology of this condition is unknown. Over the years, a variety of therapeutic techniques for lateral epicondylitis have been used in clinical practise. In these patients, analgesics and anti-inflammatories, along with rest and bracing, have remained the mainstay [14]. However, in refractory cases, these basic frontline interventions appear to be ineffectual. Local corticosteroid administration at the tendon insertion over the region of maximum discomfort offers the patient with prompt symptomatic relief. Steroids work by down regulating the immune system, which reduces the local influx of inflammatory mediators. Smidt N, et al. [24] found statistically significant differences in pain, global improvement, and grip strength in the corticosteroid injection group versus placebo, local aesthetic, and conservative treatment such as nonsteroidal anti-inflammatory drugs, elbow support, and physical therapy in a systematic review [24].

In the present study, we aimed at assessing the effectiveness of low intensity ultrasound therapy (LIUST) v/s local corticosteroid therapy in patients with refractory lateral epicondylitis (patients not responding to three cycles of conservative management with NSAIDS, rest and bracing; each cycle being one week long). The mean VAS score in the steroid injection group was 4.38+/-0.49, 4.92+/-0.48 and 5.77+/-0.51 at 2 weeks, 6 weeks and 12 weeks post treatment respectively. The mean VAS score in the LIUST group was 1.43+/-0.50, 1.83+/-0.40 and 2.07+/-0.48 at 2 weeks, 6 weeks and 12 weeks post treatment respectively. Thus, there was found to be a highly significant improvement in the LIUST group as compared to the corticosteroid group ($p<0.001$ at all three follow ups). The mean PRTEE score in the steroid injection group was 51.69+/-3.05, 55.96+/-2.69 and 61.80+/-2.53 at 2 weeks, 6 weeks and 12 weeks post treatment respectively. The mean PRTEE score in the LIUST group was 41.07+/-2.24, 43.57+/-1.73 and 45.77+/-1.72 at

2 weeks, 6 weeks and 12 weeks post treatment respectively. The outcome in terms of pain relief was significantly better in the group of patients treated by LIUST than those treated with corticosteroid injections ($p<0.05$ at all three follow ups). This was in contrast to the findings of Rahman MS, et al. [25], who concluded that local corticosteroid injections at the extensor origin in patients with lateral epicondylitis provide better pain and tenderness relief, as well as a faster functional improvement, than therapeutic ultrasound treatment. However, this could be due to the author's short follow-up period (VAS score was measured one and two weeks after therapy), as none of the patients in their study were followed up for long-term efficacy.

The findings of this study are consistent with those of Murtezani A. et al. [26], who concluded that ultrasound therapy combined with exercise therapy forms a superior modality for the treatment of chronic lateral epicondylitis [26], with a mean VAS score of 3.1+/-1.1 and 1.8+/-0.9 at 6 weeks and 12 weeks post treatment, and a mean PRTEE score of 14.2+/-5.8 and 16.3+/-5.2 at 6 weeks and 12 weeks post treatment. Martinez-Silvestrini JA, et al. [27] suggested that for individuals with tennis elbow, rehabilitation should be the primary treatment option, as corticosteroid injections do not provide clinically significant and long-term relief [27]. Binder and colleagues found that individuals with TE who were treated with ultrasound had a considerably better recovery than those who were treated with sham ultrasound [28].

Conclusion

A placebo group was not included in this study. Additionally, the follow-up period was short, and long-term effectiveness was therefore not assessed. Keeping these limitations in mind, it is safe to conclude from the present study that both corticosteroids and low intensity ultrasound therapy are effective modalities in treating refractory lateral epicondylitis. However, as steroid injection works by alleviating symptoms only, its benefits are short lasting as compared to LIUST. LIUST is a convenient, safe and economic treatment modality in chronic lateral epicondylitis. We recommend a longer follow-up involving a large sample size to obtain sufficient evidence regarding definitive treatment of refractory lateral epicondylitis. The author declares no conflicts of interest.

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