

Treatment of lateral epicondylitis using three different local injection modalities: a randomized prospective clinical trial

Yunus Dogramaci · Aydiner Kalaci ·
Nazan Savaş · I. Gokhan Duman · A Nedim Yanat

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Abstract

Background To determine the effectiveness of three different local injection modalities in the treatment of lateral epicondylitis.

Methods In a prospective randomized study on lateral epicondylitis, 75 patients were divided into three equal groups A, B and C ($n = 25$) and were treated using three different method of local injection. The patients in group A were treated with local injection of a steroid (1 mL triamcinolone) combined with local anaesthetic (1 mL lidocaine), those in group B were treated with injection of local anaesthetic (1 mL lidocaine) combined with peppering technique and those in group C with local injection of a steroid (1 mL triamcinolone) combined with local anaesthetic (1 mL lidocaine) and peppering technique. The outcome was defined by measuring the elbow pain during the activity using a 10-cm visual analogue scale (VAS) and satisfaction with the treatment using a scoring system based on the criteria of the Verhaar et al. at 3 weeks and 6 months after the injection and compared with the pre-treatment condition.

Results There were significant ($P = 0.006$) differences in the successful outcomes between the three groups at 6 months. In group C in which local steroid + peppering injection technique were used; excellent results were

obtained in 84% of patients comparing to 36% and 48% for patients in groups A and B, respectively. The successful outcomes were statistically higher in group C comparing to group A ($P = 0.002$) and group B ($P = 0.011$). In all groups, there was a significantly lower pain (VAS) at the 3-week and 6-month follow-ups comparing to the pre-treatment condition. VAS measured at 6-month follow-up were significantly lower in group C comparing to other groups ($P = 0.002$).

Conclusion In the treatment of lateral epicondylitis, combination of corticosteroid injections with peppering is more effective than corticosteroid injections or peppering injections alone and produces better clinical results.

Keywords Lateral epicondylitis · Local injection treatment · Steroid · Peppering injection technique

Introduction

Tennis elbow, lateral epicondylitis of the humerus is an enthesopathy of the common extensor origin. The pathogenesis of lateral epicondylitis has not been determined with any certainty. The general opinion is that the condition is due to overuse [6, 12, 15, 18]. Epicondylitis may be a misleading term as there is no traditional inflammation [1, 15]. The histological findings may include granulation tissue, micro rupture and degenerative changes [11, 14, 15, 18].

Many treatment modalities have been described for lateral epicondylitis including rest, modification of activity, splints, analgesic and anti-inflammatory drugs, physiotherapy, acupuncture, injections and surgery, have all been investigated and have shown to end up with variable clinical benefit.

Y. Dogramaci (✉) · A. Kalaci · I. G. Duman · AN. Yanat
Department of Orthopaedics and Traumatology,
Medical Faculty, Mustafa Kemal University,
31100 Antakya, Hatay, Turkey
e-mail: yunus_latif@yahoo.com

N. Savaş
Department of Community Medicine, Medical Faculty,
Mustafa Kemal University, Antakya, Hatay, Turkey

Targeting the common extensor origin, various substances have been used for injection treatment, including corticosteroids, platelet-rich plasma and autologous blood [5, 13]. Price et al. [16] have showed the preference for the use of injections of steroid (triamcinolone) in the management of tennis elbow. In another study, Verhaar et al. [24] have found that the steroid (triamcinolone) injections were more effective than physiotherapy. But the recurrence of symptoms after initial reduction or disappearance of pain has been reported [16, 24].

Rompe et al. [19, 20] have described the use of low-dose ESWT in patients with chronic tennis elbow with promising results. However, Crowther et al. [7] have found that in the medium term, local injection of steroid is more successful and 100 times less expensive than ESWT in the treatment of tennis elbow.

Despite of the various clinical results, the preferred method of treatment most often is local corticosteroid injection with or without addition of a local anaesthetic [4, 11, 22].

In a prospective randomized study Altay et al. [2] have assessed local injections for lateral epicondylitis and found peppering technique to be as effective as corticosteroid injection. They described this technique as a reliable and alternative method of treatment. Technically peppering is achieved by inserting, injecting, withdrawing without emerging from the skin, slightly redirecting, and reinserting. Surprisingly, only one randomized controlled trial has discussed the role of the peppering in the treatment of lateral epicondylitis.

In the current study, the effect of combining local corticosteroid injection with peppering was evaluated by comparing its effects with the local peppering injection technique and a local steroid injection alone, in a prospective controlled trial.

Materials and methods

The series consisted of 75 patients with lateral epicondylitis. The trial was approved by the local ethical committee and every patient gave informed consent.

The criteria for inclusion were: pain and tenderness over the extensor origin in the forearm, a positive chair test with pain in the region of lateral epicondyle when a chair is lifted with one hand in a position with the forearm pronated and the wrist is in flexion [9], and positive tennis elbow pain test (Mills' sign) with pain in the lateral epicondyle when the elbow is actively moved from flexion to full extension with the forearm in the prone position and the wrist in flexion [8].

Exclusion criteria were surgery for lateral epicondylitis, previous injections for lateral epicondylitis, arthritis,

effusion about the elbow, entrapment of the ulnar nerve, radiculopathy from the cervical spine, peri-articular fracture, distal humeral bone tumour, infection, and abnormal erythrocyte sedimentation rate.

The first 25 consecutive patients in group A were treated by local injection of triamcinolone (1 mL) combined with 1 mL of lidocaine, the second 25 in group B by 1 mL of lidocaine and with peppering, the third 25 in group C were treated using local injection of 1 ml triamcinolone combined with 1 mL of lidocaine with peppering injection technique. The patients were blinded to the type of injection.

The baseline characteristics in each group including the age, affected side, previous treatment methods including using NSAID, physiotherapy, splints, and the duration of pain were recorded and the mean in each group was tabulated (Table 1).

All the patients in the study were seen after 3 weeks, and later 6 months after the beginning of the treatment. No additional medication was given and no restriction of activity was advised. The patients were evaluated by reviewers who were blinded to the method of the study at 3 weeks and 6 months after the injections.

Clinical assessment consists of routine clinical history, a patient assessed 0–10 on the visual analogue scale (VAS) of pain, where zero reflected the total absence of symptoms and ten the worst imaginable pain. The outcome was, compared with the pre-treatment condition.

The rating, according to the criteria of the Verhaar et al. [23], was defined as excellent (no pain, patient satisfied with the treatment outcome, no subjective loss of grip strength and no pain provoked by resisted dorsiflexion of the wrist), good (symptoms substantially decreased, patient satisfied with the treatment outcome, occasional slight pain on the lateral epicondyle after strenuous activities, no or slight subjective loss of grip strength, and no pain provoked by resisted dorsiflexion of the wrist), fair (discomfort on the lateral epicondyle after strenuous activities but at a more tolerable level than before treatment, patient satisfied or moderately satisfied with the result of treatment, slight or moderate subjective loss of grip strength, and slight or moderate pain provoked by resisted dorsiflexion of the wrist), or poor (no decrease of pain of the lateral epicondyle, patient dissatisfied with the result of treatment, severe subjective loss of grip strength and severe pain provoked by resisted dorsiflexion of the wrist). Treatment was considered successful when the patient had an excellent or a good score.

Injection technique

We used the technique described by Altay et al. [2] for peppering injection. As the patient lies supine on the

Table 1 Baseline characteristics of subjects in each group

Demographic details	Group			
	A (steroid injection) (<i>n</i> = 25)	B (local anaesthetic injection with peppering) (<i>n</i> = 25)	C (steroid injection with peppering) (<i>n</i> = 25)	
Sex (female/male)	17/8	12/13	14/11	<i>P</i> = 0.351**
Mean age ± SD (years)	42.80 ± 10.14	46.64 ± 8.59	49.60 ± 10.64	<i>P</i> = 0.056*
Affected side (right/left)	23/2	23/2	22/3	
Previous treatments (<i>n</i>)				
Analgesics	10	3	6	
NSAIDs	11	3	9	
Physiotherapy	0	0	2	
Insoles	0	3	0	
Duration of symptoms ± SD (month)	6.16 ± 4.071	5.40 ± 3.81	6.94 ± 3.27	<i>P</i> > 0.05*
Second injection at 3rd week (% within group)	8 (32%)	11 (44%)	4 (16%)	<i>P</i> = 0.098** <i>P</i> _{A-B} = 0.382** <i>P</i> _{B-C} = 0.031** <i>P</i> _{A-C} = 0.185**

*ANOVA-Post hoc test (Bonferroni)

**Chi-square test

examination table with the elbow in 90° flexion and neutral rotation position, the elbow was prepared using an antiseptic solution. The point of maximum tenderness is peppered with small injections by inserting an 18-gauge needle, injecting, and withdrawing without emerging from the skin, slightly redirecting, and reinserting. The injections are continued until the sensation of a crepitus or cracking, which was felt at the beginning, was lost, this required 40–50 shots. The needle should be inserted lightly to avoid damage to its tip, if the bone is contacted.

The SPSS package (version 11.5, SPSS Inc, Chicago, IL, USA) was used for all statistical calculations. Chi square test were used to compare the excellent and good results among the groups. The Kruskal–Wallis test was applied to compare VAS score changes before and after local injection. Differences in VAS over time within the groups were calculated using the Wilcoxon signed ranks test. The *P* value was set to 0.05.

Results

There was no statistically significant difference between the groups with respect to sex, mean age and the duration of symptoms (*P* > 0.05) (Table 1).

At the 3-week follow-up, the patients who were not fully satisfied were offered an additional injection. The rate of additional injection was statistically lower in group C (16%) when compared to group B (44%) (*P* = 0.031), but no statistically significant difference was observed

comparing to group A (32%) (*P* = 0.185), and there was no statistically significant difference between groups A and B (*P* = 0.382) (Table 1).

At the 3-week follow-up, there were no significant differences in the pain measured using VAS between the three groups (*P* = 0.155). Successful treatment was reported by 23 (92%) patients in group A, 24 (96%) patients in group B and 20 (80%) for group C. The patients in all groups had a significantly lower VAS (pain during grip activity) post-treatment than they had pre-treatment (*P* = 0.000). Outcome for each group is shown in Table 2.

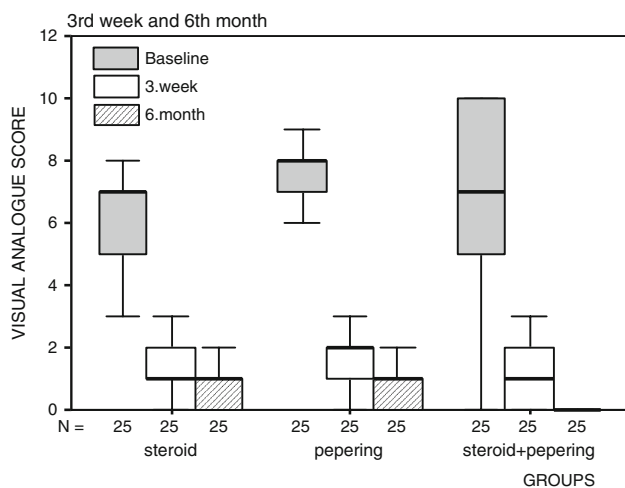
At the 6-month follow-up lateral epicondylar pain measured using the VAS were 0.84 in group A, 0.56 in group B as compared to 6.32 and 7.72 before the commencement of the treatment, and 0.12 in group C compared to pre-treatment scores of 7.20. There was statistically significant difference between the groups in the VAS measured at six months (*P* = 0.002) (Table 2). The improved VAS results in group C were significantly superior comparing to group A (*P* = 0.001). There was no statistically significant difference in the improved VAS results between group A and group B (*P* = 0.465), and between group B and group C (*P* = 0.08) (Table 2) (Fig. 1)

At the 6-month follow-up successful treatment (excellent + good) was reported by 22 (92%) patients in group A, 24 (96%) patients in group B and 25 (100%) for group C.

The rate of successful results was higher in group C when compared to groups A and B. There was also

Table 2 Pain in affected epicondyle on 10 cm VAS [mean (SD; range)]

Group	VAS (visual analogue scale)		
	Baseline	3 weeks	6 months
A (steroid)	6.32 (1.7; 3–10)	1.56 (1.044;0–4)	0.84 (0.98;0–3)
B (local anaesthetic injection with peppering)	7.72 (1.27;5–10)	1.68 (1.24;0–6)	0.56 (0.58;0–2)
C (steroid injection with peppering)	7.20 (2.56;0–10)	1.72 (2.70;0–10)	0.12 (0.33;0–1)
	$P = 0.021$	$P = 0.155$	$P = 0.002$

**Fig. 1** Visual analogue score; baseline, 3rd week and 6th month

statistically significant differences in the successful results between group C and groups A and B ($P = 0.006$), but no statistically significant difference was observed between group A and B ($P = 0.536$) (Table 3).

All patients found the injection painful. No complications or adverse effects attributable to injections were observed during the study.

Discussion

The main finding in our study was that combining the peppering technique with local injection of steroid (group C) was more effective than local injection of steroid (group A) or local injection using the peppering technique (group B) in the treatment of lateral epicondylitis. No difference was found between local steroid injection (group A) or local injection using the peppering technique (group B). Furthermore, this study revealed that combining the steroid with peppering injection technique has reduced the additional injections in the third week of treatment significantly, comparing to the peppering technique (group B).

We agree with the findings of Smidt et al. [21] that steroid injections are the best option in the short term for patients with tennis elbow. In the current study the rates of

excellent results in the 3-week follow-up were higher in groups where steroid was used in the injections (A and C). In the 6-month follow-up the excellent results were higher in the group where the steroid combined with peppering injection technique (group C) and lowest rates were found in the group treated with steroid injection alone (group A).

Altay et al. [2], in a prospective randomized study of lateral epicondylitis, has compared the peppering injection technique to (steroid + peppering) injection technique. In that study, at 6-month follow-up, excellent results were achieved in 93% of the patients in the group treated with local peppering and 95% of the patients in the group treated with (steroid + peppering). They found no significant differences in the rate of excellent results, satisfaction and success between the two groups.

In the current study excellent results were achieved in 84% of the patients treated using the steroid +peppering (group C) injections. However, the rate of excellent results was 48% for those treated with local peppering alone injections (group B) and 36% for the group treated with local steroid injection alone (group A). The rate of successful results was significantly higher in group C comparing to groups A and B.

In the current study, to diminish the local irritation and pain during injections, a local anaesthetic addition has been used in all groups. In the long term results, local anaesthetic plays no role in treating lateral epicondylitis. Solveborn et al. [22], in a prospective randomized study of lateral epicondylitis, has compared the effects of adding the short acting local anaesthetic, lidocaine, and the long acting bupivacaine to local steroid injection. The only difference was found at 2-week follow-up where bupivacaine yielded a better outcome. The long term effects of local anesthetics were equal to that of a placebo.

Local corticosteroid injections have been used for treatment of lateral epicondylitis for many years, with varying results. Verhaar et al. [24] carried out a prospective, randomized trial on 106 patients to compare the effect of local injection of steroid with Cyriax-type physiotherapy. They used triamcinolone with lignocaine and concluded that the injections were more effective than physiotherapy. Hay et al. reported a study of 164 patients

Table 3 Verhaar score at 3 weeks and 6 months according to the different groups

	Verhaar score			
	Excellent	Good	Fair	Poor
Verhaar at 3 weeks				
A (steroid injection)	5 (20%)	18 (72%)	2 (8%)	0
B (local anaesthetic injection with peppering)	0	24 (96%)	1 (4%)	0
C (steroid injection with peppering)	12 (48%)	8 (32%)	2 (8%)	3(12%)
Verhaar at 6 months				
A (steroid injection)	9 (36%)	13 (52%)	3 (12%)	–
B (local anaesthetic injection with peppering)	12 (%48)	12 (48%)	1 (4%)	–
C (steroid injection with peppering)	21 (84%)	4 (16%)	0	–

randomized to steroid injection, non-steroidal anti-inflammatory medication or a placebo. The injections gave rapid resolution of symptoms, but did not influence the long-term outcome. At 1 year there was no difference between the groups [10]. According to Boyer and Hastings, “if corticosteroid has any effect on patients with lateral Tennis elbow, it is of a short duration” [4]. A recent randomized controlled trial by Bisset et al. [3] found superior effects for physiotherapy compared with corticosteroid injections, in the long term (52 weeks) results.

Altay et al. [2] found no difference between local cortisone and local anaesthetic injection, using the peppering technique. In a review of the literature, Labelle et al. [11] reported a 66% recurrence rate, 6 months after corticosteroid injection treatment. This means that there are significant variations in the clinical results, with respect to the effectiveness of corticosteroid injections in the treatment of lateral epicondylitis.

The peppering technique of injection in the treatment of lateral epicondylitis was described 44 years ago [17]. The peppering technique probably act by creating new channels through the degenerative myxoid tissue, in which bleeding occurs; this may initiate the mode of healing in lateral epicondylitis [2].

The results of the current study suggest that, the local corticosteroid injection becomes more effective and lower the rate of required additional injections when combined with peppering in treating patients with lateral epicondylitis. This combination could be an effective alternative to the corticosteroid injection taking into account the complication of the repeated corticosteroid injections and its questionable role in treating patients with lateral epicondylitis.

Conclusion

This is the second study designed for the evaluation of the effects of combining peppering and steroid injection in the treatment of lateral epicondylitis. When local injection is considered in the treatment of lateral epicondylitis, local

steroid injection with peppering may be the first choice of treatment as it has the highest success rate and may prevent the complications of further injections.

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