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The use of dry needling vs. corticosteroid injection to treat lateral epicondylitis: a prospective, randomized, controlled study

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Background: Lateral epicondylitis (LE) is a common disease especially at middle age. Different types of treatments have been used to address LE. Corticosteroid (CS) injections and dry needling (DN) are utilized options in the treatment. However, the question of which one is better has not been entirely discussed in the literature. We hypothesized that the use of DN to treat LE would be at least as effective as using CS injections. We compared the pain relief afforded and improvements in functional disability after DN and CS injection.
Methods: A total of 108 LE patients whose pain was not relieved by 3 weeks of first-line treatment were included in a randomized manner, using an online application into DN or CS groups (54 patients each). The minimum follow-up duration was 6 months. We recorded ''Patient-Rated Tennis Elbow Evaluation'' (PRTEE) scores before treatment and after 3 weeks and 6 months of treatment.
Results: Seven patients were excluded for various reasons; thus, 101 patients were finally evaluated. Before treatment, the groups were similar in terms of age, symptom duration, and PRTEE score, but after treatment, DN-treated patients showed better improvement in the PRTEE score than CS-treated patients ($P < .01$). Both treatments were effective (both $P < .01$). From assessments at 3 weeks and 6 months post-treatment, PRTEE scores decreased over time. Four CS-treated patients (7.6%) developed skin atrophy and whitening. One DN-treated patient (2.04%) could not tolerate the pain of the intervention and withdrew from treatment.
Conclusion: DN and CS injection afforded significant improvements during the 6 months of follow-up. However, compared with CS injection, DN was more effective.
Level of evidence: Level II; Randomized Controlled Trial; Treatment Study
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Keywords: Dry needling; lateral epicondylalgia; lateral epicondylitis; corticosteroid; injection

Lateral epicondylitis (LE) is common in those aged 40 to 57 years and compromises work productivity.[1,24,28] The pathology remains unclear, but histopathology reveals that degeneration, disorganization of fibrous tissue, and angiofibroblastic proliferation accompany the diagnosis.[1,29] LE often develops in patients who engage in repetitive, resistive elbow activities; and the extensor carpi radialis brevis (ECRB) tendon is principally affected. Resistive forearm supination, hand extension, and resistive middle finger extension are painful. LE can thus be easily diagnosed; usually, no further workup is required.[6,24] As LE may be self-limiting in some cases,[3,14,28] first-line treatment should be noninterventional. Bracing as well as oral

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and topical anti-inflammatory agents are recommended.[1-3,13,14] However, if symptoms persist, an interventional second-line treatment may be required. The options include extracorporeal shock-wave therapy,[2,24,29] prolotherapy,[4] ozone treatment,[25] iontophoresis,[8] and injections of platelet-rich plasma[15,22] or saline.[12] Dry needling (DN) and corticosteroid (CS) injections have been used to treat LE.[1,2,10,17,19,28] However, the mechanism of action underlying DN treatment remains uncertain. DN may increase the blood supply (and thus oxygenation); the resulting neurophysiological effects may enhance opioid secretion or serotonin/noradrenaline release.[10,21] As DN is useful and not associated with major complications, it is increasingly used to treat a variety of tendinopathies[2,21,27] and other pathologies related to chronic pain.[5,18] The mechanism of action underlying CS treatment also remains uncertain. Although CS is anti-inflammatory, it is not known why this should be important in the LE context. Thus, in this study, it is asked whether CS or DN provided optimal treatment for LE. The hypothesis was that DN would be at least as effective as CS injection. The pain relief afforded in and improvements in functional disability of LE patients treated via DN and CS injection were compared.

Patients and methods

This is a prospective and randomized clinical study with a control group. All patients were prospectively followed up after they gave written informed consent; the patients' rights were fully protected. Using the Patient-Rated Tennis Elbow Evaluation (PRTEE) data of Murtezani et al, we calculated that the standard effect size would be 0.48.[16] Therefore, 54 patients in each group would afford 80% power and an appropriate 95% confidence interval.

First-line treatment (a nonsteroidal anti-inflammatory drug and a proximal forearm brace) was prescribed for 3 weeks to the patients who had LE pain more than 3 months. Patients were told to wear the brace continuously, except when sleeping and showering. Patients who did not improve were included in the present study after they gave written informed consent. The validated Turkish-language version of the PRTEE score was completed by all patients.

One hundred eight random numbers, divided into 2 groups, were prepared using an online software. These numbers indicated the order of the patients applying to the outpatient clinic. The numbers were listed one under the other on an online page, and the lines were painted in 2 different colors according to their group. The authors checked this online list while distributing patients with LE requiring second-line treatment to the groups and sent them to one of the 2 groups by line color.[26] Group I underwent DN and group II received CS injections. Exclusion criteria included recalcitrant cases (greater than 18 months of pain prior to treatment), prior elbow surgery or history of elbow trauma, invasive treatment for LE within 3 months before study enrollment, and patients with inflammatory arthritis or uncontrolled diabetes (patients whose serum glucose levels are under control with oral antidiabetic drugs and not higher than 150 mg/mL).

In group I, after cleaning the skin with povidone-iodine, fifteen 0.25 × 25-mm stainless steel needles were inserted at the lateral epicondyle region and throughout the course of the extensor carpi radialis brevis tendon (Fig. 1, *a*). The needles were placed down to the bone. They were then rotated 3 or 4 times, held in place for 10 minutes, and withdrawn. The insertion sites were compressed firmly to avoid excessive bleeding. DN was repeated twice weekly (5 sessions in all). All interventions were performed by a single experienced physiotherapist (E.G.Y.). Patients were not allowed to take any medications in routine, except their antihypertensive, oral antidiabetic, and thyroid medications. For group II, all CS (2 mL methylprednisolone acetate, Depo-Medrol®, 40 mg/mL) injections (single doses) were performed by the second author who employed "peppering" using a 22-G needle (Fig. 1, *b*). The periosteum was pricked 20-30 times without withdrawing the needle. No local anesthetic was used in either group. All patients were told to use the hands normally after the interventions but to avoid physically demanding activities for 4 weeks from the start of first needling.

Clinical evaluations were performed by a single physician who was not part of the study. Patients were evaluated using the PRTEE score before the intervention, and at 3 weeks and 6 months after the intervention. In the DN group, the second clinical assessment and PRTEE scoring were performed before the last (fifth) DN session at 1 week after the fourth session, that is, on day 20 (±2) of the study. In the CS group, patients were recalled for the second clinical assessment at about day 20 (±1). The third clinical assessment was performed at 6 months (±6 days); all patients were recalled for clinical examination and PRTEE scoring.

All statistical analyses were performed using SPSS software 21.0 (Statistical Package for the Social Sciences; IBM, Armonk, NY, USA). P value $<.05$ was considered to reflect the statistical significance, and the exact significance value is given in this

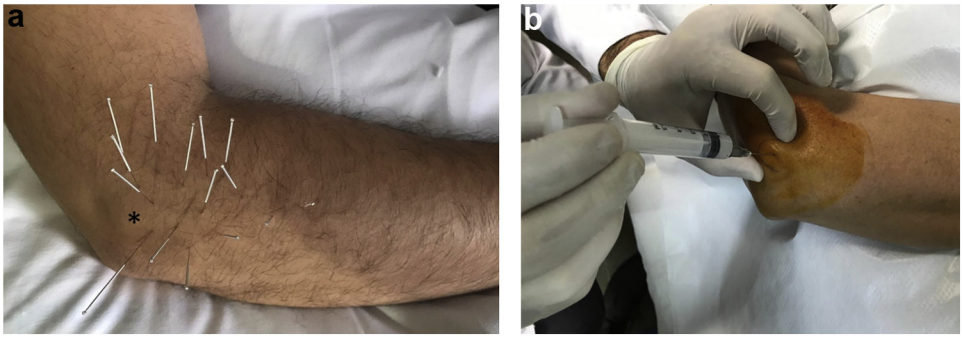

Figure 1 The most painful, lateral epicondylar area is marked (*). This area and the area throughout the course of the extensor carpi radialis brevis tendon was treated using dry needling (**a**). Corticosteroid injection was applied at the most painful area (**b**).

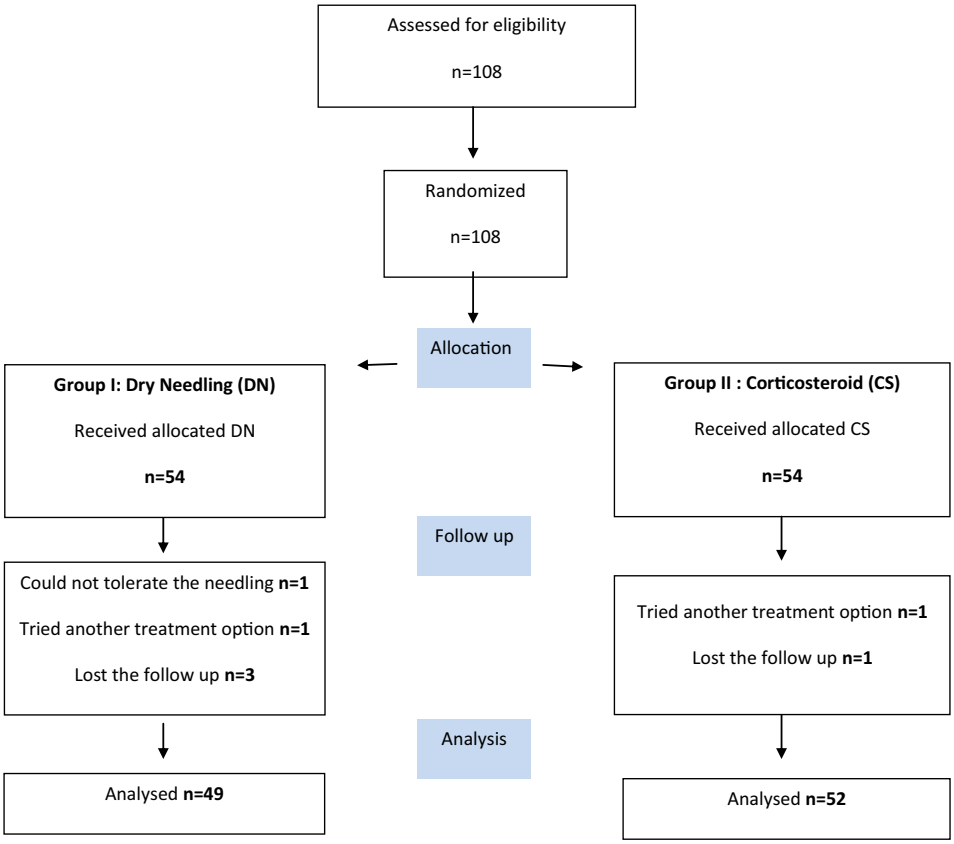

Figure 2 Study flow chart.

manuscript if it is not less than .01. We used the Mann-Whitney *U* test to compare age and pretreatment PRTEE scores between the groups, independent sample *t*-test when comparing PRTEE data obtained at week 3 and month 6, and dependent samples *t* test to compare PRTEE score values within each group.

Results

We enrolled 108 patients, but 3 were excluded. One patient (2.04%) in the DN group could not tolerate the intervention after the second session; she was excluded. Two patients (1 in each group) who underwent another treatment option (despite our prohibition) were also excluded. Four patients were lost to follow-up (Fig. 2). The study has been conducted with 101 patients (49 patients in group I, 52 patients in group II). Pretreatment PRTEE scores were collected in a blinded manner.

There was no between-group difference in age, symptom duration, or pretreatment PRTEE score. The mean patient ages were 47.5 ± 7.3 years (range, 29-64) in group I and 48.1 ± 10.3 years (range, 32-69) in group II ($P = .438$). The mean symptom duration prior to treatment was 8.4 ± 3.2 months (range, 3-12) in group I and 8.3 ± 2.5 months (range, 3-14) in group II. Demographic features are listed in Table I and the pretreatment PRTEE scores are listed in Table II. The mean follow-up duration in the study group was 6 months (±6 days).

Both treatments were effective ($P < .01$). From assessments at week 3 and month 6 post-treatment, the PRTEE scores gradually decreased over time (Table III, Fig. 3). Results comparing PRTEE scores indicated that DN patients showed better improvement than CS patients ($P < .01$) (Table III). The PRTEE score before treatment, which was 60.9 ± 11.8 in the DN group, decreased to 15.6 ± 7.7

Table I Demographic features and comparisons between the groups

Groups	n	Mean ± SD	*P* value
Age			
Group I (DN)	49	47.5 ± 7.3	.438
Group II (CS)	52	48.1 ± 10.3	
Hand dominancy, %			
Group I (DN)	49	65.3	.432
Group II (CS)	52	57.3	
Symptom duration, mo			
Group I (DN)	49	8.40 ± 3.28	.081
Group II (CS)	52	8.26 ± 2.53	

DN, dry needling; *CS*, corticosteroid;; *SD*, standard deviation.

Table II Comparison of PRTEE scores between the groups

Groups	n	Mean PRTEE score ± SD	*P* value
PRTEE score before treatment			
Group I (DN)	49	60.9 ± 11.8	.68
Group II CS	52	58.6 ± 5.1	
PRTEE score, 20th day			
Group I (DN)	49	15.6 ± 7.7	<.01*
Group II CS	52	36 ± 14.7	
PRTEE score, 6th month			
Group I (DN)	49	9.7 ± 7.6	<.01*
Group II CS	52	19.3 ± 19.4	

PRTEE, Patient-Rated Tennis Elbow Evaluation; *DN*, dry needling; *CS*, corticosteroid; *SD*, standard deviation.
* Statistically significant value.

Table III Comparison of PRTEE scores within the groups.

PRTEE score	n	Mean PRTEE score ± SD	*P* value
Group I (DN)			
Before treatment	49	60.9 ± 11.8	.01*
20th day	49	15.6 ± 7.7	
Group II (CS)			
Before treatment	52	58.6 ± 5.1	.03*
20th day	52	36.0 ± 14.7	
Group I (DN)			
Before treatment	49	60.9 ± 11.8	.01*
6th month	49	9.7 ± 7.6	
Group II (CS)			
Before treatment	52	58.6 ± 5.1	<.01*
6th month	52	19.3 ± 19.4	
Group I (DN)			
20th day	49	15.6 ± 7.7	<.01*
6th month	49	9.7 ± 7.6	
Group II (CS)			
20th day	52	36.0 ± 14.7	<.01*
6th month	52	19.3 ± 19.4	

PRTEE, Patient-Rated Tennis Elbow Evaluation; *DN*, dry needling; *CS*, corticosteroid; *SD*, standard deviation.
* Statistically significant value.

in the third week. On the other hand, this was 58.6 ± 5.1 before treatment in the CS group, which decreased to 36 ± 14.7 in the third week. Four patients (7.6%) in the CS group exhibited skin atrophy and whitening at the 6-month follow-up. One DN-treated patient (2.04%) was excluded because she could not tolerate the pain of intervention.

Discussion

We hypothesized that DN would be as effective as CS injection. Surprisingly, the PRTEE scores revealed that the DN-treated patients indicated significantly greater improvement than the CS-treated patients at both day 20 and month 6 (Fig. 3). Follow-up PRTEE scores are widely used to evaluate LE pain and functional parameters.[1,16,27] We used a validated Turkish version of the PRTEE score. CS injections relieve pain in the short term. However, the effects typically decrease in long-term follow-up.[3,4,14,20] Additionally, the literature contains more recommendations to "avoid" rather than "use" CS injections.[1,3,9,14] Repeat CS applications should be strictly avoided; these not only cause tendon degeneration and compromise tendon healing but also reduce surgical success.[9] The complications of CS injections include transient pain, skin atrophy, and pigment loss,[11,14]and we encountered skin atrophy and pigment loss (n = 4, 7.6%) during long-term follow-up.

CS injections are obviously simpler than DN; the patient returns to work after a single injection. On the other hand, DN requires multiple sessions (5 in our case; 15 minutes each). Instead of injecting a chemical matter, DN works like physical therapy. Therefore only 1 session cannot be effective.

In the literature, DN is not standardized in terms of needle size, location of needling, local anesthesia status, session interval or time, or any additional treatment.[23] As the pathology lies directly under the skin, we did not use any form of guidance during needling. A similar technique (without ultrasonography) has been described by Suzuki et al.[23]

DN is usually safe. The reported complications include transient pain during injection (principally), transient soreness, local hemorrhage, and syncope[11,23,27]; all are minor. We encountered 1 patient (2.04%) who had to be excluded because of pain intolerance. In the CS group, the complications were minor and late; the single complication in the DN group was even more minor, but major in the sense that needling was halted. DN is low-risk, low-cost, minimally invasive, and easy to learn and perform. However, physicians should be alert to pain intolerance.

In the literature, many studies are comparing the effectiveness and safety of different methods in the treatment of LE. However, the perfect treatment option has not been identified yet. LE can show a self-limiting attitude in some cases, whereas it can be refractory in others. The occupational differences and activity levels of the patients may play a role in this result. This study yields an alternative method of treatment. In recent years, as CS injections have slowly lost their popularity, the safe use of DN has increased. The cost-effectiveness of the treatment options in LE is another matter of debate. Coombes et al reported that CS injections are not cost-effective as first-line treatments.[7] On the other hand, as DN requires multiple sessions, special appointments are needed to be given to the patients. Besides, instead of a single shot in CS, each session in DN takes an obviously longer time than CS. Considering the cost-effectiveness of DN and CS, data are lacking and further work on this topic is required.

Figure 3 Gradual decreases in the Patient-rated Tennis Elbow Evaluation (PRTEE) scores in both groups over time.

The strengths of our study are the prospective and randomized design with the inclusion of a control group. The number of individuals enrolled was satisfactory; however, as a limitation of study, we lost 6.4% of the patients during the follow-up (7 patients: 3 were excluded and 4 were lost to follow-up). Other limitations include the use of only the PRTEE score. Grip strength should also be measured, and a visual analog pain score employed. Also, the DN treatment was not standardized with the literature. More prospective, randomized studies are needed to optimize this treatment modality.

Conclusion

Both DN and CS injections significantly improved LE during 6 months of follow-up. However, DN produced better outcomes. We encountered minor complications after CS injections; thus, such injections should be reconsidered.

Disclaimer

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