Percutaneous Tendon Needling without Ultrasonography for Lateral Epicondyritis

Taku Suzuki, Takuji Iwamoto, Noboru Matsumura, Masaya Nakamura, Morio Matsumoto and Kazuki Sato

1 Department of Orthopaedic Surgery, Keio University School of Medicine, Tokyo, Japan
2 Institute for Integrated Sports Medicine, Keio University School of Medicine, Tokyo, Japan

Percutaneous ultrasonic tendon needling has been used to treat persistent lateral epicondyritis, and its efficacy has been demonstrated. However, whether ultrasonography is necessary remains unclear. The purpose of this retrospective study was to evaluate the efficacy of percutaneous tendon needling without ultrasonography for lateral epicondyritis. A total of 36 patients who underwent tendon needling without ultrasonography for lateral epicondyritis were retrospectively included in the study. The tendinotic lesion was needled by fenestration approximately 20–30 times without sonographic assistance. The Visual Analogue Scale (VAS) pain score, the grip strength, and success rates were assessed at baseline and at 1, 3, 6, and 12 months after treatment. The Nirschl tennis elbow score was evaluated at baseline and at 6 and 12 months after the needling procedure. The mean VAS pain score and grip strength at 3, 6, and 12 months significantly improved compared to the baseline values. At 6 and 12 months, the success rates had significantly increased compared to the rates at 1 month. The mean Nirschl scores at 6 and 12 months were significantly better than the baseline value. No severe complications were observed during the study period. Percutaneous tendon needling without ultrasonography is a simple and safe technique.

Keywords: tennis elbow, lateral epicondyritis, tendon needling, dry needling, ultrasound

Introduction

Lateral epicondyritis (tennis elbow) is a common elbow disorder characterized by microtears within the extensor carpi radialis brevis muscle (ECRB) resulting in chronic pain in the lateral elbow. To date, various nonoperative treatments have been reported: physical therapy, tennis elbow straps, extracorporeal shock waves, laser therapy, topical nitrate, and injection of corticosteroid, hyaluronic acid, botulinum toxin, autologous blood, or platelet-rich plasma. Recently, a novel technique termed tendon needling, dry needling, needle tenotomy, or tendon fenestration has been introduced as an effective treatment for chronic tendinitis, e.g., Achilles tendinitis, patellar tendinopathy, and rotator cuff diseases. Repeated percutaneous needle fenestration of the affected tendon origin may promote a healing response by disrupting the chronic degenerative process and encouraging localized bleeding and fibroblastic proliferation. This procedure may achieve the release of growth factors and promote new vessel formation. The technique has been gradually applied to lateral epicondyritis, and some reports have demonstrated its efficacy.

In most previous studies, tendon needling for lateral epicondyritis was performed using ultrasonography. During needle insertion, ultrasonography is usually used to visualize the needle, the origin of the ECRB tendon,
and the lateral epicondyle. To our knowledge, there have been two previous reports regarding tendon needling without ultrasonography. Consequently, limited data are available to assess the efficacy of tendon needling without ultrasonography. Furthermore, only five penetrations were performed in one report, and the number of penetrations was not reported in the other report. Because the needling technique generally includes 20–50 needle penetrations into the tendon, the effect of tendon needling was unclear in these two reports.

The effectiveness of tendon needling without ultrasonography is not fully understood. The purpose of this study was to evaluate the efficacy of percutaneous tendon needling without ultrasonography for lateral epicondylitis.

**Methods**

The study protocol was approved by our institutional review board. From April 2015 to January 2018, 56 patients who underwent tendon needling for lateral epicondylitis were retrospectively enrolled at three institutions. Lateral epicondylitis was clinically diagnosed by pain at the lateral epicondyle of the elbow, pain induced by resistance to middle finger extension or wrist extension, and the chair test.

The criteria for performing tendon needling include pain resistant to at least three conventional nonoperative treatments (physiotherapy, elbow straps, wrist splints, nonsteroidal anti-inflammatory medications, and injection of corticosteroid), and continuous symptoms for 3 months from the appearance of the initial pain. Exclusion criteria included patients with less than 12 months of follow-up, local corticosteroid injections within 4 weeks of treatment, and a history of trauma or surgery of the elbow.

**Tendon needling procedure**

Tendon needling was performed on an outpatient basis by a single hand specialist. All procedures were conducted in a standard manner with the patient sitting in a chair with elbows at 90° of flexion and the forearm in the neutral position (Fig. 1). The injection site was determined by the examiner using their thumb to locate where patients complained of strong pain around the lateral epicondyle. For percutaneous anesthesia, the injection site was sterilized with povidone iodine and blocked using 2 mL of 1% lidocaine. Then 3 mL of 1% lidocaine was injected into the periosteum around the lateral epicondyle using a 22-gauge needle. A 22-gauge needle was used because we consider the 18-gauge needle to be rather thick; moreover, there is a risk that a 23-gauge needle might be broken during insertion. Without pulling the 22-gauge needle out of the skin, the ECRB tendon origin, the bone surface of the lateral epicondyle, and the surrounding area were penetrated by the needle about 20–30 times. Penetration to the bone surface was confirmed by palpation using the examiner’s finger.

The whole process was completed in approximately 1 min. After puncture, adhesive tape was placed over the injection site. The active range of motion of the patient’s elbow was not restricted as long as the pain did not increase. If a brace (elbow straps or wrist splints) had been used before tendon needling, patients were permitted to use the brace after the procedure, according to their needs.

**Evaluation**

Clinical outcomes were assessed by the same hand specialist who had performed the tendon needling. Assessments were done at baseline (pretreatment) and at 1, 3, 6, and 12 months after the procedure. The primary outcomes were pain and grip strength. Pain intensity was assessed using an ordinal level Visual Analogue Scale (VAS) ranging from 0 (no pain) to 100 (severest pain). Two types of VAS were recorded in this study. One evaluated tenderness at the lateral epicondyle in response to the maximum force of the examiner’s thumb (VAS-TDS). VAS-TDS was assessed with the patient sitting in a chair with elbows at 90° of flexion, and the forearm in the neutral position. Another type of VAS assessed pain by resistance to wrist extension (VAS-RWE). We evaluated VAS-RWE with the patient sitting in a chair with elbows at 0° of extension, the forearm in pronation, and fingers in the full grip position. The grip strengths of both hands were measured with a dynamometer (Hand Dynamometer; MIS, Tokyo, Japan) and the percentage of the value for the affected side compared to the unaffected side was
The secondary outcome was the success rate (the percentage of patients who achieved successful treatment) at 1, 3, 6, and 12 months after treatment. Successful treatment was defined as a reduction of greater than or equal to 25% or 50% of the VAS scores compared to baseline.11 We also assessed the rate of complete remission, which was defined as a VAS score of 0 at 12 months after the procedure. The success rate and complete remission were assessed using both VAS-TDS and VAS-RWE.

The third functional outcome used the Nirschl tennis elbow score, which was evaluated at baseline and at 6 and 12 months after the needling procedure. The Nirschl tennis elbow score is specific to this condition and incorporates pain, function, patient satisfaction, and range of motion, with a maximal score of 80. Greater than 70 is rated excellent, greater than 60 is rated good, greater than 50 is rated fair, and less than 50 is rated poor.20

During the research period, we documented any complications such as increased pain, infection, nerve injury, bleeding, or breakage of the needle.

**Statistical analysis**

To evaluate the post-procedure VAS score, grip strength, and Nirschl tennis elbow score compared to baseline, statistical analyses were performed using repeated-measures analysis of variance. Multiple post hoc comparisons were corrected using the Bonferroni method. McNemar’s test was used to analyze post-treatment success rates. A P value of <0.05 was considered statistically significant. Statistical analyses were performed using SPSS software (version 23.0; SPSS, Chicago, IL, USA).

**Results**

**Patients**

Of the 56 patients who underwent tendon needling for lateral epicondylitis during the study period, 36 were included in the study and 20 were excluded. Of the 20 excluded patients, 15 had a short follow-up period, 4 had incomplete data, and 1 received local corticosteroid injections within 4 weeks of tendon needling. No patients had undergone previous surgery of their elbows. There were 19 male patients and 17 female patients with a mean age of 55 years (range, 37–75 years) at the time of the procedure. Of the 36 patients studied, 25 underwent treatment of the right elbow and 11 the left elbow. The mean time from the onset of symptoms to the needling procedure was 10 months (range, 3–60 months).

**Pain score and grip strength**

The mean VAS-TDS and VAS-RWE scores and grip strength are shown in Fig. 2A, B. The mean VAS-TDS and VAS-RWE scores and the grip strength (percentage of value vs. the uninjured side) at 3, 6, and 12 months had significantly improved compared to the baseline values (P < 0.05). These parameters at 1 month had not improved significantly compared to the baseline (P > 0.05).

**Success rate and complete remission**

The success rate was measured by a 25% or 50% improvement of pain score compared to the baseline (Fig. 3A, B). The 25% and 50% success rates of VAS-TDS at 6 and 12 months) had significantly increased compared to
the scores at 1 month ($P < 0.05$). The 25% and 50% success rates of VAS-RWE at 3, 6, and 12 months had also significantly increased compared to the scores at 1 month ($P < 0.05$). Complete remission of pain at 12 months was observed in 5 patients (14%) for VAS-TDS and in 11 patients (31%) for VAS-RWE.

**Nirschl tennis elbow score**

The mean Nirschl tennis elbow scores are shown in Table 1. The mean score was 44 (range, 15–60) at baseline, 61 (range, 25–80) at 6 months, and 64 (range, 40–80) at 12 months. The mean scores at 6 and 12 months were significantly better than the baseline score ($P < 0.05$). There was no significant difference between the mean scores at 6 and 12 months ($P > 0.05$).

**Complications**

After tendon needling, 35 patients (97%) complained of increased pain compared to pretreatment, but this pain disappeared in 2–14 days. These events were probably related to the treatment. No other complications, such as infection, nerve injury, bleeding, or breakage of the needle, were observed in any of the patients.

**Discussion**

In this study, we performed percutaneous tendon needling without ultrasonography for lateral epicondylitis that was resistant to conventional nonoperative treatments. Clinical and functional impairment of the elbow were improved significantly compared to pre-treatment. We also demonstrated the safety of this simple technique.

The advantage of needling with ultrasonography is the visualization of the needle, the origin of the abnormal common extensor tendon, and the lateral epicondyle, thereby enabling accurate insertion of the needle into the tendinotic lesion. Moreover, the calcifications and bony surface of the epicondyle can be abraded using ultrasonography. The disadvantage is the requirement for ultrasound equipment. Because ultrasonic devices are not necessarily available at every outpatient clinic, its use restricts the locations where needling can be performed. A systematic review of needle tenotomy for lateral epicondylitis also identified operator-dependent skill in ultrasonography as a disadvantage. Furthermore, sono-graphically-guided needling takes more time. Although Stenhouse et al. reported that the procedure using ultra-

**Table 1. The Nirschl tennis elbow score**

<table>
<thead>
<tr>
<th>Pretreatment</th>
<th>6 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean score ±SD</td>
<td>43.7 ± 12.8</td>
<td>61.1 ± 15.1</td>
</tr>
<tr>
<td>Evaluation, n</td>
<td>E; 0; G; 7; F; 14; P, 15</td>
<td>E; 10; G; 9; F; 8; P, 9</td>
</tr>
</tbody>
</table>

Excellent (E) ≥70; Good (G) ≥60; Fair (F) ≥50; Poor (P) <50.

SD, standard deviation
sonography took only 2 min, Barnes et al.\textsuperscript{15} and McShane et al.\textsuperscript{17} described total treatment times of approximately 15–20 min. In contrast, our technique is quick (less than 1 min) and does not require ultrasound equipment. This advantage enables the needling procedure to be performed by a larger number of clinicians in any outpatient clinic.

We determined the injection site by detecting the tenerness of the lateral epicondyle and performed blind penetration into the surrounding area. There is concern as to whether each individual tendon is accurately needled without ultrasonic guidance. We consider that the tendinotic lesion can be needled about 20–30 times by fenestration around the lateral epicondyle. The clinical outcomes of our study are comparable to those of previous studies that used ultrasonographic guidance. The VAS score is most frequently used as an outcome measure. Stenhouse et al.\textsuperscript{10} performed a prospective randomized trial and evaluated tendon needling with or without autologous conditioned plasma in 28 patients. The dry tendon needling group showed significant improvement from 6.9 on a 10-point VAS pain score scale at baseline to 4.5 at 6 months post-treatment. Barnes et al.\textsuperscript{15} also conducted a similar type of randomized controlled trial, showing an improvement of the VAS pain score from 6.4 at baseline to 0.7 at 12 months post-treatment in the dry needling group.

There have been a few studies investigating the efficacy of tendon needling for lateral epicondylitis.\textsuperscript{10,11,15–19} Different techniques have been used in various studies, e.g., the number of needle fenestrations (5–50), the number of needle (18–23 G), the number of treatments (one or two), the location of fenestration (tendon only or tendon and bone surface), and post-treatment management (the duration of rest and the need for physiotherapy). These differences in procedures make the comparison of results among the studies difficult. Therefore, in the current study, we have considered only the effect of our needling technique without ultrasonography. Standardized techniques should be established after further investigations.

This study has some limitations: it is retrospective, it is a case series, and the sample size is relatively small. Moreover, the needling procedures and the assessment of the technique were performed by a same hand specialist, which may potentially introduce bias to the data. A case–control study with a larger sample size with and without ultrasonography is needed for further evaluation. Despite such limitations, this study showed that percutaneous tendon needling without ultrasonography provides good clinical results. It is a safe and simple technique. We hope that this technique will be considered as a conservative treatment option for lateral epicondylitis.

Conflicts of Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References