Chapter

Chronic Pain Associated with Lateral Epicondylitis: Treatment with Radiofrequency

Vicente Vanaclocha, Nieves Saiz-Sapena, José María Ortiz-Criado and Leyre Vanaclocha

Abstract

Lateral epicondylitis is a painful condition that impairs the quality of life and the working capacities of many middle-aged people. Conservative treatments offer an opportunity for improvement in the majority of cases. Surgical alternatives can be considered in those patients with persisting pain. Open, arthroscopic and percutaneous extensor tendon procedures offer similar results with 10–20% failure rates. Radiofrequency microtenotomies have been introduced with comparable results to traditional surgical procedures. Although both thermal and pulsed radiofrequency techniques have been applied, there is more experience with the thermal. In the past, thermal radiofrequency has been applied through a 3–5 cm skin incision, but now some researchers have reported its percutaneous application with radiofrequency cannulas. The results are similar to former techniques but with significantly reduced surgical aggressiveness that correlates with less postoperative discomfort and a faster recovery.

Keywords: lateral epicondylitis, radiofrequency, pulsed radiofrequency, radiofrequency microtenotomy, tennis elbow, elbow joint

1. Introduction

Lateral epicondylitis relates to pain in the humeral insertion of the hand extensor tendons, loss of hand grip strength and aggravation of the pain on grasping objects like turning the doorknob or handshaking [1, 2]. The name lateral epicondylitis is a misnomer in itself as it is not an inflammatory process but rather a tendinosis of the humeral insertion of the hand extensor muscles, usually the extensor carpi radialis brevis [3]. Despite its popular name—tennis elbow—only 5–10% of those suffering from it play tennis [4]. This condition arises from repetitive gripping with wrist extension, radial deviation and/or forearm supination [3, 5, 6], and its incidence is 1–3 per 1000 inhabitants/year [7–10]. Lateral epicondylitis can be diagnosed clinically, as direct pressure to the lateral epicondyle reproduces the pain [11], and confirmed with the Thomsen test, in which resisted wrist extension with the elbow in an extended position aggravates the pain [12, 13]. It affects people aged 40–50 years with similar distribution between men and women [7] and can lead to work absenteeism and permanent work incapacities [2, 14].

In about 80% of cases of lateral epicondylitis, symptoms improve over a year [15, 16] often after the offending activity is stopped [17], but in the remaining 20%, it becomes a chronic condition [18].

Physical therapy is a first-line treatment [11, 18–21], which can be supplemented with wrist orthoses [20].

Local steroid injections in the painful areas are commonly used in the treatment of lateral epicondylitis [16, 22] despite being associated with iatrogenic soft tissue calfication [23] and long-term poor outcomes in some cases [24–26].

Botulinum toxin injections weaken temporarily the hand extensor muscles facilitating the healing of the extensor tendon injury [27–29] but can induce weakness in wrist and finger extension, impairing hand grip [28].

Newer treatment modalities include injection in the lateral epicondyle of platelet-rich plasma [30–34], autologous whole blood [35, 36] and stem cell therapy [37, 38]. These are as effective as some more invasive techniques and thus are becoming increasingly popular [31].

Surgical treatment is indicated when all conservative treatments have failed, which occurs in 5–10% of the patients [39–42]. Open surgical resection of the extensor carpi radialis brevis tendon was traditionally the gold standard [43, 44], but recently it is being reevaluated [45]. Some surgeons recommend more extensive procedures with simultaneous posterior interosseous nerve decompression and intra-articular pathology resolution [46], and others prefer collateral ligament repair [47]. To reduce the surgical aggressiveness, several arthroscopic extensor tendon release techniques have been introduced [48–50] finding that they render equivalent clinical results to the open surgical resection of the same anatomical structures [51, 52]. Further refinements are performing the extensor tendon release with an 18-gauge needle [53] or with ultrasound equipment [54]. On comparing open, arthroscopic and percutaneous procedures, no significant differences in clinical outcomes were observed [55], all of them rendering 10–20% of cases with persistent pain and functional incapacity [56–59].

Moreover, lateral epicondyle innervation is provided by sensory branches coming mostly from the radial nerve [60, 61]. Open surgical removal of those branches was attempted [62–64], but it is an aggressive technique and yielded poor clinical results. Other nearby nerves also contribute to the lateral epicondyle pain perception such as the musculocutaneous, the median and the ulnar nerves [60, 65, 66]. Considering that the removal of the sensory branches from all of them was not feasible, other alternatives have been tried.

One of these alternatives is radiofrequency. Radiofrequency—both thermal and pulsed—is a well-stablished technique for chronic pain treatment [67, 68], but its application to recalcitrant cases of lateral epicondylitis is a relatively new procedure [69, 70]. The rationale was that the pulse radiofrequency modulates the nerve function and alters the pain transmission [71], while the thermal radiofrequency destroys the sensory nerve terminals and induces collagen fibre reorganization [72].

1.1 Lateral epicondylitis radiofrequency treatment: historical background

In 2005, Tasto et al. [70] were the first to report radiofrequency microtenotomy in the treatment of chronic lateral epicondyle pain that persisted after 6 months of conservative treatment. The procedure was performed with a Topaz Microdebrider device (ArthroCare, Sunnyvale, CA) through a 3 cm skin incision. In 13 patients and with a 24-month follow-up, they reported pain amelioration but did not quantify it. No complications were reported. It was Meknas et al. [69] in 2008 using the same equipment and 3 cm skin incision who compared the radiofrequency microtenotomy with the open surgical extensor tendon release and repair. At 18 months, both groups

had similar pain relief rates, but hand grip strength improved only in the radiofrequency group. No side effects were reported. Further studies with more patients and longer follow-ups (7 [13] and 9 [73] years) confirmed these results [74, 75]. The reduced surgical aggressiveness correlated with a shorter operating time [13], lower rates of post-operative discomfort [76] and faster recoveries [75]. The percentage of patients with residual pain was 10% [75], similar to the reported for the open and arthroscopic procedures [57].

The next step was taken by Lin et al. [77] in 2011, where they investigated the applications of percutaneous radiofrequency. With a Radionics RFG-3C Generator (Radionics Inc., Burlington, Massachusetts, USA), special cannulas and under ultrasound guidance, they applied the radiofrequency with no skin incision in 34 patients that had been symptomatic for lateral epicondylitis for over 6 months and had exhausted all conservative treatment options. With an average follow-up of 14.3 months (range 12–21 months), Lin et al. [77] found an improvement of 78% in pain and 20.6–27.0 kg in hand grip strength. No complications were reported.

Subsequently, Weber and Kabelka [78] in 2012 reported the administration of radiofrequency directly on the skin to the lateral epicondyle without needles. The procedure—known as monopolar capacitive-coupled radiofrequency (mcRF)—was applied with the Alpha Orthopaedics' AT2 System (Hayward, CA, USA). This equipment provides a maximum local temperature increase of 50°C [79], damaging selectively the unmyelinated fibres, while the myelinated axons are mostly spared [80]. This study involved 39 patients with an average 14-month follow-up, reporting an 81% successful outcome and an 89% patient satisfaction with no adverse effects.

Another possibility is pulsed radiofrequency, which can be applied without an irreversible neural damage [81] and has been used in many areas of chronic pain management. Oh et al. [82] in 2016 reported its use on elbow pain, aiming at the radial nerve as it crosses the elbow joint. The procedure was performed with a radiofrequency 22G cannula with a 5 mm active tip (SL-S505-2, Neuro-Them, Wilmington, DE, USA). Only two patients were treated this way but showed significant pain relief for 12 months. No long-term results were reported but no statistically significant data can be extracted from two isolated cases.

2. Indications for radiofrequency lateral epicondyle treatment

Patients must have confirmed lateral epicondyle chronic pain that has not been controlled after at least 6 months of conservative treatment [39, 43].

Exclusion criteria: elbow instability, rheumatic arthritis, cervical radiculopathy, severe cervical osteoarthritis and higher-grade extensor tendon damage [69, 74].

3. Surgical techniques for radiofrequency lateral epicondyle treatment

The techniques reported to apply the radiofrequency in the treatment of lateral epicondylitis are the radiofrequency-based microtenotomy, the monopolar capacitive-coupled radiofrequency, the monopolar thermal radiofrequency and the bipolar thermal radiofrequency. To these, we could add the pulsed radiofrequency, but as its used has only been described in two patients and there are no long-term results, we will not describe it.

The technique for radiofrequency-based microtenotomy as performed by several groups [13, 69, 70, 73–75] will be described first. Under general anaesthesia and in the supine position, a tourniquet is applied to the affected arm. The humeral insertion of the extensor tendons is exposed through a 3–5 cm skin incision.

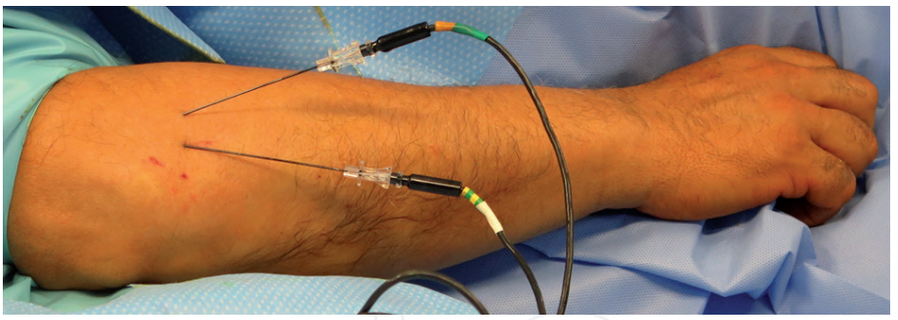

Figure 1.
Bipolar radiofrequency treatment of lateral epicondyle chronic pain.

The tendons from the extensor carpi radialis brevis, the extensor carpi radialis longus and the extensor digitorum communis are identified. The radiofrequency-based microtenotomy is performed with the Topaz Microdebrider electrode. The electrode is inserted 3–5 mm deep inside the extensor carpi radialis brevis tendon at 5 mm intervals in a grid-like pattern. Usually 3–6 lesions are required [13]. Once the procedure is over, the wound is closed by layers. After the procedure, patients are discouraged from heavy work for 6 weeks.

The monopolar capacitive-coupled radiofrequency is performed with the Alpha Orthopaedics' AT2 System and applied directly to the skin without any anaesthetic agent [78, 83]. The painful points are marked and a grid depicted on the skin to guide the treatment's application. A grounding pad is placed on the forearm volar side. The energy pulses are delivered applying the equipment hand piece directly on the skin and concentrated on the most painful points. Patients are advised not to apply ice or NSAIDs over the treated area and to return the next morning to normal daily activities with no restrictions at all [78].

Another alternative is thermal radiofrequency, applied with a Radionics RFG-3C Generator (Radionics Inc., Burlington, Massachusetts, USA) [77]. The procedure is guided and controlled with ultrasound imaging. With the patient in the supine position, the painful lateral epicondyle areas are identified by manual palpation and marked with a pen. After local anaesthetic agent is injected, a 22-gauge cannula is inserted through the skin with a 30–45° angle and advanced to the painful spots parallel to the extensor carpi radialis brevis tendon. To confirm the painful spots, sensory stimulation is applied at 50H frequency and 0.5 V. Muscle stimulation is also performed to rule out proximity of any motor nerve or that the active electrode tip lies inside muscular tissue. Another 0.3 mL of local anaesthetic is injected though the lesioning cannula and the radiofrequency applied to achieve a temperature of 80° for 120 s. For optimal results, the lesion should be performed at the extensor muscle humeral insertion [77]. Patients are allowed to regain normal working activities by 6 weeks after the procedure.

To improve the results, we do a variation of this procedure. The thermal radiofrequency is applied not monopolar but bipolar. This increases the size of the lesion and covers the painful areas better. To do it, two radiofrequency cannulas are used (22 gauge, 100 mm length, 5 mm active tip, Halyard, Alpharetta, GA, USA) and the energy provided by a generator (Coolief Cooled Radiofrequency Pain Management Generator, Halyard Alpharetta, GA, USA) (**Figure 1**).

4. Conclusions

Lateral epicondylitis is a painful condition that often resolves spontaneously. The recalcitrant cases in which the pain persists can be treated with a vast array of

options. Physiotherapy and local steroid injections are commonly used. Further conservative treatment modalities include local injection of botulinum toxin, platelet-enriched plasma, autologous blood or stem cells. The traditional open surgery has been subsided by other less invasive procedures like arthroscopic or percutaneous tenotomies. Radiofrequency, particularly thermal, has been proven as an adequate alternative to the surgical procedures and after failure of conservative treatments. Although in the past the radiofrequency was applied through a 3–5 cm skin incision, it is now possible to apply it through a cannula, minimising the surgical aggressiveness, reducing the patients' discomfort and speeding up the recovery.

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