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TITLE

Percutaneous electrochemical debridement of the Plantaris tendon: a novel option in the treatment of midportion Achilles tendinopathy.

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BLINDED MANUSCRIPT

TITLE

Percutaneous electrochemical debridement of the Plantaris tendon: a novel option in the treatment of midportion Achilles tendinopathy.

ABSTRACT

Plantaris tendon disorders are a well-known source of midportion Achilles tendinopathy. Plantaris tendon thickening and fibrous tissue formation between the tendons are the histological abnormalities which are typically observed. Surgical approaches (scraping of the Achilles medial and ventral paratendinous tissues and excision of the Plantaris tendon) have already shown good clinical outcomes; despite this, cost-benefit ratio of these interventions may be unfavourable and their accessibility is limited. Percutaneous needle electrolysis is a minimally invasive ablative technique of increasing consideration in the treatment of tendinopathies and associated conditions. The purpose of this article is to introduce a novel procedure to treat Plantaris tendon-related midportion Achilles tendinopathy. The procedure starts with the insertion of a non-coated needle (diameter: 0.30-0.40 millimetres; length: 30 millimetres) between the Plantaris and Achilles tendons, under ultrasound guidance. Subsequently, galvanic current (intensity: 2 mA) is locally transferred. This, in turn, induces instant non-thermal electrochemical ablation of the intertendinous tissues in close proximity to the needle, finally debriding the Plantaris tendon. In order to further promote its release, second part of the procedure involves partial tenotomy of the lateral peripheral aspects of the Plantaris tendon. Usually, the total duration of the session does not exceed thirty minutes. Percutaneous needle electrolysis may be considered as a valid alternative to surgery. The out-patient procedure presented in this article is, in fact, safe and quick to perform. Additionally, long suspension of working or sporting activities after the treatment is not required. Future investigations are needed to ascertain the short- and long-term therapeutic outcomes in the treatment of Plantaris tendon-related midportion Achilles tendinopathy, in particular by comparing them with those obtained with other mini-invasive interventions.

KEYWORDS

Ablative techniques – Electrolysis – Interventional ultrasonography – Tendon injuries

INTRODUCTION

The role of the Plantaris tendon in the etiopathogenesis of midportion Achilles tendinopathy has been certified over the last decade [1–3]. However, research of highly specific diagnostic modalities and optimal treatment strategies is still ongoing. Plantaris tendon-related midportion Achilles tendinopathy is clinically characterised by debilitating pain and swelling, which are typically localised in the medial aspects of the Achilles tendon body [2–3]. Friction and compression traumas between the tendons are likely to be the biomechanical disorders that lead to the histological changes observed in many researches, such as Plantaris tendon thickening, fibrous tissue formation between the tendons and alteration of the vascularisation and innervation patterns of the Achilles paratenon [1–4].

Surgical scraping of the Achilles medial and ventral paratendinous tissues has shown good clinical results in many trials, especially when associated with excision of the Plantaris tendon [5–8]. Despite this, cost-benefit ratio of these interventions may be unfavourable and their accessibility is relatively limited. Additionally, post-surgery rehabilitation protocols may last several months. As a consequence of this, there is need to identify new therapeutic solutions which may be as effective as surgery but without having these relevant weak points.

Thus, the main purpose of this article is to introduce the debridement of the Plantaris tendon via electrochemical ablation, induced by cathode-centred percutaneous needle electrolysis. The latter is an ultrasound-guided and minimally invasive technique which may be considered a valid alternative to surgery or, at least, a treatment option to contemplate before performing it. In support of this hypothesis, minimally invasive techniques (needle scraping or sclerosing polidocanol injections) have already shown encouraging clinical results in the treatment of Plantaris tendon-related midportion Achilles tendinopathy [9] and, on the other hand, percutaneous needle electrolysis is generally of increasing consideration in the treatment of tendinopathies and associated conditions [10–13].

PERCUTANEOUS NEEDLE ELECTROLYSIS

This study was designed and conducted according to national and international standards and in compliance with the Helsinki Declaration and the International Principles governing research on humans. Considering the typology of this article (clinically illustrated – technical note), *material and methods* and *results* sections are neither required nor presented.

Equipment

The Authors apply the technique using a specifically developed and medically certified device (EPI Advanced

Medicine®, Barcelona, Spain; directive 93/42/EEC). This instrumentation permits intratissue galvanic current transfer, at settable intensities, through an appropriate non-coated needle (diameter: 0.30-0.40 millimetres; length: 30 millimetres; same manufacturer as above). While the needle acts as the cathode, the anode can be handled by the patient or applied on the skin. The cathodic flow is the only one that is used during the procedure (cathode-centred electrolysis). When the current is transferred, the basic electrochemical process of saltwater electrolysis instantly develops, inducing the non-thermal ablation of the tissue in close proximity to the needle. The latter is inserted under ultrasound guidance in order to precisely treat the target tissue, without involving other structures. For this purpose, the Authors use the GE Healthcare® Logiq S7 Expert ultrasound equipped with the ML6-15 (50mm; 6-15 MHz) and L8-18I-D (25mm; 8-18 MHz) linear probes.

Preliminary ultrasound investigation

The patient lies on his or her side, with the medial aspects of the Achilles tendon directed upwards. The region is shaved and disinfected by applying a proper protocol. A preliminary ultrasound is carried out in order to accurately detect the portions of the Plantaris tendon in anatomical relationship with the medial aspects of the Achilles tendon body. It may be helpful to delimit the region to be treated, marking its distal and proximal limits with a sterile dermographic pencil. It is also advisable to mark the points at which the patient complains about having more pain and swelling ("critical areas") and where the major anatomical alterations are discernible (figures 1–2).

Description of the procedure

The procedure is graphically represented in figure 3. First, the needle is inserted between the Plantaris and Achilles tendons, under ultrasound guidance (figure 4). Subsequently, the galvanic current is transferred (intensity is pre-set to 2mA). Doing this, the local ablation of the fibrous intertendinous and Achilles paratenon tissues is instantaneously obtained, anatomically debriding the Plantaris tendon (figure 5). The single applications of current last 2-3 seconds.

Then, the needle is partially withdrawn and pointed toward the Plantaris tendon. In order to further promote its release, a partial tenotomy of the lateral peripheral aspects of the tendon is performed (figure 6). To this effect, the single application can have a variable duration, between 2-6 seconds, depending of the mechanical resistance offered by the tendinous tissue to the needle penetration (the lower the resistance, the shorter the application).

All the actions presented above are repeated approximatively every five millimetres (or less, in the "critical areas"; see above), in distal-proximal direction, throughout the region previously skin-marked. Typically, the total duration of the session does not exceed thirty minutes (including disinfection and dressing processes).

Tolerability of pain and side effects

The insertion of the needle typically cause minimal discomfort. By contrast, the patients may experience moderate strong pain during the applications of galvanic current. Anyway, anaesthetics are usually not locally injected before percutaneous electrolysis, since the procedure is generally well-tolerated by the patients (the single galvanic current application can be stopped at any time if the pain is not bearable) and because the use of syringes would substantially increase the overall invasiveness of the intervention. Anyway, use of anaesthetics remains a considerable option. Relevant vagal reactions during and immediately after the intervention are possible [14]. Bleeding in area of needle insertion and intervention-related discomfort in the treatment area (up to 48 hours) are the most common side effects. Infection-related issues are extremely rare, as the technique is minimally invasive and the electrolytic process has a substantial bactericidal effect.

DISCUSSION

The main purpose of this article is to introduce the debridement of the Plantaris tendon, via electrochemical ablation induced by cathode-centred percutaneous needle electrolysis, to treat Plantaris-related midportion Achilles tendinopathy. This novel procedure permits to eliminate the fibrous tissue interposed between the Plantaris and the Achilles tendons, debriding the Plantaris tendon and improving the local biomechanics.

The main practical value of this technique is the possibility of performing it in out-patient clinics, reducing considerably the costs, the waiting lists-related issue and the other implication and side effects of Achilles tendon surgery, such as suture reactions, incisional neuromas, and granuloma formation [15]. Furthermore, it should be reminded that post-surgery protocols may last several months. On the contrary, consistent with our experience, in particular with professional football (soccer) player, it is not necessary to completely suspend the sporting (or working) activities for more than 24-48 hours, after percutaneous needle electrolysis treatment. In fact, the side effects tend to be very moderate. However, many authors that use this technique, including us, find it helpful to implement a complementary protocol of active physical therapy [10–13]. Preliminary studies carried out by our research group indicate that the short-term clinical results (not yet published) after percutaneous needle electrolysis treatment in professional athletes are very promising but that it commonly necessary to conduct at least 3-5 sessions (one per week) to obtain long-lasting results. However, to date, clinical or imaging predictors of outcome are substantially unknown.

CONCLUSION

Percutaneous needle electrolysis is an ultrasound-guided and minimally invasive technique that allows specific treatment of the anatomical alterations that cause Plantaris tendon-related midportion Achilles tendinopathy. Since it is safe and quick to perform, it may be considered as a valid alternative to surgery. Future investigations are needed to ascertain the short- and long-term therapeutic outcomes in the treatment of Plantaris tendon-related midportion Achilles tendinopathy, in particular by comparing them with those obtained with other mini-invasive interventions.

REFERENCES

1. Olewnik L, Wysiadecki G, Polguj M, et al: Anatomic study suggests that the morphology of the plantaris tendon may be related to Achilles tendonitis. Surg Radiol Anat 39(1): 69, 2016.
2. Masci L, Spang C, van Schie HTM, et al: How to diagnose plantaris tendon involvement in midportion Achilles tendinopathy - clinical and imaging findings. BMC Musculoskeletal Disorders 17: 97, 2016.
3. van Sterkenburg MN, van Dijk CN: Mid-portion Achilles tendinopathy: why painful? An evidence-based philosophy. Knee Surg Sports Traumatol Arthrosc 19: 1367, 2011.
4. Spang C, Harandi VM, Alfredson H, et al: Marked innervation but also signs of nerve degeneration in between the Achilles and plantaris tendons and presence of innervation within the plantaris tendon in midportion Achilles tendinopathy. J Musculoskelet Neuronal Interact 15(2): 197, 2015.
5. Perace CJ, Carmichael J, Calder JD: Achilles tendinoscopy and plantaris tendon release and division in the treatment of non-insertional Achilles tendinopathy. Foot Ankle Surg 18: 124, 2012.
6. van Sterkenburg MN, Kerkhoffs GMMJ, van Dijk CN: Good outcome after stripping the plantaris tendon in patients with chronic mid-portion Achilles tendinopathy. Knee Surg Sports Traumatol Arthrosc 19: 1362, 2011.
7. Bedi HS, Jowett C, Ristanis S, et al: Plantaris Excision and Ventral Paratendinous Scraping for Achilles Tendinopathy in an Athletic Population. Foot Ankle Int 37(4): 386, 2016.
8. Calder JDF, Stephens JM, van Dijk CN: Plantaris Excision Reduces Pain in Midportion Achilles Tendinopathy Even in the Absence of Plantaris Tendinosis. Orthop J Sports Med 4(12): 2325967116673978, 2016.
9. Alfresdon H, Ohberg L, Zeisig E, et al: Treatment of midportion Achilles tendinosis: similar clinical results with US and CD-guided surgery outside the tendon and sclerosing polidocanol injections. Knee Surg Sports Traumatol Arthrosc 15: 1504, 2007.
10. Abat F, Diesel WJ, Gelber PE, et al: Effectiveness of the Intratissue Percutaneous Electrolysis (EPI®) technique and isoinertial eccentric exercise in the treatment of patellar tendinopathy at two years follow-up. Muscles

Ligaments Tendons J 4(2): 188, 2014.

11. Valera-Garrido F, Minaya-Munoz F, Medina-Mirapeix F: Ultrasound-guided percutaneous needle electrolysis in chronic lateral epicondylitis: short-term and long-term results. Acupunct Med 32: 446, 2014.

12. Moreno C, Mattiussi G, Nunez FJ, et al. Intratissue Percutaneous Electolysis (EPI®) combined with Active Physical Therapy for the treatment of Adductor Longus Enthesopathy-related Groin Pain: a randomised trial. J Sports Med Phys Fitness, 2017.

13. Arias-Buria JL, Truyols-Dominguez S, Valero-Alcaide R, et al: Ultrasound-Guided Percutaneous Electrolysis and Eccentric Exercises for Subacromial Pain Syndrome: A Randomized Clinical Trial. Evid Based Complement Alternat Med: 315219, 2015.

14. de la Cruz Torres B, Albornoz Cabello M, Garcia Bermejo P, et al: Autonomic responses to ultrasound-guided percutaneous needle electrolysis of the patellar tendon in healthy male footballers. Acupunct Med 34(4): 275, 2016.

15. Saxena A, Maffulli N, Nguyen A, et al: Wound Complications from Surgeries Pertaining to the Achilles Tendon. JAPMA 98(2): 995, 2008.

FIGURES

Figure 1. Plantaris tendon morphological abnormalities are commonly observed in case of mid-portion Achilles tendinopathy. The transversal, grey-scale, high resolution ultrasound image presented shows increasing of the thickness and width of the Plantaris tendon (indicated by the *dashed arrow*). In order to complete an accurate investigation, it is advisable to compare the tendon dimensions with those of the contralateral one and to take into high consideration the data concerning the normal morphology of the Plantaris tendon presented by Olewnik et al [1]. *Ach* = Achilles tendon; *K* = Kager's fat pad. Probe used: ML6-15 (50mm footprint).

Figure 2. Transversal, high resolution ultrasound image showing high blood flow (*filled arrows*) in the medial aspects of the Achilles tendon (*Ach*) and paratenon, between the Achilles and Plantaris tendon (indicated by the *dashed arrow*) and around the latter. In case of mid-portion Achilles tendinopathy, these signs may be discernible also in the ventral portions of the Achilles tendon [2]. Probe used: ML6-15 (50mm footprint).

Figure 3. Schematic diagram of the percutaneous needle electrolysis procedure, for the debridement of the Plantaris tendon. The needle is initially inserted between the Plantaris (*dashed arrow*) and the Achilles (*Ach*) tendons, as indicated

by the *line 1*, and, subsequently, within the lateral peripheral aspects of the Plantaris tendon, as indicated by the *dashed line 2*. *Asterisk* = tibial neurovascular bundle.

Figure 4. Ultrasound-guided insertion of the needle between the Achilles and the Plantaris tendons. Considering their anatomical relationship, the preferred approach is in posterior-to-anterior and medial-to-later direction. Inclination of the needle is variable and depends upon the specific morphological features of the tendons.

Figure 5. An iperechoic area (*arrows*) is typically observable around the needle immediately after the application of galvanic current and consequent development of the electrochemical process. This should confirm that only the intertendinous tissues have been treated, without involvement of other structures (first part of the procedure). *Dashed arrow*=Plantaris tendon; *Ach*=Achilles tendon. Probe used: L8-18I-D (25mm footprint).

Figure 6. After the ablation of the intertendinous fibrotic tissues, the needle (*asterisks*) is partially withdrawn and inserted in the lateral peripheral aspects of the Plantaris tendon (second part of the procedure). *Dashed arrow*=Plantaris tendon; *Ach*=Achilles tendon. Probe used: L8-18I-D (25mm footprint).

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