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Treatment Techniques

Critical review

Intratendinous surgery and injection treatment for midportion Achilles tendinopathy: a critical review

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Abstract

Introduction

Treatment of chronic painful midportion Achilles tendinopathy is known to be difficult. Multiple non-tendon-invasive and tendon-invasive methods are used. When traditional non-invasive treatments fail, it has become increasingly popular to try injections of PRP and autologous blood, and intratendinous open surgery is indicated finally. There is little, if any, scientific evidence from human studies backing up intratendinous injection treatment, and intratendinous surgical treatment can also be questioned. The aim of this critical review is to discuss intratendinous surgery and intratendinous treatment with injection for midportion Achilles tendinopathy.

Discussion

Based on a recent research using immunohistochemical analyses of tissue biopsies from patients with midportion Achilles tendinopathy, new non-tendon-invasive treatment methods combined with short rehabilitation periods have been invented. These methods have shown good clinical results, few complications and decreased tendon thickness along with improved tendon structure, over time.

The knowledge about innervation patterns, tendon cells and potentials in the soft tissue on the ventral (deep) side of the Achilles tendon midportion, along with good results using treatment methods focussing on the outside of the tendon, questions the use of tendon-invasive treatment methods for midportion Achilles tendinopathy.

Conclusion

A new science backing invasive treatment outside the tendon and newly-invented methods such as ultrasound and Doppler-guided surgical scraping treatment have shown promising results.

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Introduction

Although multiple treatment methods are used, treatment of midportion Achilles tendinopathy is known to be difficult[1]. Both conservative and surgical treatment methods are used, which can be divided into non-Achillestendon-invasive, and Achilles tendon-invasive methods.

Among the non-tendon-invasive conservative methods, painful eccentric calf muscle training is considered to be the most beneficial[2,3]. There are also indications that shock wave treatment[3] and ultrasound (US) + Doppler (DP)-guided sclerosing polidocanol injections[4] are beneficial. Tendon-invasive conservative methods include injection treatments with Platelet Rich Plasma (PRP)[5,6] and autologous blood (peri-or intratendineously)[7,8]. Stem cell injection treatment is also being used, but there are no studies on humans[9].

Surgical treatments include non-tendon-invasive procedures such as US and DP-guided scraping[10] and scraping combined with plantaris tendon removal[11]. Among the tendon-invasive methods, tenotomy with excision of degenerative tendon tissue is the most commonly used[12–14], which is sometimes combined with a flexor hallucis longus transfer procedure[15].

Morphologically, in the thickened and painful tendinopathy tendon, there is an altered tendon structure, including irregular fibre bundle arrangement and local high concentrations of glucosaminoglycans (GAGs), hypercellularity and neovascularisation[14]. Specific studies on the cells in the hyper-cellular region have shown that some of these cells produce transmitter and pain substances, and seem to have a more stemcell-like function[16–18]. Using US and DP, a localised high blood flow has been found outside and inside (in close relation to regions with structural changes) the ventral side in tendinopathy tendons, but not in normal Achilles tendons[19]. Immunohistochemical analyses of tissue specimens, obtained with US and DP guidance, outside and inside the region with tendon changes, have shown multiple sympathetic, but also sensory, nerves outside, but very few nerves inside, the Achilles tendon[20].

This critical review specifically questions the use of Achilles tendon invasive treatment methods without having a scientifically verified background.

Discussion

The author has referenced some of his own studies in this review. These referenced studies have been conducted in accordance with the Declaration of Helsinki (1964) and the protocols of these studies have been approved by the relevant ethics committees related to the institution in which they were performed. All human subjects, in these referenced studies, gave informed consent to participate in these studies.

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Critical review

Studies involving treatment methods outside the tendon[2,4,10,11] have shown good clinical results. Also, a decreased tendon thickness and improved tendon structure have been demonstrated in 2–3-year US follow-ups[21]. These treatments are based on the findings from immunohistochemical studies of tissue biopsies taken with US and DP-guidance, which show that the nerves were located in close relation to blood vessels outside the ventral side of the tendon[20]. Interestingly, interference with the tissue outside the ventral side of the thickened and painful Achilles had effects on the thickness and structure inside the Achilles, clearly demonstrating the high potential in the tissue outside the ventral Achilles.

Since many years, surgical treatment for midportion Achilles tendinopathy has focussed on the inside of the Achilles tendon. A method using a central longitudinal tenotomy to visualise the inside of the tendon, followed by excision of macroscopically 'abnormal' tendon tissue,[12–14] and a method using a flexor hallucis-longus transfer for re-inforcement is also being used[15]. These methods are most often combined with a period of immobilisation in a booth or cast[13,15], followed by gradually increased loading along with often 3–6 months of rehabilitation[12–16]. The results using these methods are not convincing[22], and US+DP follow-ups have shown remaining poor tendon structure[23]. With the knowledge we have today about the location of the nerves outside the Achilles tendon[20], and the positive effects on tendon thickness and structure after treatment outside the tendon[21], it seems difficult to justify intratendinous surgery for the treatment of midportion Achilles tendinopathy. It might be argued that in midportion Achilles tendinopathy, there is involvement of minor partial ruptures in the tendon, and that these ruptures need to be treated with intratendinous surgery. In fact, these tendons were even used to be called degenerative and weak tendons. But, today it is known that these degenerative and weak tendons most likely are not weak, but instead might be strong tendons. This statement is based on the thousands of midportion Achilles tendinopathy tendons that have been subjected to very high loads during painful eccentric calf muscle training[2,3], and high numbers of patients that return to Achilles tendon loading sports 3–4 weeks after treatment with sclerosing polidocanol injections[4] and scraping procedures[10] outside the tendon, without rupturing. Instead, it is known that most Achilles tendon ruptures are seen in individuals who never had Achilles tendon pain before the rupture[24]. They might have had morphological changes in their Achilles tendons, but they did not have painful midportion tendinopathy. A few morphology studies have suggested the existence of minor ruptures, but this has never been verified in clinical studies. Also, MRI and US examinations sometimes suggest partial ruptures in tendinopathy tendons, but again, this has not been verified in clinical studies. For grey-scale US examinations, a finding of a hypo-echoic region in the central or ventral part of the tendon is not seldom interpreted as a partial rupture. However, it is important to question such a statement. The hypo-echoic region represents a fluid-rich region, often seen in tendinopathy, and reflects local accumulation of hydrophilic GAGS[25]. Of course, these regions are soft and easy to inject into because they are rich in fluid. When followed over time, that is, after sclerosing injection or surgical scraping treatment outside the tendon, these hypo-echoic regions change in size, and often disappear, over days. Instead, in this region, the fibre bundles can be seen, which clearly indicates that this rapidly shifting local fluid accumulation instead should be interpreted as a type of oedema. Although it is relatively rare, midportion Achilles tendinopathy can be accompanied by a partial rupture, but those ruptures are located on the superficial, most loaded[26,27], side of the tendon. Using DP examination along with the US, localised high blood flow can be demonstrated in close relation to structural tendon changes/defect on the superficial (skin side) side of the tendon[28]. It is important to remember that tendinopathy is mainly found on the ventral (deep side) 'resting side', while partial ruptures are found on the dorsal (superficial side) 'loaded side'[26,27]. If there is a partial rupture along with the midportion Achilles tendinopathy, it can be treated by using a 1–2-cm heel lift in the shoe and by avoiding stretching for 3 months[29]. Then, the tendinopathy can be treated in the next phase. To conclude, in my opinion, with present knowledge about the innervation patterns and tendon recovery after treatment outside the tendon, there is no role for intratendinous surgical treatment of chronic painful midportion Achilles tendinopathy.

Intratendinous injection treatments have gained a dramatically increased popularity in the treatment of midportion Achilles tendinopathy during the last 5 years. PRP[5,6], autologous blood[7,8] and stem cells also[9] have been injected, often with the help of US, into the Achilles. To the best of my knowledge, scientific evidence is not available to justify the use of these methods. No studies were conducted on humans to prove deficiency of certain growth factors, cytokines or other bioactive proteins in the tendinopathy tendon. In fact, injecting certain factors might worsen the condition. Recently conducted studies on humans with tissue specimens from midportion Achilles tendinopathy tendons show that for unknown reasons, cells in the hyper-cellularity region act like nerve-like cells, and produce transmitters and pain substances such as substance-P, glutamate, acetylcholine, catecholamines (Figure 1). What

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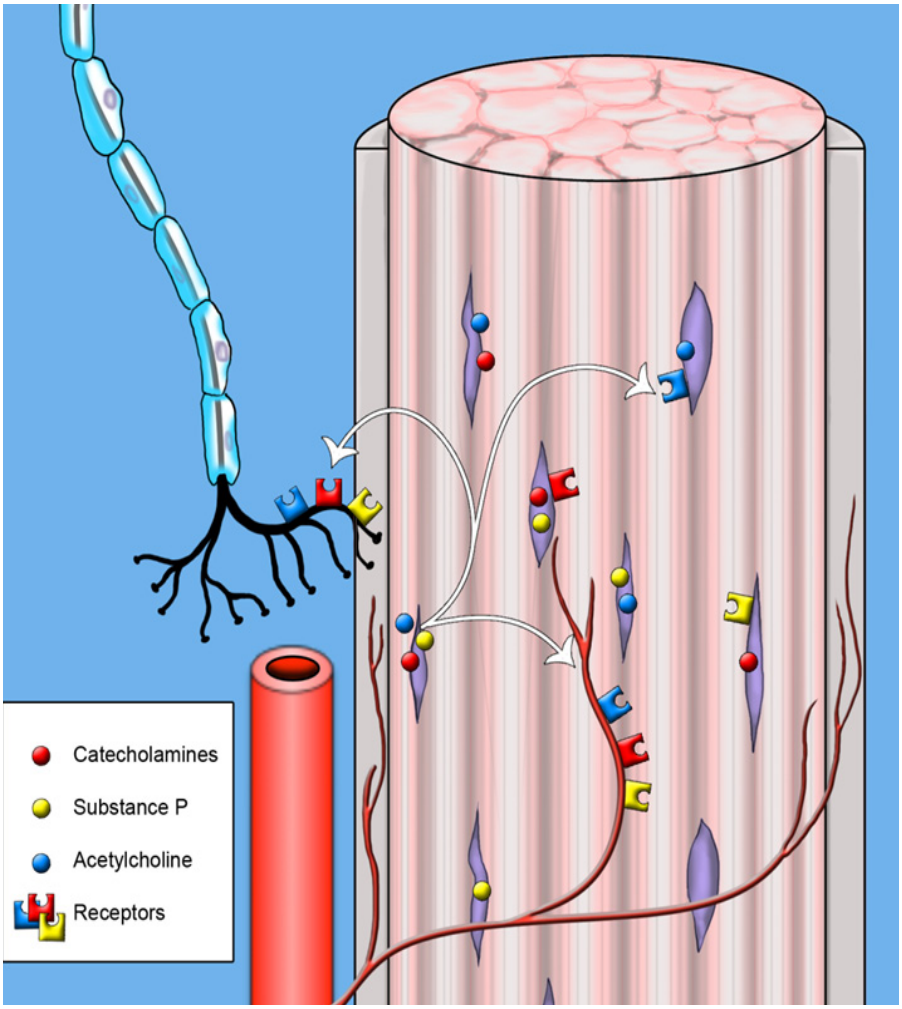

Figure 1: Midportion Achilles tendinopathy. Cells inside Achilles tendon producing catecolamines, substance-P and acetylcholine. Nerves and blood vessels are located outside the tendon.

would happen if we inject some element that triggers the production of pain substances? What is the role of stem cells? We know that some of the cells in the hyper-cellularity regions clearly show stem cell characteristics, and is it then indicated to inject more stem cells? Altogether, in my opinion, there are many major concerns around the use of these types of intra-tendinous injection treatments. What about legal aspects? What happens if there are complications after injections? What is the patient being told when he/she asks why this injection is given? It can certainly not be stated that there is deficiency and therefore a need to inject certain growth factors, bioactive proteins or cells inside the tendon. To conclude, until there is scientific evidence showing that there is a deficiency of certain growth factors, cytokines or other bioactive proteins or stem cells inside the chronic painful midportion Achilles tendinopathy tendon, it is my opinion that these types of intra-tendinous injection treatments should not be used.

Conclusion

In summary, there is no science backing up intra-tendinous injection treatment, and intra-tendinous surgical treatment should be questioned. New techniques focusing on treatment outside the tendon, such as US and DP-guided surgical scraping treatment combined with a short rehabilitation period are available with promising results.

Abbreviations list

DP, Doppler; GAG, glucosaminoglycan; US, ultrasound.

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