ABSTRACT

Purpose. To evaluate outcomes of radiofrequency coblation for chronic tendinosis of the foot and ankle tendons.

Methods. Records of 7 men and 8 women (16 feet) aged 27 to 65 years who underwent radiofrequency coblation for chronic tendinosis (combined with other procedures for other pathology) of the Achilles, posterior tibial, and peroneal tendons were retrospectively reviewed. The visual analogue scale (VAS) for pain status, the Short Form (SF-36) questionnaire for quality of life, and the American Orthopaedic Foot and Ankle Society (AOFAS) scores for functional status of the patients were determined pre- and post-operatively.

Results. All patients reported significant reduction in pain at 3 months, with more than 63% attaining VAS scores of 0 at 6 months. AOFAS scores were significantly improved at both 3 and 6 months. Most components of SF-36 scores improved at 6 months except those for general health and role emotional; only those for bodily pain improved significantly. At postoperative month 3 and 6 respectively, 93 and 100% of the patients had their expectations met, whereas 93 and 88% had good-to-excellent satisfaction. There were no major complications.

Conclusions. Radiofrequency coblation for chronic tendinosis of the foot and ankle achieves good short-term outcomes and pain relief. It may be combined with other procedures for maximal benefit.

Key words: ankle injuries; foot injuries; tendinopathy

INTRODUCTION

Overuse tendon injuries were thought to be inflammatory in nature and thus named tendinitis, but are actually tendinosis involving tendon degeneration without clinical or histological signs of inflammation. Distinguishing tendinosis from tendinitis is clinically difficult and can only be made by histopathological examination. Histologically, tendinosis is characterised by collagen degeneration, fibre disorientation, increased non-collagenous matrix, disorganised neovascularisation, focal necrosis, and an absence of inflammatory cells. It is
commonly due to ageing, microtrauma from overuse, and vascular compromise.¹

Tendinopathy of the foot and ankle is usually due to degeneration of the Achilles, tibialis posterior, and peroneal tendons.²,³ It is categorised into an initial acute phase followed by a protracted chronic phase.⁴ The acute phase is characterised by a combination of pain, swelling, and inflammation that can be alleviated by conservative measures,⁵ including immobilisation to rest the tendon and anti-inflammatory medicine to relieve the pain. The chronic phase is characterised by the lack of inflammatory cells and a poor healing response.⁶ Owing to the absence of inflammation, non-steroidal anti-inflammatory drugs (NSAIDs) do not work well in these conditions.

25 to 50% of patients with chronic tendinosis undergo surgery.⁷,⁸ Sclerosing injections have yielded good clinical results in Achilles tendinosis but not for other tendons.⁹ Radiofrequency has been used to resect, coagulate, or ablate tissue,¹⁰ and is thought to incite a healing response mediated by growth factors and cytokines. It has also been used in transmyocardial revascularisation, chondroplasty, meniscal repair, and even microtenotomy for lateral epicondylitis and rotator cuff tendinopathy.¹¹⁻¹³ As well as tendinosis of the foot and ankle.¹⁴⁻¹⁵ To maximise benefits, concomitant pathology should also be addressed at the same setting.

Radiofrequency coblation relieves pain via an anti-nociceptive effect.¹⁶ It induces degeneration of sensory nerve fibres immediately after treatment, but the nerves regenerate completely within about 90 days.¹⁷ The anti-nociceptive response is transient and is replaced by a longer term angiogenic response.¹¹ High concentrations of the excitatory neurotransmitter glutamate but not prostaglandin E2 have been found in Achilles tendinosis,¹⁸ consistent with a non-inflammatory aetiology. In Achilles tendinosis biopsies, neovascularisation is accompanied by neural ingrowth.¹⁹ Therefore, radiofrequency is able to ablate the pain without affecting the strength or structure of the tendon.²⁰

We evaluated the outcomes of radiofrequency coblation for chronic tendinosis of the foot and ankle.²¹

**MATERIALS AND METHODS**

Records of 7 men and 8 women (16 feet) aged 27 to 65 (mean, 52; standard deviation [SD], 11) years who underwent radiofrequency coblation for chronic tendinosis (combined with other procedures for other pathology) of the foot and ankle were retrospectively reviewed (Table 1). These 15 patients were operated on by the same surgeon over the period May 2007 to October 2008 after conservative therapy (activity modification, orthoses, and NSAIDs) had failed to resolve the symptoms. The mean duration of symptoms was 13 (SD, 14; range, 3–60) months. Patients with less than 3 months of follow-up, no preoperative assessment, or concurrent bony reconstruction were excluded.

The radiofrequency probe (Topaz microdebrider; ArthroCare, Sunnyvale [CA], US) was connected to a generator and timer. Two wands were used: one for open surgery and one with a 45º bend for tendoscopic surgery (Fig. 1). A controlled plasma-mediated radiofrequency-based process (coblation) was used.¹¹ Microtenotomy of the tendon was performed at 5-mm intervals with alternating depths of 3 to 5 mm and repeated in a grid-like fashion (Fig. 2). Postoperatively, patients were put on a short aircast for 6 weeks.

Patients were followed-up at week 2, 4, and 6, and month 3 and 6. The visual analogue scale (VAS) for pain status, the Short Form (SF-36) questionnaire for quality of life, and the American Orthopaedic Foot and Ankle Society (AOFAS) scores for functional status of the patients were determined pre- and post-operatively (3 and 6 months).

Pre- and post-operative paired samples were compared using the Wilcoxon signed rank test. A p value of <0.05 was considered statistically significant.

**RESULTS**

Preoperative VAS scores for the midfoot and hindfoot ranged from 0 to 10 (median, 5 and 7, respectively); some patients with posterior tibial tendon dysfunction and peroneal tendinosis had pain in one section but not the other. At the 6-month follow-up, the median VAS scores for the midfoot and hindfoot improved to 0; 67 and 63% of the patients achieved VAS scores of 0 (Table 2). At the 6-month follow-up, the median AOFAS midfoot and hindfoot scores improved significantly to 91 and 83, respectively (from 48 and 38 preoperatively, Table 2). The mean preoperative SF-36 scores of our patients were lower than the normal United States reference, except those for general health, role emotional, and mental health.²¹ At the 6-month follow-up, all the scores improved except those for general health and role emotional; only those for bodily pain improved significantly (month 3, p=0.005; month 6, p=0.003; Table 3).

At postoperative month 3 and 6 respectively, 93 and 100% of the patients had their expectations met, whereas 93 and 88% of patients had good-to-
Table 1

<table>
<thead>
<tr>
<th>Patient no.</th>
<th>Side</th>
<th>Sex/age (years)</th>
<th>Diagnosis</th>
<th>Operation</th>
</tr>
</thead>
</table>
| 1           | Left  | F/28            | 1. Peroneal longus tear, tendinosis, and symptomatic os peroneii  
2. Plantar fasciitis  
3. Equinus contracture | 1. Peroneal tendon reconstruction, excision of os peroneii, and radiofrequency coblation  
2. Planter fascia radiofrequency coblation  
3. Endoscopic gastrocnemius recession |
| 2           | Right | M/48            | 1. Tendo-Achilles insertional tendinosis  
2. Haglund’s deformity | 1. Tendo-Achilles radiofrequency coblation  
2. Tendo-Achilles proximal transfer  
3. Calcaneoplasty and excision of Haglund’s deformity  
4. Excision of retro-calcaneal bursa |
| 3           | Left  | F/53            | 1. Tendo-Achilles insertional tendinosis  
2. Haglund’s deformity | 1. Tendo-Achilles radiofrequency coblation  
2. Tendo-Achilles proximal transfer  
3. Calcaneoplasty and excision of Haglund’s deformity  
4. Excision of retro-calcaneal bursa |
| 4           | Left  | M/50            | 1. Ankle impingement  
2. Posterior tibial tendon tendinosis  
3. Equinus contracture | 1. Ankle arthroscopic debridement  
2. Posterior tibial tendon radiofrequency coblation  
3. Percutaneous tendo-Achilles lengthening |
| 5           | Left  | F/59            | 1. Talonavicular and naviculomedial cuneiform osteoarthritis  
2. Posterior tibial tendon tendinosis  
3. Equinus contracture | 1. Talonavicular and naviculomedial cuneiform joint arthrodiesis  
2. Posterior tibial tendon radiofrequency coblation  
3. Percutaneous tendo-Achilles lengthening |
| 6           | Left  | M/56            | 1. Posterior tibial tendon tendinosis  
2. Equinus contracture | 1. Posterior tibial tendon radiofrequency coblation  
2. Endoscopic gastrocnemius recession |
| 7           | Right | M/65            | 1. Posterior tibial tendon tendinosis  
2. Equinus contracture | 1. Posterior tibial tendon radiofrequency coblation  
2. Endoscopic gastrocnemius recession |
| 8           | Bilat-eral | F/52 | 1. Bilateral posterior tibial tendon tendinosis  
2. Bilateral equinus contracture | 1. Bilateral posterior tibial tendon radiofrequency coblation  
2. Bilateral endoscopic gastrocnemius recession |
| 9           | Right | F/56            | 1. Posterior tibial tendon tendinosis  
2. Equinus contracture | 1. Posterior tibial tendon radiofrequency coblation  
2. Endoscopic gastrocnemius recession |
| 10          | Right | M/27            | 1. Tendo-Achilles non-insertional tendinosis | 1. Tendo-Achilles arthroscopic debridement and radiofrequency coblation  
2. Posterior tibial tendon radiofrequency coblation |
| 11          | Left  | M/49            | 1. Ankle impingement  
2. Posterior tibial tendon tendinosis | 1. Ankle arthroscopic debridement  
2. Posterior tibial tendon radiofrequency coblation |
| 12          | Left  | F/58            | 1. Ankle impingement  
2. Peroneal tendon tendinosis | 1. Peroneal tendon arthroscopic debridement and radiofrequency coblation  
2. Peroneal tendon radiofrequency coblation |
| 13          | Right | M/58            | 1. Tendo-Achilles non-insertional tendinosis | 1. Tendo-Achilles arthroscopic debridement and radiofrequency coblation  
2. Peroneal tendon radiofrequency coblation |
| 14          | Right | F/62            | 1. Peroneal tendon paratendinitis and tendinosis | 1. Peroneal tendon arthroscopic debridement and radiofrequency coblation  
2. Peroneal tendon radiofrequency coblation |
| 15          | Right | M/55            | 1. Peroneal tendon tendinosis with tear  
2. Ankle impingement | 1. Peroneal tendon arthroscopic debridement, repair and radiofrequency coblation  
2. Ankle arthroscopic debridement |

Excellent satisfaction (Table 4). One patient with postoperative swelling and pigmentation had unmet expectations and fair satisfaction at 3 months, but at 6 months his VAS score was 0. Two patients had a fair degree of satisfaction at 6 months: one returned to normal activity and the other with posterior tibial tendon tendinosis complained of increasing pain and deformity with inability to perform single straight leg heel raising at 6 months, although he had no tendon rupture. He underwent medialising calcaneal osteotomy and Evan’s lateral column lengthening osteotomy and had returned to work. One patient with tendo-Achilles insertional tendinosis and Haglund’s deformity developed superficial wound dehiscence.

DISCUSSION

Conservative treatment for foot and ankle...
Tendinopathy requires prolonged immobility or intensive physiotherapy and rehabilitation for 12 to 16 weeks, and attains success rates of about 50%. Surgery is an acceptable choice for patients after failed conservative treatment. It involves debridement for tendinotic tendons, repair and tubularisation for torn or split tendons. The debridement includes longitudinal division of the crural fascia, excision of macroscopic adhesions and any intratendinous lesions, via open or arthroscopically assisted.
Table 4
Patient expectation and satisfaction

<table>
<thead>
<tr>
<th>Questions</th>
<th>Postoperative month 3 (% of patients)</th>
<th>Postoperative month 6 (% of patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has the surgery for your foot/ankle condition met your expectation so far?</td>
<td>Yes, totally 0 25</td>
<td>Yes, almost totally 93 38</td>
</tr>
<tr>
<td></td>
<td>Yes, quite a bit 0 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>More or less 0 25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No, not quite 7 0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No, far from it 0 0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No, not at all 0 0</td>
<td></td>
</tr>
<tr>
<td>How would you rate the overall results of the surgery for your foot/ankle condition?</td>
<td>Excellent 14 38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Very good 57 25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good 22 25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fair 7 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poor 0 0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Terrible 0 0</td>
<td></td>
</tr>
</tbody>
</table>

Other extensive forms of surgery involve augmentation and tendon transfers, but these entail prolonged recovery and require foot protection for 3 months and optimal results are only achieved after a year. For competitive athletes who need to return to sports as soon as possible, pain reduction is paramount.

Most of our patients had early posterior tibial tendon dysfunction and all had chronic pain and tendinosis unrelieved with conservative therapy. Our patients achieved good results, similar to those with Achilles, lateral and medial epicondylitis, and patellar tendinosis. Radiofrequency coblation can be used safely in early posterior tibial tendon dysfunction and may halt or delay its progression to stage 3. It can be combined with minimally invasive techniques such as tendoscopy (Fig. 3) for Achilles tendonitis and achieve significant short-term pain relief without major complications.

Radiofrequency microtenotomy shortens the natural history of disease in the tendon and hastens recovery. VAS scores decrease more markedly in the short term after radiofrequency microtenotomy than open surgery, but there is no difference at the 18-month follow-up. The procedure is especially useful for young competitive athletes who need shorter rehabilitation and quicker recovery. Recovery should be long-term, barring any re-injuries. Full function of the tendon is likely to be achieved with no compromise in strength, as the tendons are not severed (as in release procedures).

Early protection of the foot is necessary, as patients may over exert prematurely, because of early pain relief. Most of our patients had other underlying pathology associated with tendinosis. For maximal benefit, such pathology must be dealt with during the index procedure. Long-term follow-up is needed to determine whether the benefits are sustainable.

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REFERENCES