

# The Effectiveness of Radial Extracorporeal Shock Wave Therapy for Chronic Achilles Tendinopathy: A Case Report with 18 Months Follow-Up

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## Abstract

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**BACKGROUND:** Achilles tendinopathy (AT) is a pathological state resulting from repetitive loading or stress on the tendon. The article aims to evaluate the effects of the low - energy radial extracorporeal shockwave therapy (RESWT) in the treatment of the adult with chronic insertional Achilles tendinopathy (AT) after the unsuccessful conservative treatment, with 18 months follow - up evaluation.

**CASE REPORT:** We report the case of a 55 years - old male suffering from severe right posterior heel pain for 4 months. For his chronic insertional Achilles tendinopathy on the right heel, he received conservative treatment in the Institute of Physical Medicine and Rehabilitation. For outcome assessment, Numerical Rating Scale (NRS) for pain, the range of motion in the ankle, and Roles-Maudsley Score (RMS) for assessment of function were used. At the baseline the pain was severe, and he received physical therapy treatment. After unsuccessful conservative treatment, he underwent RESWT treatment. Numeric Rating Scale was significantly decreased at immediate, short-term and long-term follow-up. After the last treatment, the patient had no pain, and function assessed by Roles-Maudsley Score was excellent. At the follow-up check-up at 3, 6, 12 and 18 months the patient had no pain and excellent functional results.

**CONCLUSION:** Radial ESWT is a safe and effective treatment even for a longer period for patients with chronic insertional Achilles tendinopathy.

## Introduction

Achilles tendinopathy (AT) is a pathological state resulting from repetitive loading or stress on the tendon [1]. The two main categories of Achilles tendon disorder are broadly classified by anatomical location to include non - insertional and insertional conditions [2].

This clinical condition is characterised by pain and tenderness in or around Achilles tendon, frequently occurring in active, as well as, inactive individuals [3]. Chronic Achilles tendinopathy was defined as a condition lasting more than six weeks [4] or more than three months [1]. Chronic Achilles

tendinopathy has been described as the most common overuse injury in sports medicine [5].

Several treatment modalities such as activity modification, heel lifts, arch supports, stretching exercises, nonsteroidal anti-inflammatories, and eccentric loading are known as standard conservative treatment [4] [5] [6], as well as various injections and extracorporeal shock wave therapy (ESWT) [2].

In chronic refractory cases that exhibited no improvement after appropriate conservative treatment, surgical intervention has been performed [5] [6] [7].

Extracorporeal shock wave therapy (ESWT) has been successfully used in soft - tissue pathologies like lateral epicondylitis, plantar fasciitis, and calcific

tendinopathy of the shoulder, Achilles tendinopathy and also in bone and skin disorders [5].

Radial extracorporeal shock wave therapy (RESWT) is the application of high-intensity acoustic radiation, (high - energy acoustic waves - shock waves). Shock waves are defined as a sequence of single sound pulses which are characterized by high point of pressure that can reach up to 100 MPa (but most often 50 - 80 MPa), fast reach of pressure for a short period of less than 10ns, short duration (10  $\mu$ s), followed by a variable negative pressure that can affect cavitation and a frequency of 16 - 20 Hz [8] [9].

Last decade some article about the effectiveness of extracorporeal shock wave therapy as management of chronic Achilles tendinopathy had been published [10] [11] [12].

The mechanism by which ESWT may produce a clinical effect is still uncertain. Several theories have been proposed: a mechanical effect by increasing the pressure in the calcium deposition causing fragmentation; a molecular effect with induction of an inflammatory response with neovascularisation and then a chemotactic action and phagocytosis of calcific deposits; an analgesic effect by inhibiting the activation of the serotonergic system, and peripheral denervation. Probably, a combination of angiogenic and analgesic effects explains the overall outcomes on the target tissues [13].

The article aims to evaluate the effects of the radial extracorporeal shockwave therapy (RESWT) in the treatment of an adult with chronic insertional Achilles tendinopathy (AT) after unsuccessful conservative treatment, with 18 months follow - up evaluation.

## Case report

We report the case of a 55 years - old male (man) suffering from severe right posterior heel pain for 4 months. He performed recreational activities like walking, skiing, swimming, riding the boat regularly. He suffered from pain, tenderness at the Achilles tendon insertion at the back of the heel bone, with or without activity, even when he wears comfortable shoes. He underwent plain radiography. Plane x-ray radiography of the right heel showed the presence of retrocalcaneal entensophyte (bone spur) (Figure 1).

He didn't have the presence of systemic inflammatory disease; previous history of foot surgery; fracture of foot or ankle; and calcification of Achilles tendon. For his chronic insertional Achilles tendinopathy on the right heel, he received conservative treatment in the Institute of Physical Medicine and Rehabilitation.



Figure 1: Plane x-ray radiography of the right heel showed the presence of retrocalcaneal entensophyte (bone spur)

For outcome assessment Numerical Rating Scale (NRS) for pain, the range of motion in the ankle, and Roles - Maudsley Score (RMS) (12) for assessment of function were used. Numerical Rating Scale is an 11 - point pain intensity rating scale, where 10 points indicate worst possible pain and 0 points no pain.

The immediate follow - up (1 week after the last RESWT), short-term outcome (after 3 and 6 months) and long-term outcome (after 12 and 18 months) were analysed. The assessments were performed at baseline, at the end of the treatment, 1 week and 3, 6, 12 and 18 months after completion of the treatment.

At the baseline the pain was severe, Numeric Rating Scale 7 points, and his functioning was assessed with Roles - Maudsley Score as poor (point 4, pain - limited activities), the range of motion in the right ankle was in normal range (dorsal flexion 20 degrees, plantar flexion 30 degrees bilaterally). He had pain on palpation in the area of the insertion of Achilles tendon. He received physical therapy treatment with therapeutic ultrasound, iontophoresis with anaesthetic (novocaine), and stretching calf exercises during two weeks (10 sessions with weekend pause).

After that treatment, he had some improvement with some decreasing of pain (Numeric Rating Scale 5 points) and small functional improvement Roles - Maudsley Score as fair (point 3, some discomfort after prolonged activity). After unsuccessful conservative treatment one week later he underwent on low energy radial extracorporeal shock wave treatment.

### RESWT protocol

For the application of the radial extracorporeal shock wave therapy the device BTL - 5000 SWT Power (BTL Industries Ltd., United Kingdom) was used, with 15 mm radial probe. Shockwave was

applied to the area of maximal tenderness (over the insertion) at Achilles tendon with the patient lying in the prone position. The therapy was applied by the recommendations of the manufacturer: continuous type of the shocks, with 2000 shocks per session. The shocks were applied with a pressure of 2 Bar and a frequency of 10 Hz. The low energy was used, so the application was painless and required no anaesthesia or analgesics. A total number of treatment sessions were 5. The time interval between treatments was one week. RESWT was used as a single intervention.

The patient was educated to perform home-based Achilles tendon stretching exercise and recommended to reduce activity level, to avoid impact activities, such as running and to wear comfortable, soft leather shoes.

Numeric Rating Scale was significantly decreased at immediate and long-term follow-up. Between the treatments sessions, the patient reported decreasing the pain level and improvement of functioning. After the last treatment, the patient had no pain (Numeric Rating Scale was 0 point), and there was an improvement of function Roles - Maudsley Score was excellent (point 1, no pain, full movement and activity). At the follow - up check - up at 3 months, 6 months, 12 and 18 months the patient has no pain and excellent functional results. He was involved in all previous work duties and recreational activities.

## Discussion

In our study, we report the immediate, short - term and long - term effectiveness of low - energy radial extracorporeal shock wave therapy in a patient with chronic insertional Achilles tendinopathy.

Achilles tendinopathy may be insertional or non - insertional (mid - portion) tendinopathy. Non - insertional Achilles tendinopathy is often managed conservatively, and many rehabilitation protocols have been adapted and modified, with excellent clinical results. The management of insertional Achilles tendinopathy with conservative rehabilitation protocols as used in non - insertional disorders were thought to prove less successful [2].

For chronic Achilles tendinopathy (symptoms lasting longer than six weeks), an intense eccentric strengthening program of the gastrocnemius/soleus complex improved pain and function between 60 and 90 percent in randomised trials [4].

In the management of chronic tendon injuries, other modalities such as prolotherapy, topical nitroglycerin, iontophoresis, phonophoresis, therapeutic ultrasound, extracorporeal shock wave therapy, and low - level laser therapy have less

evidence of effectiveness but are reasonable second-line alternatives to surgery for patients who have persistent pain despite appropriate rehabilitative exercise [4].

Treatment such as extracorporeal shock wave therapy is also proving successful [2]. Our patient had significant improvement with decreasing of heel pain and improvement of the function at short-term (3 and 6 months) and at long-term follow - up (12 and 18 months).

Most of the studies regarding usage of ESWT in patients with chronic Achilles tendinopathy reported short-term 3 or 4 months [10], 6 months [14] or long - term 12 months outcome [10] [11] [12]. We used low - energy radial extracorporeal shock wave therapy.

Recently published data have shown the efficacy and low - energy [10] [11] as well as of focused extracorporeal shock wave therapy [15] in chronic Achilles tendinopathy.

In our study, a maximum of 5 sessions of low - energy radial ESWT (Bars, 10 Hz, 2000 shocks per session, weekly) were conducted until the patient reached "excellent" treatment success.

In the reported studies, Rompe et al. treatment protocol included 3 sessions of low - energy ESWT using  $0.12 \text{ mJ/mm}^2$  with 2,000 shocks per session [10], Pavone included 4 sessions of low - energy ESWT with a 2 - week interval, from 800 shocks in each one (4 Hz, 14 KeV) [11]; Lee et al. included a maximum of 12 sessions of ESWT ( $0.10 - 0.11 \text{ mJ/mm}^2$ , 600 shocks, weekly) were conducted until Roles - Maudsley Score reached 'good' or 'excellent' (treatment success), [12]; while Furia performed just a single session of ESWT using high - energy ( $0.21 \text{ mJ/mm}^2$ ) with 3,000 shocks [15].

In the randomised, controlled trial of 50 patients with chronic (6 months or more) recalcitrant insertional Achilles tendinopathy eccentric loading showed inferior results to low - energy shock wave therapy as applied in patients with chronic recalcitrant tendinopathy of the insertion of the Achilles tendon at four months of follow - up. The favourable results of repetitive low - energy shock wave therapy at four months were stable at the one - year follow - up evaluation [10].

Pavone V et al. reported the results of a series of 40 patients with chronic insertional Achilles tendinopathy treated with low - energy ESWT after the failure of a 3 - month program of eccentric exercises alone. All patients were previously treated with only eccentric exercises for a 3 - month period. The treatment protocol included 4 sessions of ESWT with a 2 - week interval, from 800 shots in each one (4 Hz, 14 KeV), together with eccentric exercises. At the 12 - month follow - up, 26 (65.0%) patients did not complain about pain (VAS < 2), 11 (27.5%) patients got back to normal activities

despite residual pain (VAS 2 - 4), and 3 (7.5%) of the patients still complained about pain (VAS > 4). There was no significant improvement in both scores after eccentric exercises alone [11].

Costa ML et al. in the randomised placebo-controlled trial with forty - nine patients with Achilles tendon pain who were treated with ESWT once a month for 3 months, at the end of the trial, they found no difference in pain relief between the shock wave therapy group and the control group [16].

Furia JP, reported one month, 3 months, and 12 months after treatment that group of patients with chronic insertional Achilles tendinopathy who were treated with 1 dose of high-energy extracorporeal shock wave therapy had significant reduction of pain on Visual Analogue Scale compared with a group of patients who were treated with nonoperative therapy. Twelve months after treatment, the number of patients with successful Roles and Maudsley scores was statistically greater in the ESWT group compared with the control group, with 83% of ESWT group patients having a successful result [15].

In the systematic review of 4 prospective randomised controlled trials and 2 prospective clinical trials with a minimum 3 months' follow - up, Al - Abbad H, and Simon JV, investigated the effectiveness of ESWT in the treatment of insertional and noninsertional Achilles tendinopathies. Four out of six studies reported statistically significant improvement with ESWT in pain scores at a minimum of four months period, and also four of five studies reported statistically significant improvement in functional outcome with ESWT. Overall, their review showed satisfactory evidence for the effectiveness of low - energy ESWT in the treatment of chronic insertional and noninsertional Achilles tendinopathies at a minimum 3 months' follow - up before considering surgery if other conservative management fails. However, combining ESWT with eccentric loading appeared to show superior results [1].

Our patient had the good immediate therapeutic effect of RESWT although his plane x-ray showed the presence of retrocalcaneal enthesophyte. Presence of retrocalcaneal enthesophyte may imply that the patient has high activity level and is more liable to overuse injuries.

Retrocalcaneal enthesophytes may be an adaptive response to increased traction in the Achilles tendon [17]. Increased mechanical loading triggers osteoblastic activity at the tendon attachment site, and physically active people are more likely to exhibit the presence of enthesophytes [18].

In the recently published study, Lee JY et al. investigated immediate and long-term outcome (mean 26 months) in 36 patients who underwent ESWT for chronic (> 6 months) AT after unsuccessful

conservative treatment. They concluded that ESWT appeared to be effective in achieving long-term success. Immediate success was associated with the absence of retrocalcaneal enthesophyte on X-ray, the presence of pretreatment abnormal ultrasonography echogenicity, shorter mean duration of 'post-treatment soreness', and shorter duration of 'post -treatment soreness after first ESWT'. The shorter duration of 'post - treatment soreness after first ESWT' was identified as the only positive prognostic parameter in achieving long - term success [12].

There were no adverse effects of application of radial ESWT in our patient.

Costa ML et al. in the randomized placebo - controlled trial reported that there were two patients (62 years and 65 years) with tendon ruptures in the treatment group, suggesting caution when treating older patients [16].

In the retrospective clinical study with 67 patients were compared the results of extracorporeal shock wave therapy (ESWT) for insertional Achilles tendinopathy with or without Haglund's deformity. Authors reported that ESWT resulted in greater clinical outcomes in patients without Haglund's deformity compared with patients with Haglund's deformity [19].

In conclusion, radial extracorporeal shock wave therapy is a safe and effective treatment even for longer period of time for patients with chronic insertional Achilles tendinopathy if conservative treatment fails. Further research is warranted to better define the appropriate dosage, interval of treatments, number of sessions to achieve excellent and good clinical outcome.

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