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Shockwave Therapy for Patients with Plantar Fasciitis: A One-Year Follow-up Study

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ABSTRACT

The effect of shockwave therapy was investigated in 79 patients (85 heels) with plantar fasciitis with one-year follow-up. There were 59 women and 20 men with an average age of 47 (range, 15-75) years. Each patient was treated with 1000 impulses of shockwave at 14 kV to the affected heel. A 100-point scoring system was used for evaluation including 70 points for pain and 30 points for function. The intensity of pain was based on a visual analogue scale from 0 to 10. The overall results were 75.3% complaint-free, 18.8% significantly better, 5.9% slightly better and none unchanged or worse. The effect of shockwave therapy seemed cumulative and was time-dependent. The recurrence rate was 5%. There were no device-related problems, systemic or local complications. Shockwave therapy is a safe and effective modality in the treatment of patients with plantar fasciitis.

Key Words: Shockwave, Therapy, Plantar Fasciitis

INTRODUCTION

The exact cause of plantar fasciitis is unknown, and the role of heel spur in the causation of heel pain remains controversial.^{6,11} The diagnosis of plantar fasciitis is usually made clinically and the heel spur confirmed with an X-ray. The goals of treatment are to alleviate pain and restore function. Non-surgical management is

the initial treatment of choice. Surgical treatment with either an open or an endoscopic release of the plantar fascia has been recommended in patients who failed to respond to conservative treatment.^{1,4,11}

The results from nonsurgical treatments including orthotics, nonsteroidal anti-inflammatory drugs, local cortisone injection, physiotherapy or an exercise program vary considerably and there is no consensus on the best method of treatment.^{6,11} Similarly, the results of surgery are also inconsistent.^{4,11} Shockwave therapy was recently introduced for the alleviation of pain due to plantar fasciitis with a high rate of success in short-term.^{5,7} However, the long-term results on the effect of shockwave therapy for patients with plantar fasciitis are lacking. Our initial experience with shockwave treatment for patients with plantar fasciitis showed 80% satisfactory result at three months follow-up.¹³ The purpose of this study was to further update the results of shockwave therapy for patients with plantar fasciitis with one-year follow-up.

MATERIALS AND METHODS

Seventy-nine patients (85 heels) were treated with shockwave therapy for refractory plantar fasciitis between August 1998 and April 1999. Six patients had treatments on bilateral heels. There were 59 women and 20 men with an average age of 47 years (range, 15 to 75). The left heel was affected in 44 cases and the right heel in 41. The average duration of the condition was 9.8 months (range, six to 36 months). The inclusion criteria included patients with an established diagnosis of plantar fasciitis who had failed at least six months of nonsurgical treatments. Surgery would therefore be recommended as the next treatment. Patients with less than six months of symptoms, systemic or local infection, diabetes mellitus, obstructive peripheral vascular disease, metabolic disease such as gout, pregnancy, nerve pain or nerve entrapment or patients younger than 18 years were excluded.

EMG and nerve conduction studies were performed if there was a question of nerve entrapment. Each heel

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was treated with 1,000 impulses of shockwaves at 14 kV (0.18 mJ/mm² energy flux density). The source of shockwave was from an OssaTron orthopedic lithotripter[®] (High Medical Technology, Kruealigen, Switzerland). The treatments were performed as outpatient using local anesthesia with 2% xylocaine. The area of treatment

was focused with a control guide and surgical lubricant was placed on the skin in contact with the shockwave tube. The patient's vital signs and local discomfort were monitored throughout the course of treatment. The treated area was inspected for local swelling, ecchymosis or hematoma immediately after the treatment. Patients were sent home with non-narcotic analgesic such as acetaminophen. Nonsteroidal anti-inflammatory drugs were not prescribed. Sixteen patients (20%, 19 heels) also received a second treatment because of inadequate response 30 to 45 days from the first treatment. Similarly, five patients (six heels) received a third treatment for reason of incomplete response from the second treatment. Therefore, 58 patients (73%, 60 heels) received one treatment, 16 patients (20%, 19 heels) received a second treatment and five patients (6%, six heels) received a third treatment.

The follow-up examinations were scheduled at six weeks, three, six and 12 months after shockwave therapy. At the 12 months follow-up, 48 patients were examined and 31 patients were given a telephone survey. A 100-point scoring system was used for evaluation including 70 points for pain and 30 points for function (Table 1). The pain scores included pain after maximal distance for level walking (>1,000 meters), start-up pain and pressure pain; and the functional scores included pain at work, pain during free time including sports activities and pain at night. The intensity of pain was measured with a visual analogue scale from 0 to 10 points with 10 points for patients with no pain and 0 point for patients with severe pain. The visual analogue scale scores were reversed to keep a consistent scoring system in this study. It did not alter or affect the statistical results. The values of scores before treatment and at 12 months after treatment were compared statistically using a paired t test with a statistical significance at $p < 0.05$. No control group of patients was included in this study.

Table 1: A 100-point scoring system.

I. Pain scores (70 points):

1. Pain on maximal distance for level walking

(0-45 points)

Distance	points
0 meter	0
<100 meters	15
<1,000 meters	30
>1,000 meters	45

2. Start-up pain (0-5 points)

Yes	0
No	5

3. Pressure pain (0-20 points)

(0 point for severe pain; 20 points for no pain)

II. Functional scores (30 points):

1. Pain at work (0-10 points)

(0 for severe restriction; 10 points for no restriction)

2. Pain during free time/sports (0-10 points)

(0 for severe restriction; 10 points for no restriction)

3. Pain at night (0-10 points)

(0 for severe restriction; 10 points for no restriction)

Table 2: Pain scores and functional scores before treatment and at 12 months after treatment in patients who received one shockwave therapy.

Evaluation scores	Before treatment	At 12 months	p-value*
Number of patients/heels	58/60	58/60	
Total pain scores	25.4±12.4	67.7±6.6	<0.001
Pain on level walking	19.8±10.5	44.0±3.8	<0.001
Start up pain	2.4±2.1	49.7±0.2	<0.001
Pressure pain	3.3±2.8	18.8±3.0	<0.001
Total function scores	14.1±4.0	29.0±2.6	<0.001
Pain at work	3.7±1.96	9.4±1.3	<0.001
Pain during free times	4.5±1.7	9.7±0.95	<0.001
Pain at night	5.9±2.5	9.9±0.5	<0.001

*paired t test

RESULTS

In this study, 58 patients (60 heels) received one treatment, 16 patients (19 heels) received a second treatment and five patients (six heels) received a third treatment. The clinical results were analyzed separately in three groups of patients according to the number of shockwave treatments they had received.

In group I of 58 patients (60 heels) who received one treatment, the intensity of pain was 2.5±0.9

before treatment and 9.48 ± 1.28 at 12-month follow-up ($p < 0.001$). The total pain scores were 25.4 ± 12.4 before treatment and 67.7 ± 6.6 at 12 months ($p < 0.001$). The functional scores were 14.1 ± 4.0 before treatment versus 28.95 ± 2.63 at follow-up ($p < 0.001$). The details of pain scores and function scores are summarized in Table 2. The overall results were complaint-free in 49 (81.7%), significantly better in nine (15%), slightly better in two (3.3%) and none unchanged. None of the patients' symptoms became worse.

In group II, 16 patients (19 heels) received a second treatment. The intensity of pain was 3.79 ± 1.40 after the first treatment and 9.16 ± 1.21 after the second treatment ($p < 0.001$). The total pain scores were 38.8 ± 15.0 after the first treatment and 67.1 ± 6.2 after the second treatment ($p < 0.001$). The functional scores were 16.7 ± 5.8 after the first treatment versus 28.5 ± 2.3 after the second treatment ($p < 0.001$). The details of pain scores and function scores after the first and the second treatments are summarized in Table 3. The overall results were complaint-free in 12 (63.2%), significantly better in four (21.1%), slightly better in three (15.8%) and none unchanged. It seemed that patients who did not respond favorably to the first treatment still had a good chance to achieve satisfactory results after a second treatment. Shockwave therapy seemed to show positive cumulative effects in the treatment of patients with plantar fasciitis.

In group III, five patients (six heels) received a third treatment. The results were complaint-free in three patients (three heels), significantly better in two patients (three heels) and none unchanged or worse.

When all 79 patients (85 heels) were analyzed collectively, the overall results were complaint-free in 64 (75.3%), significantly better in 16 (18.8%), slightly better in five (5.9%) and none unchanged. None of the patients' symptoms became worse. Four patients (5%)

Table 3: Pain scores and function scores before and after treatment in patients who also received a second treatment.

Evaluation scores	Before treatment	After treatment	p-value*
Number of patients/heels	16/19	16/19	<0.001
Total pain scores	38.8 ± 15.0	67.1 ± 6.2	<0.001
Pain on level walking	19.8 ± 10.5	44.0 ± 3.8	<0.001
Start-up pain	3.8 ± 1.1	5.0 ± 0.2	<0.001
Pressure pain	6.6 ± 5.0	18.7 ± 2.0	<0.001
Total function scores	16.7 ± 5.8	28.5 ± 2.3	<0.001
Pain at work	5.1 ± 2.1	9.2 ± 1.2	<0.001
Pain during free time	6.7 ± 2.3	9.6 ± 0.7	<0.001
Pain at night	25.4 ± 12.4	9.7 ± 0.5	<0.001

* paired t test

developed recurrent heel pain an average of 15 months (range, 12 to 18 months) after shockwave therapy. One patient chose physiotherapy, one received local cortisone injection, one with change of footwear and one refused further treatment. The overall results of shock wave treatment in patients with plantar fasciitis are summarized in Table 4.

There were no device-related problems, and no systemic or local complications. Approximately one-half of the patients required no pain medication, and the other half required only non-narcotic analgesics such as acetaminophen. None of the patients received narcotics after shockwave therapy.

DISCUSSION

The mechanism of shockwave therapy is not yet known. However, shockwaves have been proven effective clinically in the treatment of pseudoarthrosis with a 75% success rate, and positive effects have been reported in the treatment of patients with tennis elbow, calcifying tendinitis of the shoulder and painful heel syndrome.^{2,3,5,7-10,12} We hypothesize that shockwave therapy enhanced neovascularization, increased local vascularity, and reduced the inflammatory reaction to local trauma. Rompe et al.⁷ compared the

Table 4: The overall results of shockwave treatment in patients with plantar fasciitis.

Shockwave treatment (s)	The entire group	One treatment	Two treatments	Three treatments
Number of patients/heels	79/85	58/60	16/19	5/6
Complaint-free	75.3% (64/85)	81.7% (49/60)	63.2% (12/19)	50% (3/6)
Significantly better	18.8% (16/85)	15% (9/60)	21.1% (4/19)	50% (3/6)
Slightly better	5.9% (5/60)	3.3% (2/60)	15.8% (3/19)	0
Unchanged or worse	0	0	0	0

results of 15 patients with painful heels treated with 1,000 impulses of shockwaves at 0.06 mJ/mm² given three times at weekly intervals with the results in an equal number of patients treated with placebo and concluded there was significant alleviation of pain and improvement of function in shockwave treated patients. The preliminary results of our early clinical experience in 41 patients with plantar fasciitis treated with shockwaves showed 80% satisfactory results at 12 weeks follow-up. The effect of shockwave therapy seemed to show a positive cumulative effect from six to 12 weeks. However, the long-term results of shockwave therapy in patients with plantar fasciitis are unknown. The results of the current study showed that shockwave therapy for patients with plantar fasciitis provided 94% complete or nearly complete resolution of pain at one-year follow-up. In addition, the majority of patients who did not respond favorably to the first treatment did respond satisfactorily to a second or even a third treatment. Shockwave therapy seemed to have positive cumulative effects in the treatment of patients with plantar fasciitis.

Shockwave therapy is a safe and effective modality in the treatment of patients with plantar fasciitis and the effects of shockwave therapy are long-lasting and the recurrent rate is low. There were no device-related problems, no systemic or local complications.

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