Evaluation of a single session of low-energy extracorporeal shock wave treatment for chronic plantar fascitis

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The purpose of the present study was to evaluate the effect of low-energy extracorporeal shock wave treatment (ESWT) in patients with chronic plantar fascitis. 20 patients (22 heels) with symptomatic plantar fascitis that did not respond to conservative treatment for at least 6 months were studied. Patients received a single session of low-energy, ultrasound- and patient feedback-guided ESWT. Visual analog scale (VAS) was used to compare pain intensity before treatment and at 2 follow-ups (72 ± 15 days (FU I) and 568 ± 75 days (FU II) after treatment). There was a significant decrease in overall pain (VAS 5.3 ± 1.8 vs. 2.8 ± 2.6 (FU I) and 1.6 ± 2.6 (FU II), p=0.000), maximum pain (7.6 ± 2.0 vs. 3.7 ± 3.7 (FU I) and 2.6 ± 3.3 (FU II), p=0.000) and pain at activities of daily living (5.1 ± 2.1 vs. 2.5 ± 2.6 (FU I) and 1.8 ± 2.7 (FU II), p=0.001). Night pain decreased to a lesser extent (2.5 ± 2.5 vs. 1.3 ± 2.1 (FU I) and 0.7 ± 1.4, n.s.). In 17 heels ESWT improved symptoms of which 10 were completely symptom free at follow-up II about 1.5 years after treatment (16 and 6 patients after 2.4 months respectively). All male patients improved after ESWT. Patients that were younger, had a shorter duration of symptoms and fewer previous treatment modalities tended to benefit more from ESWT, whereas no significant difference was recorded for patient's body mass index, severity of symptoms or kind of previous treatment. Low-energy ESWT proved to be an effective treatment option for the majority of patients with chronic plantar fascitis that failed to respond to conservative treatment.

Plantar fascitis is a common orthopaedic disorder and several treatment options are available. Nonoperative treatment includes nonsteroidal anti-inflammatory drugs, local cortisone injection(s), orthotics, stretching exercise, night splint and physical therapy. However, there is no consensus about which is the best method (1) and some patients fail to respond to any of these treatment options or symptom relief is only temporary and insufficient. The outcome of surgical treatment (release of the plantar fascia) is also inconsistent and unpredictable (2,3). Results in literature regarding the effectiveness of extracorporeal shock wave treatment (ESWT) vary (4) and parameters that may have an effect on outcome of ESWT have not yet been identified. Therefore the purpose of this study was to evaluate the effect of a single session of low-energy ESWT in patients with chronic plantar fascitis after conservative treatment modalities have failed and to study parameters that might be predictive for successful outcome of treatment.

Material and methods

21 patients were treated at Kuopio University hospital between September '05 and March '06 because of chronic plantar fascitis. The diagnosis was based on patient's history and clinical examination by an orthopaedic surgeon. Symptoms had persisted for at least 6 months with an average duration of 22 ± 22 months (range: 6–108 months). All patients had previously received a variety of conservative treatments at local health centres including nonsteroidal anti-inflammatory drugs, local cortisone injection(s), stretching exercise, night splint, shoe inserts and physical therapy. None of these had provided sufficient symptom relief and patients were referred to university hospital for operative treatment. Instead of surgery patients were assigned to ESWT. For each patient a questionnaire was completed to obtain information about kind of symptoms and previous treatment.

After giving an informed consent at the outpatient department before treatment the patients received a single session of ultrasound- and patient feedback-assisted ESWT using electromagnetic low-energy shock waves (Storz Modulith SLK, 2500–3000 impulses for 12–25 min). Ultrasound gel was applied to the contact area at the heel before treatment. No local anaesthesia was used. One patient did not tolerate the treatment due to pain and was not included in the study. Two patients had bilateral symptoms so a total of 20 patients (22 heels: 10 right and 12 left heels) were studied. The average age of the patients was 50 ± 10 years (range 30–68 years).

To assess the success of ESWT the 10-point VAS-scale for pain intensity (0= no pain, 10= worst possible pain) was used. Scores of overall pain, maximum pain, pain at activities of daily living and pain at night during the past weeks were evaluated before ESWT and at follow-up about 2 months (FU I) and 1.5 years (FU II) after treatment. One patient was lost at FU II so results are only based on 19 patients (21 heels). In addition VAS-scores immediately before, during and after the treatment session as well as the presence of a clearly defined pain centre at the heel vs. diffuse pain were recorded.

Statistical analysis was done with SPSS-software version 13.0 (SPSS inc., Chicago, USA) using Friedman-, Mann-Whitney U-, Chi-square- and Wilcoxon-test. Level of statistical significance was defined as $p < 0.05$.

Results

Figure 1 shows VAS scores before treatment and at follow-up at an average of 72 ± 15 days (FU I) and 568 ± 75 days (FU II) after treatment. Overall pain intensity decreased significantly from VAS 5.3 ± 1.8 to 2.8 ± 2.6 (FU I) and 1.6 ± 2.6 (FU II) (p=0.000). A significant reduction was also noted for maximum pain (7.6 ± 2.0 vs. 3.7 ± 3.7 (FU I) and 2.6 ± 3.3 (FU II), p=0.000) and pain at activities of daily living (5.1 ± 2.1 vs. 2.5 ± 2.6 (FU I) and 1.8 ± 2.7 (FU II), p=0.001). Night pain decreased to a lesser extent (2.5 ± 2.5 vs. 1.3 ± 2.1 (FU I) and 0.7 ± 1.4 (FU II), n.s.). In 17 heels ESWT improved symptoms of which 10 were completely symptom free at follow-up II about 1.5 years after treatment (16 and 6 patients after 2.4 months respectively) (table 1). In all male patients ESWT improved symptoms and 4 of the 5 male patients were completely symptom free. Patients that experienced no symptom relief from ESWT tended to have had a longer duration of symptoms (26 ± 12 vs. 22 ± 24 months, n.s.), more previous treatment modalities (4.7 ± 1.6 vs. 3.9 ± 0.9, n.s.) and tended to be older (56 ± 8 vs. 48 ± 10 years, n.s.). 14 heels with a well-defined pain centre during treatment improved while 3 did not. Of 5 heels with diffuse pain 2 improved and 3 did not improve at FU I, while at FU II 3 heels with diffuse pain had improved and only one not. No difference was found for other parameters like body mass index (BMI), kind of previous treatment, VAS-score before, during and immediately after treatment, duration of treatment and time of follow-up.

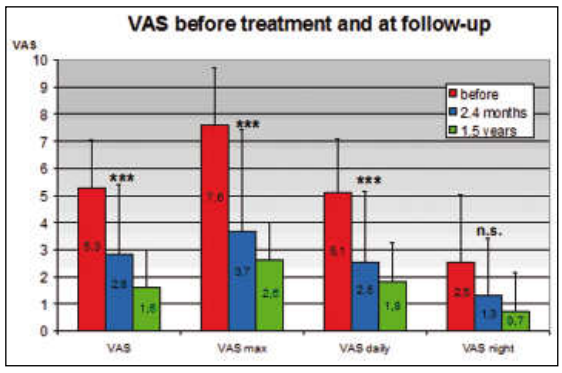

*Figure1: VAS-scores for overall pain (VAS), maximal pain (VAS max), pain at activities of daily living (VAS daily) and night pain (VAS night) before ESWT and at follow-up 2.4 months and 1.5 years after treatment. ***= statistically significant difference (p≤0.001), n.s.= not significant (p≥0.05).*

Table 1: Patient characteristics, previous treatment and treatment characteristics of 19 patients (21 heels) at follow-up II about 1.5 years after treatment. Numbers in brackets indicate results at follow-up I (about 2 months after treatment (20 patients, 22 heels)); *= statistically significant difference (p<0.05), a BMI= Body mass index, b ESWT= extracorporeal shock wave treatment.

		Symptom free	Improved	Not improved	All
Gender*	male	4 (4)	5 (5)	0	5
	female	6 (2)	12 (11)	4 (6)	16 (17)
Age (years)		45±10 (50±10)	48±10 (50±12)	56±8 (48±12)	49±10 (50±10)
BMI (kg/m2)a		28±4 (27±3)	29±4 (29±5)	27±6 (26±5)	28±5 (28±5)
Side affected	right	4 (4)	8 (8)	2 (2)	10 (10)
	left	6 (2)	9 (7)	2 (4)	11 (12)
Duration of symptoms (months)		17±9 (19±9)	22±24 (33±25)	26±12 (18±10)	23±22 (22±22)
Previous treatment	number of treatment modalities	3.7±1.0 (3.4±0.6)	3.6±1.0 (3.9±0.9)	4.7±1.5 (3.7±1.6)	3.8±1.2 (3.9±1.1)
ESWTb	number of impulses	2667±258 (2625±250)	2730±259 (2769±259)	3000±0 (2900±233)	2794±254 (2805±250)
	time (min)	15±2 (16±3)	16±3 (16±3)	16±3 (16±2)	16±3 (16±3)
	clear pain centre(*)	9 (6)	14 (14)	3 (3)	17 (17)
	diffuse pain	1 (0)	3 (2)	1 (3)	4 (5)
Follow-up (days)		587±73 (64±8)	583±69 (71±12)	507±77 (76±23)	568±75 (72±15)

Discussion

In the present study results of low-energy ESWT are very encouraging. A single session of ultrasound- and patient feedback-guided low-energy ESWT improved symptoms of chronic plantar fascitis in almost 80 % of the heels in patients that had undergone various conservative treatment modes without sufficient symptom relief. Reported success rates of ESWT in literature vary between 60 % and 90 % (1,5–9) but comparing studies is difficult due to the use of different treatment devices (electrohydraulic, electromagnetic or piezolelectric shock wave production, high- or low-energy shock waves) and protocols (method of focusing the shock waves, use of anaesthetics, number and timing of treatments, duration of follow-up) (10).

Average pain intensity was significantly reduced at follow-up for overall pain, maximum pain and pain during activities of daily living. VAS-score for night pain decreased as well but this reduction was not significant probably due to the fact that most patients did not have any or only little pain at night already before treatment. According to WANG et al. (1) most patients improved within 2 weeks with the most beneficial effects seen after 1–2 months while CHEN et al. (5) observed that symptoms continued to improve from 6 weeks to 6 months and that success of ESWT increases with time. Our results are consistent with these findings. Pain was already reduced after 2.4 months and showed a further significant decrease between first and second follow-up and the number of patients that were completely symptom free increased from 6 to 10.

Gender was a predictive parameter for success of ESWT in the present study. All 5 male patients showed improvement of symptoms (4 of them were completely symptom free) while the 4 patients that did not experience symptom relief were all females. A similar observation was made by HYER at al. (8). In their study VAS-scores tended to improve more in men than in women and 4 of the 5 failures were women.

In our study patients that experienced symptom relief at follow-up 1.5 years after ESWT tended to have a shorter duration of symptoms before treatment. No differences were recorded at the first follow-up. According to ALVAREZ (11) patients with symptoms for less than 2 years were slightly more likely to have a positive therapeutic response. Our results sup-

port this finding, with an average duration of symptoms of 26 months in patients that had not improved compared to 22 months in patients that improved and 17 months in patients that were symptom free. In contrast in ALVAREZ's study the two patients with the longest duration of symptoms improved and in a study by HELBIG et al. (6) patients with a long duration of symptoms (more than 35 months) all improved while worst results of treatment were noted in those patients with pain for only 3–12 months. According to HELBIG et al. in more acute conditions there may not be sufficient interstitial tissue change that is conductive or responsive to ESWT effects. Therefore ESWT should not be considered as initial treatment for plantar fasciitis.

Patients that had an easily detectable pain centre were more likely to benefit faster from treatment than patients with diffuse heel pain. All patients that were symptom free at the first follow-up had clearly localized pain. 3 patients that did not respond to ESWT had rather diffuse pain at the heel; one of the patients had a corticosteroid injection 2 weeks before treatment, which was probably the reason why pain was more diffuse and another patient had atypical symptoms so diagnose remained unsure. At second follow-up after 1.5 years no difference in outcome between patients with clearly localized and diffuse pain was observed.

Patients that had improved at second follow-up tended to be younger and had undergone fewer previous treatment modalities, whereas no difference regarding these parameters were noticed at first follow-up. Pain intensity during treatment had no influence on success of treatment. Immediately after treatment most patients were pain free, but this was not predictive for long-term treatment outcome. Pain intensity before ESWT (overall pain, maximum pain, pain at activities of daily living and night pain) can be an indicator of severity of disease but does not seem to be predictive for the success of treatment. Patient's BMI or kind of previous treatment did not affect the outcome of ESWT either.

The initial treatment of plantar fascitis is conservative but the present study supports the use of a single session of low-energy ESWT as a valuable alternative to operative treatment in patients that do not respond to conservative treatment. In contrast to surgery no systemic or local complications or adverse effects (except for pain during treatment) of ESWT occurred in our study.

The limitations of the present study are the small number of patients studied and the absence of a control group.

Conclusion

A single session of low-energy ESWT proved to be an effective treatment option for the majority of patients with chronic plantar fascitis (duration of symptoms > 6 months) that failed to respond to conservative treatment. Male patients seem to benefit most from ESWT.

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