

## Medline Abstracts:

J Foot Ankle Surg. 2005 Mar-Apr;44(2):137-43.

### **Evaluation of ultrasound-guided extracorporeal shock wave therapy (ESWT) in the treatment of chronic plantar fasciitis.**

Hyer CF, Vancourt R, Block A.

Orthopedic Foot and Ankle Surgery, Orthopedic Foot and Ankle Center, Columbus, Ohio, USA.

Thirty patients (39 heels) were evaluated to determine the success of ultrasound-guided ESWT for treatment of recalcitrant plantar fasciitis. All patients had been diagnosed and treated for plantar fasciitis for greater than 6 months and had failed at least 3 conservative treatment modalities. Each patient received 3800 shockwaves into the treated heel using the Dornier Epos Ultra ESWT machine. The average postoperative follow-up was 124 days (range, 33 to 255). Written subjective surveys evaluated pre- and posttreatment pain levels using a visual analog scoring system. The mean pretreatment score was 8.51 (range, 5 to 10), which improved to a mean follow-up score of 3.75 (range, 0 to 10). This represents an improvement in the mean VAS of 4.76, which is statistically significant (  $P = .0002$ ). Twenty-five of 30 patients reported some degree of improvement, with 5 experiencing no change. These early results indicate ultrasound-guided ESWT may be a useful tool in the treatment armamentarium for chronic plantar fasciitis.

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Am J Orthop. 2005 Jan;34(1):13-9; discussion 19.

### **Safety and efficacy of extracorporeal shock wave therapy for chronic lateral epicondylitis.**

Furia JP.

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Efficacy and safety of extracorporeal shock wave therapy (ESWT) were investigated in 36 patients with chronic lateral epicondylitis--9 patients receiving and 27 patients not receiving worker's compensation. All patients were treated with a single application of 3200 shock waves. Twelve weeks after treatment, the mean visual analog scale score for the entire group improved from 8.0 to 2.5 ( $P < .05$ ), and the mean RAND 36-Item Health Survey (Physical Functioning) score improved from 65.6 to 88.0 ( $P < .05$ ). Outcomes for 28 elbows (77.8%) were rated excellent or good on the Roles and Maudsley scale. There were no significant differences in outcome measures among the subgroups. There were no significant complications. ESWT is an effective treatment for chronic lateral epicondylitis. Worker's compensation status did not affect outcomes.

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Foot Ankle Int. 2004 May;25(5):290-7.

### **Extracorporeal shock wave therapy for the treatment of plantar fasciitis.**

Theodore GH, Buch M, Amendola A, Bachmann C, Fleming LL, Zingas C.

Foot and Ankle Surgery, Massachusetts General Hospital, Boston, MA 02114, USA.

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One hundred fifty patients were enrolled in a multicenter, randomized, placebo-controlled, prospective, double-blind study to assess the clinical safety and effectiveness of extracorporeal shock wave therapy (ESWT) using the Dornier Epos Ultra for the treatment of plantar fasciitis. The Active Group was treated with electromagnetically generated shocks using ultrasound guidance during a single therapy session. The Control Group received a sham treatment under similar clinical conditions. The groups were demographically similar with respect to age, height, and weight. The average duration of symptoms was nearly 2 years in both groups. All patients were evaluated by the visual analog scale for pain, American Orthopaedic Foot and Ankle Society scores, Roles and Maudsley Score, SF-12 health status questionnaire, and physical examination. The Active Group reported 56% success at 3 months and 94% success at 12 months posttreatment. The Control Group reported 47% success at 3 months posttreatment. Twelve-month data were not collected for the Control Group as they were unblinded at 3 months and offered treatment. ESWT represents a safe treatment option for chronic proximal plantar fasciitis.

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Arch Orthop Trauma Surg. 2005 Feb;125(1):6-9. Epub 2003 Oct 3.

### **Ultrasonographic evaluation at 6-month follow-up of plantar fasciitis after**

**extracorporeal shock wave therapy.**

Hammer DS, Adam F, Kreutz A, Rupp S, Kohn D, Seil R.  
Orthopaedic University Hospital, 66421, Homburg/Saar, Germany.

**INTRODUCTION:** The aim of this study was to investigate the effect of extracorporeal shock wave therapy (ESWT) on the ultrasonographic appearance of chronically painful, proximal plantar fasciitis. **MATERIALS AND METHODS:** Twenty-two patients with a unilateral proximal plantar fasciitis were prospectively enrolled after unsuccessful conservative treatment lasting 6 months. The contralateral plantar fascia was used as the control. ESWT (3x3000 shock waves/session of 0.2 mJ/mm<sup>2</sup>) was performed at weekly intervals. The thickness of the plantar fascia was measured ultrasonographically about 2 cm distal of the medial calcaneal tuberosity. Pain estimation on a visual analogue scale (VAS) and the comfortable walking time were recorded. No local anaesthesia was applied. Follow-up was done at 6, 12 and 24 weeks. **RESULTS:** Before ESWT, the plantar fasciitis side was ultrasonographically significantly thicker than the control side ( $p < 0.05$ ), whereas 6 months after ESWT, the thickness of the fascia was no longer significantly different. The decrease in thickness of the plantar fasciitis side was significant ( $p < 0.05$ ). Pain during activities of daily living decreased by 79% according to the VAS, and the comfortable walking time increased, both significantly ( $p < 0.01$ ). In patients with little pain (VAS < 30), the thickness of the plantar fasciitis side was significantly less ( $p < 0.01$ ) compared with patients who still suffered more pain (VAS > 30). **CONCLUSION:** After ESWT, the thickness of the plantar fascia in patients with plantar fasciitis decreased, pain and walking time improved (all significantly).

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J Orthop Res. 2003 Sep;21(5):937-40.

Comments 2004 Nov;22(6):1362-4 and 2004 Nov;22(6):1365

**Extracorporeal shock wave therapy for plantar fasciitis. A double blind randomised controlled trial.**

Speed CA, Nichols D, Wies J, Humphreys H, Richards C, Burnet S, Hazleman BL.  
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**BACKGROUND:** Extracorporeal shock wave therapy (ESWT) is an increasingly popular therapeutic approach in the management of a number of tendinopathies. Benefit has been shown in calcific tendinitis of the rotator cuff, but evidence for its use in non-calcific disorders is limited. **AIMS:** To perform a double blind randomised controlled trial of moderate dose shock wave therapy in plantar fasciitis. **METHODS:** Adults with plantar fasciitis for at least 3 months were randomised to receive either active treatment (0.12 mJ/mm<sup>2</sup>) or sham therapy, monthly for 3 months. Pain in the day, nocturnal pain and morning start-up pain were assessed at baseline, before each treatment and 1 and 3 months after completion of therapy. **RESULTS:** Eighty-eight subjects participated and no differences existed between the groups at baseline. At 3 months, 37% of the subjects in the ESWT group and 24% in the sham group showed a positive response (50% improvement from baseline) with respect to pain. Positive responses in night pain occurred in 41% and 31% in the ESWT and sham groups, respectively. Positive responses in start-up pain occurred in 37% and 36% in the ESWT and sham groups, respectively. Both groups showed significant improvement over the course of the study, but no statistically significant difference existed between the groups with respect to the changes were seen in any of the outcome measures over the 6-month period. **CONCLUSIONS:** There appears to be no treatment effect of moderate dose ESWT in subjects with plantar fasciitis. Efficacy may be highly dependent upon machine types and treatment protocols. Further research is needed to develop evidence based recommendation for the use ESWT in musculoskeletal complaints. [full text](#).

**Note:** Sonorex objected to the study above for the following reasons: patients had PF for only 3 months (not chronic cases), evaluation was at 6 months instead of the standard 12 weeks, treatments were monthly instead of weekly, and the aiming of the device may not have targeted the correct problem area of the heel.

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Clin Podiatr Med Surg. 2003 Apr;20(2):323-34.

**Extracorporeal shock wave therapy for plantar fasciitis.**

Perez M, Weiner R, Gilley JC.

Clintonville Foot and Ankle Group, Inc., 3695 N. High Street, Columbus, OH 43214, USA.  
Shock wave therapy is quickly becoming a mainstay treatment for chronic recalcitrant plantar fasciitis, and many more applications for this therapy may exist. Many advances have been

made in regard to this modality of treatment in just a few decades since it was first investigated in the 1950s. Much research has been conducted, revealing the physics and physiologic effect of shock wave therapy. Devices are now approved that produce shock waves for medicinal purposes by one of the three primary methods of shock wave generation. Studies and research are actively being reported and published that demonstrate shock wave therapy success rates comparable to those found in surgical intervention but without the risks inherent in surgery. In conclusion, ESWT has proved to be a viable treatment option for the intervention of chronic recalcitrant plantar fasciitis.

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## **Extracorporeal shockwave therapy (ESWT) in patients with chronic proximal plantar fasciitis.**

Foot Ankle Int 2002 Apr;23(4):309-13

**Hammer DS, Rupp S, Kreutz A, Pape D, Kohn D, Seil R.**

Orthopaedic University Hospital, Homburg/Saar, Germany. dietrich.hammer@med-rz.uni.sb.de

The aim of this study was to compare the effect of extracorporeal shockwave therapy (ESWT) in patients with chronically painful proximal plantar fasciitis with a conventional conservative treatment consisting of nonsteroidal anti-inflammatory drugs, heel cup, orthoses and/or shoe modifications, local steroid injections and electrotherapy. Forty-seven patients (49 feet) with a previously unsuccessful conservative treatment of at least six months were randomized to two groups. Treatment of Group 1 (25 heels) started immediately with three sessions of ESWT (3000 shockwaves/session of 0.2 mJ/mm<sup>2</sup>) at weekly intervals. In the patients of Group 2 (24 heels) treatment was continued for 12 weeks. After this period they were treated using the protocol of Group 1. No significant difference of pain and walking time after further non-ESWT treatment (three months) was seen. Six months after ESWT pain decreased by 64% to 88% on the visual analog scale (VAS) and the comfortable walking time had increased significantly in both groups.

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## **Ultrasound-guided extracorporeal shock wave therapy for plantar fasciitis: a randomized controlled trial.**

JAMA 2002 Sep 18;288(11):1364-72

**Buchbinder R, Ptasznik R, Gordon J, Buchanan J, Prabakaran V, Forbes A.**

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CONTEXT: Extracorporeal shock wave therapy (ESWT) is increasingly used for plantar fasciitis, but limited evidence supports its use. OBJECTIVE: To determine whether ultrasound-guided ESWT reduces pain and improves function in patients with plantar fasciitis. DESIGN: Double-blind, randomized, placebo-controlled trial conducted between April 1999 and June 2001. SETTING: Participants were recruited from the community-based referring physicians (primary care physicians, rheumatologists, orthopedic surgeons, and sports physicians) of a radiology group in Melbourne, Australia. PARTICIPANTS: We screened 178 patients and enrolled 166; 160 completed the 15-week protocol. Entry criteria included age at least 18 years with plantar fasciitis, defined as heel pain maximal over the plantar aspect of the foot of at least 6 weeks' duration, and an ultrasound-confirmed lesion, defined as thickening of the origin of the plantar fascia of at least 4 mm, hypoechogenicity, and alterations in the normal fibrillary pattern. INTERVENTIONS: Patients were randomly assigned to receive either ultrasound-guided ESWT given weekly for 3 weeks to a total dose of at least 1000 mJ/mm<sup>2</sup> (n = 81), or identical placebo to a total dose of 6.0 mJ/mm<sup>2</sup> (n = 85). MAIN OUTCOME MEASURES: Overall, morning, and activity pain, measured on a visual analog scale; Maryland Foot Score; walking ability; Short-Form-36 Health Survey (SF-36) score; and Problem Elicitation Technique score, measured at 6 and 12 weeks after treatment completion. RESULTS: At 6 and 12 weeks, there were significant improvements in overall pain in both the active group and placebo group (mean [SD] improvement, 18.1 [30.6] and 19.8 [33.7] at 6 weeks [P =.74 for between-group difference], and 26.3 [34.8] and 25.7 [34.9] at 12 weeks [P =.99], respectively). Similar improvements in both groups were also observed for morning and activity pain, walking ability, Maryland Foot Score, Problem Elicitation Technique, and SF-36. There were no statistically significant differences in the degree of improvement between treatment groups for any measured outcomes. CONCLUSION: We found no evidence to support a beneficial effect on pain, function, and quality of life of

ultrasound-guided ESWT over placebo in patients with ultrasound-proven plantar fasciitis 6 and 12 weeks following treatment. PMID: 12234230 [comments and full text in our message board](#)

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### **[Shock wave therapy for recalcitrant plantar fasciitis with heel spur: a prospective randomized placebo-controlled double-blind study]**

Z Orthop Ihre Grenzgeb 2002 Sep-Oct;140(5):548-54 [Article in German]

**Abt T, Hopfenmuller W, Mellerowicz H.**

Fachbereich Humanmedizin, Freie Universitat Berlin.

AIM: Efficacy of low-energy shock wave therapy for recalcitrant plantar fasciitis. METHOD: 32 patients were randomly assigned into real and placebo ESWT groups, treatment comprised 1000 impulses of 0,08 mJ/mm<sup>2</sup> at 14 kV (OssaTron OSA 120, HMT AG, Switzerland) in 12 cases repeated after six weeks or placebo (energy-absorbing foil). Follow-up evaluation (19, 32 and 48 wks.) included specific questionnaire, clinical-functional examination and measurement of plantar pressure while walking (Emed AT-4, pedograph, Novel GmbH, Munich). Examiner and patients were blinded. RESULTS: 88 % of the treatment group were pain free or had good results. None of the placebo group were pain free, 33.3 % had good results (Roles and Maudsley Score). The treatment group showed significantly better outcome for morning and resting pain, pressure stamp-tolerance and walking ability.

Pedography did not show a clear correlation between pain relief and load pattern.

CONCLUSION: The results of this study corroborate the value of ESWT for recalcitrant plantar fasciitis. As a non invasive technique with low side effects, it can complement the row of conservative treatments. PMID: 12226782

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Orthopade 2002 Jul;31(7):667-77

[Article in German]

**Maier M, Milz S, Wirtz DC, Rompe JD, Schmitz C.**

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Detailed knowledge concerning the action of extracorporeal shock waves on the locomotor system as well as concerning possible side effects of extracorporeal shock wave therapy (ESWT) are crucial to optimize the clinical use of ESWT for the treatment of illnesses such as calcific tendinitis of the shoulder, tennis elbow, plantar fasciitis, aseptic pseudarthrosis, and aseptic hip necrosis. This study presents the current knowledge gained from animal experiments, which have yielded important findings, in particular concerning possible side effects of ESWT. Very recent studies have also provided valuable insights into the molecular actions of extracorporeal shock waves on the locomotor system. Further intensified experimental animal research will greatly improve the scientific basis for the clinical use of ESWT in the near future. PMID: 12219666

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J Foot Ankle Surg 2002 May-Jun;41(3):166-72

### **Extracorporeal shock wave therapy for the treatment of chronic plantar fasciitis: indications, protocol, intermediate results, and a comparison of results to fasciotomy.**

**Weil LS Jr, Roukis TS, Weil LS, Borrelli AH.**

Weil Foot & Ankle Institute, Des Plaines, IL 60016, USA.

A review of the history, mechanism of action, and application of extracorporeal shock wave therapy for chronic plantar fasciitis is presented. The results of 40 feet treated with this modality are reviewed after a mean follow-up time of 8.4 months. All procedures were performed under intravenous sedation and local infiltrative anesthesia. An electrohydraulic shock wave with a mean of 20.6 kV combined with a mean of 2,506 pulses was used. The results of a similar demographic class of patients having undergone a percutaneous plantar fasciotomy at our institution were compared to the results of this cohort of shock wave patients. Eighty-two percent of the patients treated with extracorporeal shock wave therapy were successfully treated as compared to 83% with a percutaneous plantar fasciotomy. The mean score on the 11-point visual analog scale for satisfied patients was 7.9 preoperatively and 2.95 within 7 days postoperatively. After 3 months, the mean visual analog score was 4.2

or 50% of the preoperative value after a mean of 8.4 months following treatment. Eighty-three percent of the patients treated stated that shock wave therapy improved their symptoms. There were no complications encountered in any patient in this study. Extracorporeal shock wave therapy is an effective treatment, which significantly reduces the symptoms associated with chronic plantar fasciitis and compares favorably to the results achieved with surgical intervention in the form of a percutaneous plantar fasciotomy. PMID: 12075904

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Z Orthop Ihre Grenzgeb 2002 May-Jun;140(3):267-74

### **[Musculoskeletal shock wave therapy - current database of clinical research]**

[Article in German]

**Rompe JD, Buch M, Gerdesmeyer L, Haake M, Loew M, Maier M, Heine J.**

Orthopadische Universitätsklinik Mainz.

During the past decade application of extracorporeal shock waves became an established procedure for the treatment of various musculoskeletal diseases in Germany. Up to now the positive results of prospective randomised controlled trials have been published for the treatment of plantar fasciitis, lateral elbow epicondylitis (tennis elbow), and of calcifying tendinitis of the rotator cuff. Most recently, contradicting results of prospective randomised placebo-controlled trials with adequate sample size calculation have been reported. The goal of this review is to present information about the current clinical database on extracorporeal shock wave treatment (ESWT). PMID: 12085291

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Foot Ankle Int 2002 Apr;23(4):301-8

### **Shockwave therapy for chronic proximal plantar fasciitis: a meta-analysis.**

**Ogden JA, Alvarez RG, Marlow M.**

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**PURPOSE:** Utilizing meta-analysis, the authors have reviewed the available literature to assess the biologic and therapeutic effects of shockwaves on patients with chronic plantar fasciitis and the credibility of these published studies. **METHODS:** Meta-analysis is a systematic method for statistical analysis that combines data from various independent studies, allowing the assessment of potential benefits of various treatments when conclusions based on individual studies may be difficult to evaluate. We hypothesized that extracorporeal shockwave therapy provided a reasonable nonoperative therapeutic alternative to surgical intervention in the treatment of chronic proximal plantar fasciitis. **RESULTS:** Eight of 20 published studies fulfilled our type A to C criteria for acceptable studies of sufficient duration (one year or more after treatment). These eight studies involved 840 patients, with success rates of as much as 88%. The other 12 studies had methodological variables or lack of appropriate follow-up data that would limit their validity, although the success rates were comparable to the A to C studies. **CONCLUSIONS:** This meta-analysis shows that the directed application of shockwaves to the enthesis of the plantar fascia at the inferior calcaneus is a safe and effective nonsurgical method for treating chronic, recalcitrant heel pain syndrome that has been refractory to other commonly used nonoperative therapies. The results suggest that this therapeutic procedure should be considered before any surgical intervention, and may be preferable prior to cortisone injection, which has a recognized risk of rupture of the plantar fascia and a frequent recurrence of symptoms. PMID: 11991474

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Foot Ankle Int 2002 Mar;23(3):197-203

### **Preliminary results on the safety and efficacy of the OssaTron for treatment of plantar fasciitis.**

**Alvarez R.**

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The OssaTron may be another alternative for management of plantar fasciitis (heel pain syndrome) after failure of non-operative management and prior to surgical management. This study evaluated primarily the safety and early preliminary efficacy of the OssaTron in treatment of patients with plantar fasciitis unresponsive to non-operative management. Twenty heels of 20 patients were treated with 1000 extracorporeal shockwaves from the

OssaTron to the affected heel after administration of a heel block. The patients were followed for one year. Each patient was evaluated by roentgenogram, KinCom, range of motion and physical examination, including evaluation of point tenderness by means of a palpometer and according to a 10-cm visual analog scale. The control was the contralateral heel. Patients also performed self evaluation by means of patient activities of daily living questionnaire and pain reported by a 10-cm visual analog scale. There were no complications or adverse effects attributed to the procedure of orthotripsy. Of the 20 patients treated, 18 were improved or pain-free. Eighteen of the 20 subjects treated stated that they would undergo the procedure again instead of surgery. Based on these results, we concluded that orthotripsy is a safe and effective method of treating heel pain syndrome that has been unresponsive to nonoperative management. PMID: 11934060

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Foot Ankle Int 2002 Mar;23(3):204-7

### **Shockwave therapy for patients with plantar fasciitis: a one-year follow-up study.**

**Wang CJ, Chen HS, Huang TW.**

Department of Orthopedic Surgery, Chang Gung Memorial Hospital at Kaohsiung, Taiwan. w281211@adm.cgmh.org.tw

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. PMID: 11934061

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J Bone Joint Surg Am 2002 Mar;84-A(3):335-41

### **Evaluation of low-energy extracorporeal shock-wave application for treatment of chronic plantar fasciitis.**

**Rompe JD, Schoellner C, Nafe B.**

Department of Orthopaedics, Johannes Gutenberg University School of Medicine, Mainz, Germany. rompe@mail.uni-mainz.de

**BACKGROUND:** Although the application of low-energy extracorporeal shock waves to treat musculoskeletal disorders is controversial, there has been some limited, short-term evidence of its effectiveness for the treatment of chronic plantar fasciitis. **METHODS:** From 1993 to 1995, a prospective, two-tailed, randomized, controlled, observer-blinded pilot trial was performed to assess whether three applications of 1000 impulses of low-energy shock waves (Group I) led to a superior clinical outcome when compared with three applications of ten impulses of low-energy shock waves (Group II) in patients with intractable plantar heel pain. The sample size was 112. The main outcome measure was patient satisfaction according to a four-step score (excellent, good, acceptable, and poor) at six months. Secondary outcome measures were patient satisfaction according to the four-step score at five years and the severity of pain on manual pressure, at night, and at rest as well as the ability to walk without pain at six months and five years. **RESULTS:** At six months, the rate of good and excellent outcomes according to the four-step score was significantly (47%) better ( $p < 0.0001$ ) in Group I than in Group II. As assessed on a visual analog scale, the score for pain caused by manual pressure at six months had decreased to 19 points, from 77 points before treatment, in Group I, whereas in Group II the ratings before treatment and at six months were 79 and 77 points ( $p < 0.0001$  for the difference between groups). In Group I, twenty-five of forty-nine patients were able to walk completely without pain at six months compared with zero of forty-eight patients in Group II ( $p < 0.0001$ ). By five years, the difference in the rates of good and excellent outcomes according to the four-step score was only 11% in favor of Group I ( $p = 0.071$ ) because of a high rate of good and excellent results from subsequent surgery in Group II; the score for pain caused by manual pressure had decreased to 9 points in Group I and to 29 points in Group II ( $p = 0.0006$  for the difference between groups). At five years, five (13%) of thirty-eight patients in Group I had undergone an operation of the heel compared with

twenty-three (58%) of forty patients in Group II ( $p < 0.0001$ ). CONCLUSIONS: Three treatments with 1000 impulses of low-energy shock waves appear to be an effective therapy for plantar fasciitis and may help the patient to avoid surgery for recalcitrant heel pain. In contrast, three applications of ten impulses did not improve symptoms substantially. PMID: 11886900

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Clin Orthop 2001 Jun;(387):68-71

### **Correlations between the duration of pain and the success of shock wave therapy.**

**Helbig K, Herbert C, Schostok T, Brown M, Thiele R.**

Patients who have had successful treatment for either chronic heel pain (plantar fasciitis) or humeral epicondylitis subsequently were evaluated for a comparable problem in the contralateral heel or elbow. Patients who had experienced symptoms in the contralateral heel or elbow for a shorter period were less likely to have a positive result from shock wave therapy than those patients who had received treatments for more chronic symptoms. PMID: 11400896

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Clin Orthop 2001 Jun;(387):47-59

### **Shock wave therapy for chronic proximal plantar fasciitis.**

**Ogden JA, Alvarez R, Levitt R, Cross GL, Marlow M.**

Atlanta Medical Center, GA, USA.

Three hundred two patients with chronic heel pain caused by proximal plantar fasciitis were enrolled in a study to assess the treatment effects consequent to administration of electrohydraulic-generated extracorporeal shock waves. Symptoms had been present from 6 months to 18 years. Each treated patient satisfied numerous inclusion and exclusion criteria before he or she was accepted into this study, which was approved by the Food and Drug Administration as a randomized, double-blind evaluation of the efficacy of shock wave therapy for this disorder. Overall, at the predetermined evaluation period 3 months after one treatment, 56% more of the treated patients had a successful result by all four of the evaluation criteria when compared with the patients treated with a placebo. This difference was significant and corroborated the fact that this difference in the results was specifically attributable to the shock wave treatment, rather than any natural improvement caused by the natural history of the condition. The current study showed that the directed application of electrohydraulic-generated shock waves to the insertion of the plantar fascia onto the calcaneus is a safe and effective nonsurgical method for treating chronic, recalcitrant heel pain syndrome that has been present for at least 6 months and has been refractory to other commonly used nonoperative therapies. This technology, when delivered using the OssaTron (High Medical Technology, Kreuz-lingen, Switzerland), has been approved by the Food and Drug Administration specifically for the treatment of chronic proximal plantar fasciitis. The results suggest that this therapeutic modality should be considered before any surgical options, and even may be preferable to cortisone injection, which has a recognized risk of rupture of the plantar fascia and recurrence of symptoms. PMID: 11400894

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FDA Consum 2001 Jan-Feb;35(1):7

### **Device delivers shock waves to help ease heel pain caused by plantar fasciitis.**

Publication Types: News PMID: 11930932

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J Rheumatol 2000 Oct;27(10):2455-62

### **Extracorporeal shock wave application for chronic plantar fasciitis associated with heel spurs: prediction of outcome by magnetic resonance imaging.**

**Maier M, Steinborn M, Schmitz C, Stabler A, Kohler S, Pfahler M, Durr HR, Refior HJ.**

Department of Orthopaedic Surgery, Ludwig-Maximilians University, Klinikum Grosshadern, Munich, Germany.

OBJECTIVE: To clarify morphologic features associated with the clinical outcome of extracorporeal shock wave application (ESWA) in chronic plantar fasciitis. METHODS: In this

prospective study 43 patients (48 heels) with chronic courses of plantar fasciitis were clinically examined before and after repetitive low energy ESWA. Standard radiographs of the affected heels were obtained before ESWA to document the existence of a calcaneal heel spur. Magnetic resonance imaging (MRI) was performed before ESWA to evaluate abnormalities of the plantar fascia, the surrounding soft tissue structures, and bone marrow edema of the calcaneus. RESULTS: After ESWA (mean followup 19.3 mo), clinical evaluation of all 48 heels revealed a statistically significant decrease in the mean visual analog scale score from 74.5 to 25.4. Using the Roles and Maudsley score (RM), an established scoring system for categorizing results of treatment following ESWA for patients with plantar fasciitis, patients could be divided into 2 groups, i.e., satisfactory clinical outcome of ESWA (grades 1 and 2 by RM scale; n = 36 heels) and unsatisfactory outcome (grades 3 and 4 by RM scale; n = 12 heels). While thickness of plantar aponeurosis, soft tissue signal intensity changes, and soft tissue contrast medium uptake did not correlate with clinical outcome, the presence of a calcaneal bone marrow edema was highly predictive for satisfactory clinical outcome (positive predictive value 0.94, sensitivity 0.89, specificity 0.8). CONCLUSION: This study indicates that in patients with chronic plantar fasciitis, the presence of calcaneal bone marrow edema on pretherapeutic MRI is a good predictive variable for a satisfactory clinical outcome of ESWA. PMID: 11036844

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Curr Opin Rheumatol 2000 Mar;12(2):150-4

### **Sports and other soft tissue injuries, tendinitis, bursitis, and occupation-related syndromes.**

**Huang HH, Qureshi AA, Biundo JJ Jr.**

Louisiana State University Health Sciences Center, New Orleans 70112, USA.

This review highlights three areas: plantar fasciitis, Achilles tendinitis, and carpal tunnel syndrome. The diagnosis and treatment of plantar fasciitis are reviewed; nonsurgical treatments remain the mainstay of management. Several recent articles support the use of night splints. Some novel treatments recently investigated, including low intensity laser irradiation and extracorporeal shock wave lithotripsy, are reviewed, as well as the effectiveness of steroid injection. Novel treatments for Achilles tendinitis are also reviewed, including the use of injection therapy and the treatment approach of one author for the management of Achilles tendon rupture. Nonsurgical techniques in the treatment of carpal tunnel syndrome, such as yoga, ultrasound, noninvasive laser neurolysis, manipulation, nerve and tendon gliding exercises, and medications, are reviewed. Prednisolone was shown to be effective in the treatment of mild to moderate disease and nonsteroidal anti-inflammatory drugs were found to be ineffective. PMID: 10751018

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Z Orthop Ihre Grenzgeb 2000 Jan-Feb;138(1):34-8

Erratum in: Z Orthop Ihre Grenzgeb 2000 Mar-Apr;138(2):185. Meier M[corrected to Maier M]

### **[Analgesic effect of low energy extracorporeal shock waves in tendinosis calcarea, epicondylitis humeri radialis and plantar fasciitis]**

**Maier M, Durr HR, Kohler S, Staupendahl D, Pfahler M, Refior HJ, Meier M.**

Orthopadische Klinik am Klinikum Grosshadern Ludwig-Maximilians Universitat, Munchen.  
markus.maier@ort.med.uni-muenchen.de

PURPOSE OF THE STUDY: Is there a pain reduction at the application site after extracorporeal shockwave application for tendinitis calcarea, epicondylitis radialis and plantar fasciitis? METHODS: In a prospective study 85 patients were observed. Shockwave application was performed three or five times using low energies (0.09-0.18 ml/mm<sup>2</sup>). Before and after shockwave application pain was evaluated using SF-36 score and Visual Analog Scale (VAS). RESULTS: After 5 months for all three indications a significant improvement of the pain situation could be reached. Patients with plantar fasciitis demonstrated the highest decrease of pain, followed by tendinosis calcarea and epicondylitis radialis. The number of applications had no influence to the clinical result of the ESWT. RELEVANCE: In the present study the analgetic effect of ESWT after repeated low-energy application was described for the standard indications. PMID: 10730361

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**Buch M, Knorr U, Fleming L, Theodore G, Amendola A, Bachmann C, Zingas C, Siebert WE.**

Orthopade 2002 Jul;31(7):637-44

Orthopadische Klinik, Kassel. M.Buch@okkassel.de

Extracorporeal shock wave application (ESWA) has been successfully used for years in routine clinical management of plantar fasciitis. So far no clinical trials have shown the efficiency in placebo-controlled protocols. This paper presents an overview of conservative and operative treatment modalities with respect to their efficacy. Results of a prospective randomized placebo-controlled double-blind multicenter trial to show efficiency and safety of ESWT are presented. In patients treated conservatively without success, a single shock wave application can improve the condition significantly compared with placebo treatment ( $p = 0.0149$ ). The Roles and Maudsley score also showed a significant improvement between the groups, with 61.6% good or excellent results in the verum group and 39.7% in the placebo group ( $p = 0.0128$ ). Therapy-related side effects (local swelling, petechia) are rare. The data presented in this study led to FDA approval in January 2002 of the shock wave device used. PMID: 12219661

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### **Extracorporeal shockwave therapy (ESWT) in the treatment of plantar fasciitis--a biometrical review.**

Clin Rheumatol 2001;20(5):324-30

**Boddeker R, Schafer H, Haake M.**

Institute of Medical Biometry and Epidemiology, Philipps-University, Marburg, Germany.

The application of extracorporeal shockwave therapy (ESWT) as a treatment for conservatively unsuccessfully treated plantar fasciitis has experienced a rapid increase over the last years. However, the efficacy of ESWT has not yet been established unequivocally, as published studies have led to inconsistent results. Furthermore, reviews on clinical trials on ESWT are either not up to date, incomplete, or methodologically inadequate. As a consequence, a systematic literature search was conducted which yielded 21 relevant articles on ESWT in the treatment of plantar fasciitis. These were rated according to biometrical criteria for the conduct of therapeutic trials based on international guidelines. None of the rated trials fulfilled all of the criteria, and it is concluded that at this point the efficacy of ESWT can be neither confirmed nor excluded. Randomised and controlled clinical trials are required to adequately estimate the value of ESWT as a treatment for plantar fasciitis.

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### **Castor oil decreases pain during extracorporeal shock wave application.**

**Maier M, Staupendahl D, Duerr HR, Refior HJ.**

Arch Orthop Trauma Surg 1999;119(7-8):423-7

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In a prospective single-blind study the contact media ultrasound gel, vaseline and castor oil were examined for their effect on surface pain caused by extracorporeal shock waves used for tendinosis calcarea ( $n = 25$ ), radiohumeral epicondylitis ( $n = 23$ ) and plantar heel spur ( $n = 12$ ). A total of 60 patients was divided into six groups. Using a Compact S shockwave source (Dornier MedTech), an energy flux density up to  $0.12 \text{ mJ/mm}^2$  was applied three times within 3 weeks. Independent of the diagnosis, there was a statistically significant influence of the contact medium on the intensity of application pain. In this comparison castor oil was best. For the diagnosis of tendinosis calcarea and plantar heel spur, castor oil was significantly better than the other two contact media, while for epicondylitis there was no significant difference. Castor oil was found to have an advantage over ultrasound jelly and vaseline in all indications used with regard to application pain. The positive effect of castor oil can be explained by its cavitation-free quality.

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### **[Extracorporeal shockwave therapy (ESWT) in orthopedic indications: a selective review]**

Versicherungsmedizin 1998 Oct 1;50(5):180-5

**Fritze J.**

A search of Medline concerning the efficacy of shock wave therapy for pseudarthrosis (nonunion), calcifying tendinitis of the shoulder, lateral epicondylitis and painful heel identified 25 publications describing 31 investigations. These investigations cannot be accepted as confirmative. The effects in pseudarthrosis appear most promising but the cases reported need a reanalysis and thorough description before efficacy can be accepted as granted. Moreover, the indication as well as the stimulus parameters have to be specified and standardized. Published data on the other indications justify prospective, randomized, double-blind, placebo-controlled (sham treatment) trials to confirm efficacy where again the procedure and dosing of shock wave therapy need data-based, rational standardization.

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**TITLE: High energy shock wave treatment of the painful heel spur**

TITLE: Hochenergetische Stosswellenbehandlung des schmerzhaften Fersenspornes.

Unfallchirurg 1998 Dec;101(12):914-8 22

AUTHORS: **Perlick L**; **Boxberg W**; **Giebel G** AUTHOR AFFILIATION: Abteilung für Unfall- und Wiederherstellungschirurgie, Kreiskrankenhaus, Ludenscheid.

ABSTRACT: extracorporeal shock wave application (ESWA) has been used in the treatment of stones located in kidneys, bile, pancreas and the glandula parotis. In the last 2 years several studies have shown the benefit of the ESWA on the treatment of soft tissue disorders. The aim of this study was to explore the effect of high energy extracorporeal shock waves in patients with painful calcaneus spurs. 83 patients who underwent medicophysical treatment without benefit were treated with 3000 impulses of 0.30 mj/mm<sup>2</sup>. Follow-ups after 12 weeks and 12 months showed that 51 of 83 patients became pain-free and 20 patients improved from the treatment. The results are showing the benefit of the high energy extracorporeal shock wave application in the treatment of chronic plantar fasciitis. NLM PUBMED CIT. ID: 10025241

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**TITLE: 5-years lithotripsy of plantar of plantar heel spur: experiences and results--a follow-up study after 36.9 months**

TITLE: 5 Jahre Lithotripsie des plantaren Fersenspornes: Erfahrungen und Ergebnisse--eine Nachuntersuchung nach 36,9 Monaten.

Z Orthop Ihre Grenzgeb 1998 Sep-Oct;136(5):402-6 31

AUTHORS: **Sistermann R**; **Katthagen BD** AUTHOR AFFILIATION: Orthopädische Klinik, Städtische Kliniken Dortmund, Klinikzentrum Mitte. PUBLICATION TYPES: JOURNAL ARTICLE LANGUAGES: Ger

ABSTRACT: INTRODUCTION: Effectivity and application as well as possible complications and side effects of extracorporeal shock wave lithotripsy of plantar heel spurs should be evaluated. METHOD: We applied extracorporeal shock wave lithotripsy (ECSL) to treat plantar fasciitis in 54 patients (period from: 3/1/1993 to 3/1/1996). 20 persons were treated with Lithostar plus (group 1) and ultrasound focussing and 34 patients (group 2) were treated by a Lithostar and X-ray focussing. RESULTS: After 6 weeks 14 (70%) of group 1 and 27 (79.4%) of group 2 were free of pain. After 36.9 months 8 (40%) of group 1 and 23 (67.6%) of group 2 were still painfree. We could not recognize any severe complications after 36.9 months. CONCLUSION: ECSL is an effective and noninvasive method of treatment. It is not the method of choice for the first treatment of plantar fasciitis but is an alternative option for operation. NLM PUBMED CIT. ID: 9823634

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**TITLE: Using extracorporeal shockwave therapy in orthopedics--a meta-analysis**

TITLE: Der Einsatz der extrakorporalen Stosswellentherapie in der Orthopädie-- eine Metaanalyse.

Z Orthop Ihre Grenzgeb 1998 Sep-Oct;136(5):390-401 32

AUTHORS: **Heller KD**; **Niethard FU** AUTHOR AFFILIATION: Orthopädische Universitätsklinik, Rheinisch-Westfälischen Technischen Hochschule Aachen.

ABSTRACT: AIM: Up to now ESWT is not a standard therapeutic technique in orthopaedics. The mechanisms of the induced analgesic effect or the mechanism of shock-waves in bony defects are still unknown. By metaanalysis successrates and indications for ESWT are worked out as well as adequate impulse- and energyrates according to actual state of knowledge. Aim of this study is to rate the published cases. METHOD: 105 papers referring to ESWT of the locomotor system are rated. Validation was performed for each paper according

to the international accepted system of the American Association of Spine Surgery in Type A-E. Advice for therapy is taken only from high quality publications of Type A and B. This advice should regard scientific as well as economic aspects. RESULTS: 4825 cases from 55 publications and abstracts that underwent ESWT were evaluated. 24 papers with 1585 cases (33%) live up to the standards of a scientific investigation. Numerous studies exist about therapy of calcifying tendinitis, epicondylitis humeri radialis, painful heel, pseudarthrosis and other enthesiopathies. Especially the studies concerning pseudarthrosis and other enthesiopathies do hardly live up to scientific standards. In calcifying tendinitis and painful heel ESWT achieves nearly the same results than the established methods. No serious complications were observed. Because of the high complication rate in operative treatment of heel spur ESWT seems to be justifiable. The techniques of ESWT, energy density levels, impulse rates and complications will be described. CONCLUSION: The advantages of ESWT are non-invasiveness and low rate of complications. Primary aim should be to evaluate adequate energy density levels and impulse rates for specific groups of indications using high quality studies according to evidence-based-medicine. Long term results need to be awaited to be able to compare ESWT with established methods. Recent inflationary use of ESWT especially in outpatient departments has no scientific indication in numerous cases as conservative methods are not used consequently. NLM PUBMED CIT. ID: 9823633

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## **[Symptomatic low-energy shockwave therapy in heel pain and radiologically detected plantar heel spur]**

**Krischek O, Rompe JD, Herbsthofner B, Nafe B.**

Z Orthop Ihre Grenzgeb 1998 Mar-Apr;136(2):169-74

Orthopadische Universitätsklinik Mainz.

QUESTION: The long-term analgetic effect of low-energetic shock-wave therapy in heel spur for two different numbers of applied impulses is investigated. METHODS: 50 patients with recalcitrant heel pain and a plantar calcaneal spur on the X-ray received in a controlled, prospective and randomized study low-energetic extracorporeal shock-wave-therapy. The first group received 3 x 500 impulses and the second group 3 x 100 impulses of 0.08 mJ/mm<sup>2</sup> with an experimental device. The follow-up was 1 1/2, 3 and by telephone after 12 months. RESULTS: There was clear improvement and relief of pain in both groups on manual pressure and while walking and an increase of the pain-free walking ability from 10 minutes before the treatment to 2 and 3 hours respectively after 12 months. We saw a significantly better result after the treatment with 3 x 500 impulses. CONCLUSION: The extracorporeal shock-wave therapy is an effective treatment in refractory heel pain. An amount of at least 3 x 500 impulses in the low energetic treatment is useful.

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## **TITLE: Complications, side-effects and contraindications in the use of medium and high-energy extracorporeal shock waves in orthopedics**

TITLE: Komplikationen, Nebenwirkungen und Kontraindikationen der Anwendung mittel- und hochenergetischer extrakorporaler Stoßwellen im orthopädischen Bereich.

Z Orthop Ihre Grenzgeb 1998 Mar-Apr;136(2):175-81 46

AUTHORS: **Sistermann R**; Katthagen BD AUTHOR AFFILIATION: Orthopädische Klinik, Städtische Kliniken Dortmund, Klinikzentrum Mitte, Dortmund.

ABSTRACT: INTRODUCTION: Possible complications and side effects using extracorporeal shock waves for orthopaedic diseases should be evaluated. METHOD: Since 1993 we prospectively evaluated the complications and adverse effects applying extracorporeal shockwaves for orthopaedic diseases. Within three years 542 lithotripsies in 276 patients were made. 190 patients were treated because of calcifying tendinitis, 34 for epicondylitis and 52 suffering from a plantar heel spur. RESULTS: In 216 cases we could recognize small superficial hematomas, 4 hyperventilations and in 3 cases a blood pressure elevation over 200 mmHg. Two cases of high blood pressure showed data over 200 mmHg without other clinical symptoms. They were of transitory nature during therapy. In one case we had to treat a hypertension crisis within the first 3 hours after therapy. Today the application of shockwaves in the thoracic region or lung, coagulopathies or anticoagulant medicine, pregnancy and the use at neural or vascular structures represent an absolute contraindication. When using extracorporeal shock waves for bone lithotripsy, bone tumors, bone infection or infected pseudarthrosis and the application at growth plates in children and

young adults represent an absolute contraindication. CONCLUSION: In general lithotripsy has only minor complications when it is used accurately. NLM PUBMED CIT. ID: 9615982

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**TITLE: Symptomatic low-energy shockwave therapy in heel pain and radiologically detected plantar heel spur**

TITLE: Symptomatische niedrig-energetische Stosswellentherapie bei Fersenschmerzen und radiologisch nachweisbarem plantaren Fersensporn.

Z Orthop Ihre Grenzgeb 1998 Mar-Apr;136(2):169-74 47

AUTHORS: **Krischek** O; Rompe JD; Herbsthofer B; Nafe B AUTHOR AFFILIATION: Orthopädische Universitätsklinik Mainz.

ABSTRACT: QUESTION: The long-term analgetic effect of low-energetic shock-wave therapy in heel spur for two different numbers of applied impulses is investigated. METHODS: 50 patients with recalcitrant heel pain and a plantar calcaneal spur on the X-ray received in a controlled, prospective and randomized study low-energetic extracorporeal shock-wave-therapy. The first group received 3 x 500 impulses and the second group 3 x 100 impulses of 0.08 mJ/mm<sup>2</sup> with an experimental device. The follow-up was 1 1/2, 3 and by telephone after 12 months. RESULTS: There was clear improvement and relief of pain in both groups on manual pressure and while walking and an increase of the pain-free walking ability from 10 minutes before the treatment to 2 and 3 hours respectively after 12 months. We saw a significantly better result after the treatment with 3 x 500 impulses. CONCLUSION: The extracorporeal shock-wave therapy is an effective treatment in refractory heel pain. An amount of at least 3 x 500 impulses in the low energetic treatment is useful. NLM PUBMED CIT. ID: 9615981

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**TITLE: extracorporeal shock-wave therapy. Experimental basis, clinical application**

TITLE: Extrakorporale Stosswellentherapie. Experimentelle Grundlagen, klinischer Einsatz. Orthopäde 1997 Mar;26(3):215-28 88

AUTHORS: **Rompe** JD; Kullmer K; Vogel J; Eckardt A; Wahlmann U Eysel P; Hopf C; Kirkpatrick CJ; Burger R; Nafe B AUTHOR AFFILIATION: Orthopädische Universitätsklinik Mainz.

ABSTRACT: The purpose of our studies was to investigate experimentally the dose-dependent effects of extracorporeal shock waves on tendon and bone and to unveil therapeutic possibilities in tendinopathies and pseudarthroses. In animal experiments, both positive and negative influences were exerted by shock waves, depending on the initial situation and on the power of the applied shock waves. In prospective clinical trials positive effects were found in the treatment of persistent tennis elbow, plantar fasciitis, calcifying tendinitis, and pseudarthrosis. Our data show that extracorporeal shock waves may provide analgesic, resorptive and osteo-inductive reactions with nearly no side effects. However, the high cost of apparatus and staff prevents a routine application. Extracorporeal shock waves thus remain a last alternative before the indication is made for an operative procedure. NLM PUBMED CIT. ID: