

## **RADIAL SHOCK WAVE THERAPY CLINICAL DATA**

### **Achilles Tendinopathy**

- Rompe JD, Furla JP, Maffulli N. **Eccentric Loading Versus Eccentric Loading Plus Shock-Wave Treatment for Midportion Achilles Tendinopathy. A Randomized Controlled Trial.** *Am J Sport Med* 2009; 37(3):463-471. (Pubmed ID: 19088057)
- Rompe JD, Furla JP, Maffulli N. **Eccentric Loading Compared with Shock Wave Treatment for Chronic Insertional Achilles Tendinopathy.** *J Bone Joint Surg Am* 2008; 90:52-61. (Pubmed ID: 18171957)
- Rasmussen S, Christensen M, Mathiesen I, Simonsen O. **Shockwave therapy for chronic Achilles tendinopathy. A double-blind, randomized clinical trial of efficacy.** *Acta Orthopaedica* 2008; 79(2):249-256. (Pubmed ID: 18484252)
- Rompe JD, Nafe B, Furla JP, Maffulli N. **Eccentric Loading, Shock-Wave Treatment, or a Wait-and-See Policy for Tendinopathy of the Main Body of Tendo Achillis A Randomized Controlled Trial.** *Am J Sport Med* 2007; 35(3):374-383. (Pubmed ID: 17244902)

### **Hip/Trochanter pain**

- Rompe JD, Segal NA, Cacchio A, Furla JP, Morral A, Maffulli N. **Home Training, Local Corticosteroid Injection, or Radial Shock Wave Therapy for Greater Trochanter Pain Syndrome.** *Am J Sport Med* 2009; 37(10):1981-1990. (Pubmed ID: 19439758)
- Furla JP, Rompe JD, Maffulli N. **Low-Energy Extracorporeal Shock Wave Therapy as a Treatment for Greater Trochanteric Pain Syndrome.** *Am J Sport Med* 2009; 37(9): 1806-1813. (Pubmed ID: 19439756)

### **Plantar Fasciitis**

- Gerdemeyer L, Frey C, Vester J, Maier M, Weil L, Jr, Weil L, Sr, Russlies M, Stienstra J, Scurran B, Fedder K, Diehl P, Lohrer H, Henne M, Gollwitzer H. **Radial Extracorporeal Shock Wave Therapy Is Safe and Effective in the Treatment of Chronic Recalcitrant Plantar Fasciitis. Results of a Confirmatory Randomized Placebo-Controlled Multicenter Study.** *Am J Sport Med* 2008; 36(11):2100-2110. (Pubmed ID: 18832341)

### **Medial Tibial Stress Syndrome/Shin splints**

- Rompe JD, Cacchio A, Furla JP, Maffulli N. **Low-Energy Extracorporeal Shock Wave Therapy as a Treatment for Medial Tibial Stress Syndrome.** *Am J Sport Med* 2010; 38(1):125-132. (Pubmed ID: 19776340)

### **Shoulder tendinitis**

- Cacchio A, Paoloni M, Barile A, Don R, de Paulis F, Calvisi V, Ranavolo A, Frascarelli M, Santilli V, Spacca G. **Effectiveness of Radial Shock-Wave Therapy for Calcific Tendinitis of the Shoulder: Single-Blind, Randomized Clinical Study.** *Phys Ther* 2006; 86(5):672-682. (Pubmed ID: 16649891)
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### **Tennis elbow/epicondylitis**

- Spacca G, Necozone S, Cacchio A. **Radial shock wave therapy for lateral epicondylitis: a prospective randomised controlled single-blind study.** *Eur Med Phys* 2005; 41( 1):17-25. (Pubmed ID: 16175767)

### **Cellulite**

- Angehrn F, Kuhn C, Voss A. **Can cellulite be treated with low-energy extracorporeal shock wave therapy?** *Clin Interv Aging* 2007; 2(4):623-630. (Pubmed ID: 18225463)

## **Eccentric Loading Versus Eccentric Loading Plus Shock-Wave Treatment for Midportion Achilles Tendinopathy. A Randomized Controlled Trial.**

<b>Authors</b>	<b>Rompe, Furia, Maffulli</b>
<b>Published</b>	<b>American Journal of Sports Medicine, Volume 37, No. 3, pp. 463-471</b>
<b>Date</b>	<b>2009</b>
<b>Place of origin</b>	Germany
<b>Background</b>	Results of a previous randomized controlled trial have shown comparable effectiveness of a standardized eccentric loading training and of repetitive low-energy shock-wave treatment (SWT) in patients suffering from chronic mid-portion Achilles tendinopathy. No randomized controlled trials have tested whether a combined approach might lead to even better results.
<b>Objective</b>	To compare the effectiveness of 2 management strategies - group 1: eccentric loading and group 2: eccentric loading plus repetitive low-energy shock-wave therapy.
<b>Tested products</b>	Radial shock wave device: Swiss Dolorclast, Electromedical Systems, Nyon, Switzerland
<b>Study design &amp; methods</b>	<p>Study Design: Randomized controlled trial; Level of evidence, 1.</p> <p>Methods: 68 patients with a chronic recalcitrant (&gt;6 months) non-insertional Achilles tendinopathy were enrolled in a randomized controlled study. All patients had received unsuccessful management for &gt;3 months, including at least (1) peritendinous local injections, (2) non-steroidal anti-inflammatory drugs, and (3) physiotherapy. A computerized random-number generator was used to draw up an allocation schedule. Analysis was on an intention-to-treat basis.</p> <p>Observer-blinded outcome assessments were performed before randomization and at 16 weeks after baseline assessment.</p> <p>Outcome measures:</p> <ul style="list-style-type: none"><li>• VISA-A score: a pain score validated for Achilles tendon problems The VISA-A questionnaire contains 8 questions that cover the 3 domains of pain (questions 1-3), function (questions 4-6), and activity (questions 7 and 8).</li><li>• General assessment was scored by the patient on a 6-point Likert scale from 1 to 6. For the computation of success rates, patients who rated themselves 1 or 2 (ie, completely recovered or much improved) were counted as successes; patients who rated themselves 3 (somewhat improved), 4 (hardly improved), 5 (not improved), or 6 (worse) were rated as failures.</li><li>• Pain Assessment: 11-point numerical rating scale (NRS; 0 = no pain to 10 = very severe pain).</li></ul>
<b>Results</b>	<p>At 4 months from baseline, the VISA-A score increased in both groups, from 50 to 73 points in group 1 (eccentric loading) and from 51 to 87 points in group 2 (eccentric loading plus shock-wave treatment).</p> <p>Pain rating decreased in both groups, from 7 to 4 points in group 1 and from 7 to 2 points in group 2.</p> <p>19 of 34 patients in group 1 (56%) and 28 of 34 patients in group 2 (82%) reported a Likert scale of 1 or 2 points ("completely recovered" or "much improved").</p> <p>For all outcome measures, groups 1 and 2 differed significantly in favour of the combined approach at the 4-month follow-up.</p> <p>At 1 year from baseline, there was no difference any longer, with 15 failed patients of group 1 opting for having the combined therapy as cross-over and with 6 failed patients of group 2 having undergone surgery.</p>

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**Conclusion**

The likelihood of recovery after 4 months was higher after a combined approach of both eccentric loading and SWT compared to eccentric loading alone. Eccentric training plus SWT should be offered to patients with chronic recalcitrant mid-portion tendinopathy of the Achilles tendon.

**Key message**

**The combined approach of eccentric loading plus repetitive low-energy SWT produced significantly better results (82% success rate) than eccentric calf muscle training alone.**

## **Eccentric Loading Compared with Shock Wave Treatment for Chronic Insertional Achilles Tendinopathy**

<b>Authors</b>	<b>Rompe, Furia, Maffulli</b>
<b>Published</b>	<b>Journal of Bone &amp; Joint Surgery</b>
<b>Date</b>	<b>2008</b>
<b>Place of origin</b>	Germany
<b>Background</b>	Non-operative management of chronic tendinopathy of the Achilles tendon insertion has been poorly studied. With the recently demonstrated effectiveness of eccentric loading and of repetitive low-energy shock wave therapy in patients with mid-substance Achilles tendinopathy, the aim of the present randomized, controlled trial was to verify the effectiveness of both procedures exclusively in patients with insertional Achilles tendinopathy.
<b>Objective</b>	To compare the efficacy of two protocols, eccentric calf strengthening and repetitive low-energy shock wave therapy, for the treatment of chronic insertional Achilles tendinopathy.
<b>Tested products</b>	Radial shock wave device: Swiss Dolorclast, Electromedical Systems, Nyon, Switzerland
<b>Study design &amp; methods</b>	<p>Randomised controlled study. Given the small size of the trial, the fact that it was not blinded, and the potential biases and confounders, this study falls under the "hypothesis-generating" category.</p> <p>50 patients with chronic (six months or more) recalcitrant insertional Achilles tendinopathy were enrolled in the study. All patients had received treatment, including local injections of an anaesthetic and/or corticosteroids, a prescription of non-steroidal anti-inflammatory drugs, and physiotherapy, without success for at least three months. A computerized random-number generator was used to draw up an allocation schedule. 25 patients were allocated to receive eccentric loading (Group 1), and 25 patients were allocated to treatment with repetitive low-energy shock wave therapy (Group 2). Analysis was on an intention-to-treat basis. Primary follow-up was at 4 months, and afterward patients were allowed to cross over. The last follow-up evaluation was at one year after completion of the initial treatment. The patients were assessed for pain, function, and activity with use of a validated questionnaire (the Victorian Institute of Sport Assessment-Achilles [VISA-A] questionnaire).</p>
<b>Results</b>	<p>At 4 months from baseline, the mean VISA-A score had increased in both groups, from 53 to 63 points in Group 1 and from 53 to 80 points in Group 2.</p> <p>The mean pain rating decreased from 7 to 5 points in Group 1 and from 7 to 3 points in Group 2. 7 patients (28%) in Group 1 and 16 patients (64%) in Group 2 reported that they were completely recovered or much improved. For all outcome measures, the group that received shock wave therapy showed significantly more favourable results than the group treated with eccentric loading (<math>p = 0.002</math> through <math>p = 0.04</math>).</p> <p>At four months, 18 of the 25 patients from Group 1 had opted to cross over, as did 8 of the 25 patients from Group 2.</p> <p>The favourable results after shock wave therapy at four months were stable at the one-year follow-up evaluation.</p>
<b>Conclusion</b>	Eccentric loading as applied in the present study 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.
<b>Key message</b>	<b>Better results with radial shock wave therapy compared to eccentric training in patients with recalcitrant chronic insertional Achilles tendinopathy.</b>

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**Shockwave therapy for chronic Achilles tendinopathy.  
A double-blind, randomized clinical trial of efficacy**

<b>Authors</b>	<b>Sten Rasmussen, Marianne Christensen, Iben Mathiesen, Ole Simonsen</b>
<b>Published</b>	<b>Acta Orthopaedica, Vol. 79, No. 2, pp. 249-256</b>
<b>Date</b>	<b>2008</b>
<b>Place of origin</b>	Department of Orthopedic Surgery, Aalborg Hospital, Aarhus University, Aalborg, Denmark
<b>Background</b>	Chronic Achilles tendinopathy is a painful condition and there are often unsatisfactory results with conservative treatment. Extracorporeal shock-wave therapy (ESWT) has been introduced for the management of various soft tissue conditions.
<b>Objective</b>	The objective of the study was to compare the effect of supplementing conservative treatment of chronic Achilles tendinopathy with ESWT or placebo.
<b>Tested products</b>	Radial shock wave device: Piezoson 100 (0.12–0.51 mJ/mm <sup>2</sup> , 50 Hz)
<b>Study design &amp; methods</b>	Randomized, double-blind, placebo-controlled trial. Patients assigned to non-operative treatment of chronic achilles tendinopathy were randomized to receive either active ESWT or sham ESWT over 4 weeks. There were 48 patients (28 men) with a mean age of 47 (19–80) years. American Orthopaedic Foot and Ankle Society (AOFAS) score and pain (using a visual analogue scale (VAS)) were assessed before treatment, during the 4-week treatment period, and at 4, 8, and 12 weeks of follow-up.
<b>Results</b>	Both groups improved during the treatment and follow-up period. AOFAS score after treatment increased more over time in the intervention group than in the control group ( $p = 0.05$ ): from 74 (SD 12) to 81 (16) in the placebo group and from 70 (6.8) to 88 (10) in the intervention group ( $p = 0.05$ ). Better results were seen in the intervention group at 8 and 12 weeks of follow-up ( $p = 0.01$ and $p = 0.04$ , respectively). Pain was reduced in both groups, but there was no statistically significant difference between the groups.
<b>Conclusion</b>	Treatment of Achilles tendinopathy with ESWT led to a clinically relevant effect, with improvement of the AOFAS score. There was no supplementary effect of ESWT on pain.
<b>Key message</b>	<b>ESWT appears to be a clinically relevant supplement to conservative treatment of tendinopathy.</b>

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**Eccentric Loading, Shock-Wave Treatment, or a Wait-and-See Policy  
for Tendinopathy of the Main Body of Tendo Achillis  
A Randomized Controlled Trial**

<b>Authors</b>	<b>Rompe, Nafe, Furia, Maffulli</b>
<b>Published</b>	<b>American Journal of Sports Medicine, Volume 35, No. 3, pp. 374-383</b>
<b>Date</b>	<b>2007</b>
<b>Place of origin</b>	Germany
<b>Background</b>	Few randomized controlled trials compare different methods of management in chronic tendinopathy of the main body of tendo Achillis.
<b>Objective</b>	To compare the effectiveness of 3 management strategies - group 1, eccentric loading; group 2, repetitive low-energy shock-wave therapy (SWT); and group 3, wait and see - in patients with chronic tendinopathy of the main body of tendo Achillis.
<b>Tested products</b>	Radial shock wave device: Swiss Dolorclast, Electromedical Systems, Nyon, Switzerland
<b>Study design &amp; methods</b>	<p>Study Design: Randomized controlled trial; Level of evidence, 1.</p> <p>Methods: 75 patients with a chronic recalcitrant (&gt;6 months) noninsertional Achilles tendinopathy were enrolled in the study. All patients had received unsuccessful management for &gt;3 months, including at least (1) peritendinous local injections, (2) nonsteroidal anti-inflammatory drugs, and (3) physiotherapy.</p> <p>A computerized random-number generator was used to allocate the patients to one of the three treatment groups.</p> <p>Outcome measures were: 1) VISA-A score : a validated questionnaire for assessing pain, function, activity; 2) NRS Load induced pain score and pressure pain threshold : for pain assessment; 3) Likert score : general assessment of recovery</p>
<b>Results</b>	<ul style="list-style-type: none"><li>• At 4 months from baseline, the Victorian Institute of Sport Assessment (VISA)-A score increased in all groups, from 51 to 76 points in group 1 (eccentric loading), from 50 to 70 points in group 2 (repetitive low-energy SWT), and from 48 to 55 points in group 3 (wait and see).</li><li>• Pain rating decreased in all groups, from 7 to 4 points in group 1, from 7 to 4 points in group 2, and from 8 to 6 points in group 3.</li><li>• Fifteen of 25 patients in group 1 (60%), 13 of 25 patients in group 2 (52%), and 6 of 25 patients in Group 3 (24%) reported a Likert scale of 1 or 2 points ("completely recovered" or "much improved").</li><li>• For all outcome measures, groups 1 and 2 did not differ significantly.</li><li>• For all outcome measures, groups 1 and 2 showed significantly better results than group 3.</li></ul>
<b>Conclusion</b>	At 4-month follow-up, eccentric loading and low-energy SWT showed comparable results. The wait-and-see strategy was ineffective for the management of chronic recalcitrant tendinopathy of the main body of the Achilles tendon.
<b>Key message</b>	<b>Both eccentric loading and repetitive low-energy SWT led to a successful outcome in 50% to 60% of patients and should be offered to patients with chronic recalcitrant midportion tendinopathy as an alternative to surgery.</b>

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## Home Training, Local Corticosteroid Injection, or Radial Shock Wave Therapy for Greater Trochanter Pain Syndrome

<b>Authors</b>	<b>Rompe, Segal, Cacchio, Furia, Morral, Maffulli</b>
<b>Published</b>	<b>American Journal of Sports Medicine, Online Preview doi:10.1177/0363546509334374</b>
<b>Date</b>	<b>2009</b>
<b>Place of origin</b>	Germany
<b>Background</b>	<p>A frequent but often overlooked painful overuse syndrome of the hip in adults engaging in recreational sports activities is commonly called trochanteric bursitis. Given the absence of bursal lesions and the presence of gluteal tendinopathy, it was suggested to rename the condition greater trochanter pain syndrome (GTPS). There are no controlled studies testing the efficacy of various non-operative strategies for treatment of GTPS.</p>
<b>Objective</b>	<p>To compare the individual effectiveness of 3 treatment modalities already in use in 2 orthopaedic outpatient clinics: a single local corticosteroid injection, a standardized home training program, and a standardized shock wave treatment protocol.</p>
<b>Tested products</b>	Radial shock wave device: Swiss Dolorclast, Electromedical Systems, Nyon, Switzerland
<b>Study design &amp; methods</b>	<p>Study Design: Randomized controlled clinical trial; Level of evidence, 2. Methods: 229 patients with refractory unilateral greater trochanter pain syndrome were assigned sequentially to a home training program, a single local corticosteroid injection (25 mg prednisolone), or a repetitive low-energy radial shock wave treatment. Subjects underwent outcome assessments at baseline and at 1, 4, and 15 months. Primary outcome measures were degree of recovery, measured on a 6-point Likert scale (subjects with rating completely recovered or much improved were rated as treatment success), and severity of pain over the past week (0-10 points) at 4-month follow-up.</p>
<b>Results</b>	<ul style="list-style-type: none"><li>• One month from baseline, results after corticosteroid injection (success rate, 75%; pain rating, 2.2 points) were significantly better than those after home training (7%; 5.9 points) or shock wave therapy (13%; 5.6 points).</li><li>• Regarding treatment success at 4 months, radial shock wave therapy led to significantly better results (68%; 3.1 points) than did home training (41%; 5.2 points) and corticosteroid injection (51%; 4.5 points). The null hypothesis was rejected.</li><li>• 15 months from baseline, radial shock wave therapy (74%; 2.4 points) and home training (80%; 2.7 points) were significantly more successful than was corticosteroid injection (48%; 5.3 points).</li></ul>
<b>Conclusion</b>	<p>The role of corticosteroid injection for greater trochanter pain syndrome needs to be reconsidered. Subjects should be properly informed about the advantages and disadvantages of the treatment options, including the economic burden. The significant short-term superiority of a single corticosteroid injection over home training and shock wave therapy declined after 1 month. Both corticosteroid injection and home training were significantly less successful than was shock wave therapy at 4-month follow-up. Corticosteroid injection was significantly less successful than was home training or shock wave therapy at 15-month follow-up.</p>

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**Key message**

**Both radial shock wave therapy and home training were significantly more effective than was the single corticosteroid injection. Better results were achieved earlier after shock wave therapy than with the home training protocol. Corticosteroid injections offered only short term benefits.**

## **Low-Energy Extracorporeal Shock Wave Therapy as a Treatment for Greater Trochanteric Pain Syndrome**

<b>Authors</b>	<b>Furia, Rompe, Maffulli</b>
<b>Published</b>	<b>American Journal of Sports Medicine, Vol. 37, No. 9, pp. 1806-1813</b>
<b>Date</b>	<b>2009</b>
<b>Place of origin</b>	Pennsylvania, USA
<b>Background</b>	Greater trochanteric pain syndrome is often a manifestation of underlying gluteal tendinopathy. Extracorporeal shock wave therapy is effective in numerous types of tendinopathies.
<b>Objective</b>	The aim of this study was to determine whether low-energy SWT is a safe and effective management modality for chronic GTPS.
<b>Tested products</b>	Radial shock wave device: Swiss Dolorclast, Electromedical Systems, Nyon, Switzerland
<b>Study design &amp; methods</b>	Study Design: Case control study (retrospective); Level of evidence, 3. Methods: 33 patients with chronic greater trochanteric pain syndrome received low-energy shock wave therapy (2000 shocks; 4 bars of pressure, equal to 0.18 mJ/mm <sup>2</sup> ; total energy flux density, 360 mJ/mm <sup>2</sup> ). 33 patients with chronic greater trochanteric pain syndrome were not treated with shock wave therapy but received additional forms of non-operative therapy (control). All shock wave therapy procedures were performed without anaesthesia. Evaluation was by change in visual analog score, Harris hip score, and Roles and Maudsley score.
<b>Results</b>	<ul style="list-style-type: none"><li>• Mean pre-treatment visual analog scores for the control and shock wave therapy groups were 8.5 and 8.5, respectively.</li><li>• One, 3, and 12 months after treatment, the mean visual analog score for the control and shock wave therapy groups were 7.6 and 5.1 (P &lt; .001), 7 and 3.7 (P &lt; .001), and 6.3 and 2.7 (P &lt; .001), respectively.</li><li>• One, 3, and 12 months after treatment, mean Harris hip scores for the control and shock wave therapy groups were 54.4 and 69.8 (P &lt; .001), 56.9 and 74.8 (P &lt; .001), and 57.6 and 79.9 (P &lt; .001), respectively.</li><li>• At final follow-up, the number of excellent, good, fair, and poor results for the shock wave therapy and control groups were 10 and 0 (P &lt; .001), 16 and 12 (P &lt; .001), 4 and 13 (P &lt; .001), and 3 and 8 (P &lt; .001), respectively.</li><li>• Chi-square analysis showed the percentage of patients with excellent (1) or good (2) Roles and Maudsley scores (ie, successful results) 12 months after treatment was statistically greater in the shock wave therapy than in the control group (P &lt; .001).</li></ul>
<b>Conclusion</b>	Shock wave therapy is an effective and safe treatment for greater trochanteric pain syndrome; the satisfactory improvement is maintained for at least 1 year.
<b>Key message</b>	<b>Shock wave therapy is an effective and safe treatment for greater trochanteric pain syndrome.</b>

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**Radial Extracorporeal Shock Wave Therapy Is Safe and Effective  
in the Treatment of Chronic Recalcitrant Plantar Fasciitis.  
Results of a Confirmatory Randomized Placebo-Controlled Multicenter Study**

<b>Authors</b>	<b>Gerdesmeyer, Frey, Vester, Maier, Weil, Russlies, Stienstra, Scurran, Fedder, Diehl, Lohrer, Henne, Gollwitzer</b>
<b>Published Date</b>	<b>American Journal of Sports Medicine, Volume 36, No. 11, pp. 2100-2110 2008</b>
<b>Place of origin</b>	Germany
<b>Background</b>	Radial extracorporeal shock wave therapy is an effective treatment for chronic plantar fasciitis that can be administered to outpatients without anaesthesia but has not yet been evaluated in controlled trials.
<b>Objective</b>	To evaluate the efficacy and safety of rESWT in patients with chronic painful heel syndrome.
<b>Tested products</b>	Radial shock wave device: Swiss Dolorclast, Electromedical Systems, Nyon, Switzerland
<b>Study design &amp; methods</b>	Randomized, controlled trial; Level of evidence, 1. Three interventions of radial extracorporeal shock wave therapy (0.16 mJ/mm <sup>2</sup> ; 2000 impulses) compared with placebo were studied in 245 patients with chronic plantar fasciitis. Primary endpoints were changes in visual analog scale composite score from baseline to 12 weeks' follow-up, overall success rates, and success rates of the single visual analog scale scores (heel pain at first steps in the morning, during daily activities, during standardized pressure force). Secondary endpoints were single changes in visual analog scale scores, success rates, Roles and Maudsley score, SF-36, and patients' and investigators' global judgment of effectiveness 12 weeks and 12 months after extracorporeal shock wave therapy.
<b>Results</b>	Radial extracorporeal shock wave therapy proved significantly superior to placebo with a reduction of the visual analog scale composite score of 72.1% compared with 44.7% (P = .0220), and an overall success rate of 61.0% compared with 42.2% in the placebo group (P = .0020) at 12 weeks. Superiority was even more pronounced at 12 months, and all secondary outcome measures supported radial extracorporeal shock wave therapy to be significantly superior to placebo (P < .025, 1- sided). No relevant side effects were observed.
<b>Conclusion</b>	Radial extracorporeal shock wave therapy significantly improves pain, function, and quality of life compared with placebo in patients with recalcitrant plantar fasciitis. Radial ESWT can be strongly recommended for patients with therapy-resistant plantar painful heel syndrome. Especially in the cases of failed nonsurgical treatment, rESWT represents an excellent alternative to surgery because anaesthesia is not required and long recovery times are avoided.
<b>Key message</b>	<b>Radial extracorporeal shock wave therapy significantly improves pain, function, and quality of life compared with placebo in patients with recalcitrant plantar fasciitis</b>

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## **Low-Energy Extracorporeal Shock Wave Therapy as a Treatment for Medial Tibial Stress Syndrome**

<b>Authors</b>	<b>Jan D. Rompe, Angelo Cacchio, John P. Furia, Nicola Maffulli</b>
<b>Published</b>	<b>American Journal of Sports Medicine, Vol. 38, No. 1, pp. 125-132</b>
<b>Date</b>	<b>2010</b>
<b>Place of origin</b>	Ortho Trauma Evaluation Center, Mainz, Germany; Department of Medicine and Physical Rehabilitation, San Salvatore Hospital of L'Aquila, Italy
<b>Background</b>	Medial tibial stress syndrome (MTSS) is a pain syndrome along the tibial origin of the tibialis posterior or soleus muscle. Traditional treatment of MTSS is generally lengthy, associated with frequent recurrences, and in some cases, an unacceptable degree of improvement. An insertional malfunction is recognised as a potential source of pain. Extracorporeal shock wave therapy (SWT) is effective in numerous types of insertional pain syndromes.
<b>Objective</b>	The aim of this study was to determine whether low energy SWT is a safe and effective management modality for chronic MTSS.
<b>Tested products</b>	Radial shock wave device
<b>Study design &amp; methods</b>	Cohort study; Level of evidence, 3. All subjects were running athletes. Treatment group: 47 consecutive subjects with chronic recalcitrant MTSS underwent a standardized home training program, and received repetitive low-energy radial SWT (2000 shocks; 2.5 bars of pressure, which is equal to 0.1 mJ/mm <sup>2</sup> ; total energy flux density, 200 mJ/mm <sup>2</sup> ; no local anesthesia). Each subject received 3 low-energy treatments in weekly intervals (at weeks 2, 3, and 4 after start of the 12-week home training program) Control group: 47 subjects with chronic recalcitrant MTSS (selected as the best match of age and gender of the subjects in the treatment group) were not treated with SWT, but underwent a standardized home training program only. Evaluation was by change in numeric rating scale. Degree of recovery was measured on a 6-point Likert scale (subjects with a rating of completely recovered or much improved were rated as treatment success). The primary outcome measurement was degree of recovery at 4 months compared with baseline; Secondary outcome measurements were degree of recovery at 1 and at 15 months compared with baseline.
<b>Results</b>	One month, 4 months, and 15 months from baseline, success rates for the control and treatment groups according to the Likert scale were 13% and 30% ( $P < .001$ ), 30% and 64% ( $P < .001$ ), and 37% and 76% ( $P < .001$ ), respectively. One month, 4 months, and 15 months from baseline, the mean numeric rating scale for the control and treatment groups were 7.3 and 5.8 ( $P < .001$ ), 6.9 and 3.8 ( $P < .001$ ), and 5.3 and 2.7 ( $P < .001$ ), respectively. At 15 months from baseline, 40 of the 47 subjects in the treatment group had been able to return to their preferred sport at their pre-injury level, as had 22 of the 47 control subjects.
<b>Conclusion</b>	This study demonstrates that low-energy radial SWT is safe and effective, that it can be used to treat subjects with chronic MTSS, and that satisfactory improvement is maintained for at least 1 year. Further prospective studies are needed to confirm this finding.
<b>Key message</b>	<b>Radial SWT as applied in this study was an effective treatment for MTSS.</b>

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## Effectiveness of Radial Shock-Wave Therapy for Calcific Tendinitis of the Shoulder: Single-Blind, Randomized Clinical Study

<b>Authors</b>	Cacchio, Paoloni, Barile, Don, de Paulis, Calvisi, Ranavolo, Frascarelli, Santilli, Spacca
<b>Published</b>	Physical Therapy, Volume 86, No. 5, pp. 672– 682
<b>Date</b>	2006
<b>Place of origin</b>	Italy
<b>Background</b>	Although RSWT has been successfully used since the late 1990s for the management of various orthopaedic disorders such as epicondylitis of the elbow and chronic heel pain, which represent 2 of the 3 musculoskeletal indications for ESWT (plantar fasciitis, lateral epicondylitis, and calcific tendinitis), no randomized clinical study has yet been performed in the treatment of shoulder calcifications. Radial shock-wave therapy (RSWT) is a pneumatically generated, low- to medium-energy type of shock-wave therapy. In RSWT, the focal point is not centred on the target zone, as occurs in ESWT, but on the tip of the applicator and then transmitted radially from the tip of the applicator to the target zone.
<b>Objective</b>	To evaluate the effectiveness of RSWT on pain relief, restoration of shoulder function, and resolution of calcific tendinitis of the shoulder.
<b>Tested products</b>	Physio Shock Wave Therapy (Pagani Elettronica, Milano, Italy)
<b>Study design &amp; methods</b>	<ul style="list-style-type: none"><li>• Single-blind, randomized, “less active similar therapy”-controlled study.</li><li>• 90 subjects were randomly assigned to either a treatment group (n 45) or a control group (n 45).</li><li>• Primary outcome: Pain (VAS score) and functional level (UCLA (University of California Los Angeles) rating scale) were evaluated before and after treatment and at a 6-month follow-up.</li><li>• Secondary outcome: Radiographic modifications in calcifications were evaluated before and after treatment.</li></ul>
<b>Results</b>	<p>The treatment group displayed significant improvement in all of the parameters analyzed after treatment and at the 6-month follow-up.</p> <ul style="list-style-type: none"><li>• Mean UCLA value: 10.25 before treatment, 33.12 after treatment, 32.12 at follow-up in treatment group, versus resp. 10.14 before, 11.28 after, 10.57 at follow-up in control group.</li><li>• VAS score: 7.96 before treatment, 0.90 after treatment, 0.95 at follow-up in treatment group, versus resp. 7.72 before, 5.85 after, 6.84 at follow-up in control group.</li><li>• Calcifications disappeared completely in 86.6% of the subjects in the treatment group and partially in 13.4% of subjects; only 8.8% of the subjects in the control group displayed partially reduced calcifications, and none displayed a total disappearance.</li></ul>
<b>Conclusion</b>	RSWT effectively reduces pain (improvement of VAS scores) and increases shoulder function (improvement of UCLA Shoulder Rating Scale scores) without device-related adverse effects. Moreover, the results seen after the treatment were maintained over the following 6 months. Moreover, RSWT was unexpectedly better than ESWT in dissolving calcifications of the shoulder. Further research is needed to directly compare RSWT and ESWT.
<b>Key message</b>	<b>The use of RSWT for the management of calcific tendinitis of the shoulder is safe and effective, leading to a significant reduction in pain and improvement of shoulder function after 4 weeks, without adverse effects.</b>

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## **Radial shock wave therapy for lateral epicondylitis: a prospective randomised controlled single-blind study**

<b>Authors</b>	Spacca, Necozone, Cacchio
<b>Published</b>	Europa Medicophysica (European Journal of Physical and Rehabilitation Medicine), Volume 41, No. 1, pp. 17-25
<b>Date</b>	2005
<b>Place of origin</b>	Italy
<b>Background</b>	Despite the lateral epicondylitis or tennis elbow is a common cause of pain in orthopaedic and sports medicine, the results of the different modalities of conservative treatment are still contradictory.
<b>Objective</b>	To evaluate the efficacy of radial shock wave therapy (RSWT) in the treatment of tennis elbow.
<b>Tested products</b>	Physio Shock Wave Therapy (Pagani Elettronica, Milano, Italy)
<b>Study design &amp; methods</b>	Prospective randomised controlled single-blind study. 62 patients with tennis elbow were randomly assigned to study group and control group. Both groups had received one treatment a week for 4 weeks; the study group received 2000 impulses of RSWT and the control group 20 impulses of RSWT. All patients were evaluated 3 times: before treatment, at the end of treatments and at 6 months follow-up. The evaluation consisted of assessments of pain (VAS at rest, by palpation, by Thomson test=resisted wrist dorsiflexion), pain-free grip strength test, and functional impairment (DASH questionnaire). Also subjective satisfaction for treatment and number needed to treat (NNT) were evaluated.
<b>Results</b>	<ul style="list-style-type: none"><li>• Statistical analysis of visual analogue scale (VAS), disabilities of the arm, shoulder, and hand (DASH) questionnaire and pain-free grip strength test scores has shown, both after treatment and at the 6-month follow-up, significant difference comparing study group versus control group (<math>p &lt; 0.001</math>).</li><li>• Statistical analysis within the groups, showed always statistically significant values for the study group. The treatment group showed significant improvements on all parameters, whereas in the control group the DASH score remained stable and the pain scores increased.</li><li>• Percentage of satisfied patients in the study group was 87% post-treatment; 84% at follow-up, compared to 10% and 3% in the control group.</li><li>• Number needed to treat (NNT) was 1.15 post-treatment and 1.25 at the 6-month follow-up.</li></ul>
<b>Conclusion</b>	The use of radial shock wave therapy allowed a decrease of pain and functional impairment, and an increase of the pain-free grip strength test, in patients with tennis elbow, without device related adverse effects. The RSWT is safe and effective and must be considered as possible therapy for the treatment of patients with tennis elbow.
<b>Key message</b>	<b>Offering reduced pain and improved elbow function and grip strength, RSWT is an effective treatment alternative for patients with tennis elbow</b>

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## Can cellulite be treated with low-energy extracorporeal shock wave therapy?

<b>Authors</b>	<b>Fiorenzo Angehrn, Christoph Kuhn, Axel Voss</b>
<b>Published</b>	<b>Clinical Interventions in Aging, Volume 2, No. 4, pp. 623–630</b>
<b>Date</b>	<b>2007</b>
<b>Place of origin</b>	Switzerland
<b>Background</b>	The stimulating effect of low-energy defocused extracorporeal generated shock waves on biological processes within the tissues reached has increasingly become the centre of interest in the last few years.
<b>Objective</b>	To investigate the effects of low-energy defocused extracorporeal generated shock waves on collagen structure of cellulite afflicted skin.
<b>Tested products</b>	ActiVitor-Derma® (SwiTech Medical AG)
<b>Study design &amp; methods</b>	<p>Cellulite measurement using high-resolution ultrasound technology was performed before and after low-energy defocused extracorporeal shock wave therapy (ESWT) in 21 female subjects. ESWT was applied onto the skin at the lateral thigh twice a week for a period of six weeks.</p> <p>At the end of the treatment period (equivalent to 96000 shots per person) a questionnaire was filled out concerning the tolerance (pain and side effects) and the subjective outcome of cellulite.</p>
<b>Results</b>	<p>An improvement-scoring procedure analyzing changes in the microstructure of the skin by collagenometry indicates that low-energy defocused ESWT may be effective in treating cellulite by remodelling collagen within the skin. From this small sample of test persons we cannot conclude that there are differential effects of treatment based upon age or cellulite stage.</p> <p>Questionnaire responses revealed that most subjects reported an improvement of the skin treated. Seven reported a clear improvement (cellulite reduction, skin more tight, finer fabric of skin and underlying tissue). A few subjects reported that treatment was unacceptable because it caused some pain.</p> <p>After two months the subjective evaluation of effects on the locally treated skin was re-evaluated. At that time six test persons reported an improvement (cellulite reduction, skin more tight, finer fabric of skin and underlying tissue) after a delay of 2–4 weeks (an effect well known in treatment of calcaneal spurs by ESWT). Ten subjects did not identify any local change since the end of treatment. Five subjects reported a re-occurrence of cellulite. The therapist who applied ESWT complained that the sound associated with treatment was irritating and required ear protection.</p>
<b>Conclusion</b>	Results provide evidence that low-energy defocused ESWT caused remodelling of the collagen within the dermis of the tested region. Improving device-parameters and therapy regimes will be essential for future development of a scientific based approach to cellulite treatment.
<b>Key message</b>	<b>Low-energy defocused ESWT is effective in treating cellulite through the remodelling of skin collagen.</b>

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