

Published Clinical Studies

Published Journal Articles

Peer-Reviewed Scientific Publications On High-Energy Extracorporeal Shock Wave for Musculoskeletal Conditions

* Articles with an asterisk indicate a use that has not been approved or cleared by the U.S. Food and Drug Administration. SANUWAVE is providing this information in an educational format and to provide a complete listing of high energy ESWT articles and makes no claims as to the effectiveness of OssaTron® in treatments, other than those approved by the FDA.

Indication	Article Title	Journal Reference	Author	Key Points
Patellar Tendinopathy*	Extracorporeal Shockwave for Chronic Patellar Tendinopathy	Am J Sports Med. 2007 Feb 16;ePub.	C. Wang, MD	At 2 - 3 year follow up, 90% of patients treated with the OssaTron reported excellent to good results. Only 50% of control group patients reported good results. Recurrence rate was 13% in the ESWT group and 50% in the control group.
Stress Fracture*	Extracorporeal Shock Wave Therapy for Resistant Stress Fracture in Athletes	Am J Sports Med. 2007 Feb 9;ePub.	Taki, M et al	Athletes ages 17 to 22 with resistant (chronic 6-12 months) stress fractures were treated with ESWT. Athletes were able to resume normal sports activities soon after treatment.
Acute Fractures*	The Effects of Extracorporeal Shockwave in Acute High-Energy Long Bone Fractures of the Lower Extremity	Arch Orthop Trauma Surg 2006 Oct;ePub.	Wang, CJ et al	High-Energy fracture patients were treated with ESWT during their initial surgical fixation during the fractures acute fracture. At 12 months, the rate of non-union was 11% in teh ESWT group vs. 20% in the control group.
Plantar Fasciitis	Long-Term Results of Extracorporeal Shock Wave Technology for Plantar Fasciitis	Am J Sports Med. 2006 Apr;34(4):592-6.	C. Wang, MD	Patients were followed 5 - 6 years after ESWT and reported 82.7% good to excellent results (69.1% excellent, 13.6% good). The study control group using conservative therapies reported only 55% good results after the same amount of time.
Plantar Fasciitis	Effectiveness of Extracorporeal Shock Wave Technology in 353 Patients with Chronic Plantar Fasciitis	The Journal of the American Podiatric Medical Association Volume 95 No.6 November/December 2005	D. Norris, MD	Post-treatment survey of 353 patients reporting 76% of patients experiencing 43% decline in pain and 66% of patients experiencing 44% increase in mobility. 69% of patients indicated they would recommend the high energy extracorporeal shock wave procedure.
Avascular Necrosis of Femoral Head	Treatment for Osteonecrosis for the Femoral Head: Comparison of Extracorporeal Shock Waves with Core Decompression and Bone-Grafting	The Journal of Bone and Joint Surgery November 2005	C. Wang, MD	Extracorporeal Shock Wave Treatment appeared to be more effective than core decompression and nonvascularized fibular grafting for providing short-term pain relief for patients affected by early stages of osteonecrosis of the femoral

				head.
Plantar Fasciitis	Electrohydraulic High-Energy Shock-Wave Treatment for Chronic Proximal Plantar Fasciitis	Journal of Bone and Joint Surgery, Inc. Volume 86-A, Number 10, October 2004	J. Ogden, MD	Reports that high-energy shock waves to the heel is a safe and effective non-invasive method to treat chronic plantar fasciitis with outcomes maintained one year and up to five years.
<i>Animal Study*</i>	<i>Effect of Shock Wave Therapy on Patellar Tendonopathy in a Rabbit Model</i>	<i>Journal of Orthopaedic Research, 22 (2004) pp. 221-227</i>	<i>R. Hsu, MD</i>	<i>Histological exams at 4 and 16 weeks after ESWT found increased tenocyte production with neovascularization at 16 weeks.</i>
Plantar Fasciitis	Symptom Duration of Plantar Fasciitis and the Effectiveness of Orthotripsy	Foot & Ankle International, Vol. 24, No. 12/December 2003	R. Alvarez, MD	Discusses that patients have a slightly better outcome if they have had chronic plantar fasciitis for 1-2 years compared to patients who had been diagnosed longer. An important secondary finding was that one hundred and twenty three patients were followed 2-5 years and their outcomes were maintained.
Plantar Fasciitis	Effect of Extracorporeal Shock Waves on Calcaneal Bone Spurs	Foot & Ankle International, Vol. 24, No. 12/December 2003	G. Lee, MD	Reviews 308 patients treated with ESWT and finds that the presence or absence of heel spurs does not affect the likelihood of a positive outcome. 82% of patients with heel spurs had excellent to good outcomes and 79% of patients without heel spurs reported excellent to good outcomes.
<i>Rotator Cuff Tendonitis*</i>	<i>Extracorporeal Shock Wave Therapy for the Treatment of Chronic Calcifying Tendonitis of the Rotator Cuff</i>	<i>JAMA, Nov. 19, 2003</i>	<i>L. Gerdemeyer, MD</i>	<i>This study discusses that high energy shock wave application is more effective than placebo and significantly more effective than low energy application. At 12 months the high-energy group had 86% complete resolution, compared to the low-energy and sham subjects who at 12 months were only 37% and 25% respectively.</i>
<i>Animal Study*</i>	<i>Shock Wave Therapy Induces Neovascularization at the Tendon-Bone Junction: A Study in Rabbits</i>	<i>Journal of Orthopaedic Research, 21 (2003) pp. 984-989</i>	<i>C. Wang, MD</i>	<i>Article finds that "the mechanism of shock wave therapy involved the early release of angiogenic growth factors (eNOS and VEGF) and subsequent induction of neovascularization and tissue proliferation. The neovascularization may play a role in pain relief of tendonitis and the repair of chronically inflamed tendon tissues at the tendon-bone junction."</i>

Lateral Epicondylitis	Shock Wave Therapy for Patients with Lateral Epicondylitis of the Elbow: A One- to Two-Year Follow-up Study	The American Journal of Sports Medicine, Vol. 30, No. 3, 2002	C. Wang, MD	One to two year study following 43 patients with lateral epicondylitis reporting 90.9% complaint-free or significantly better results with OssaTron® Shock Wave Technology. Control group patients who received sham treatment reported no change.
Plantar Fasciitis	Extracorporeal Shock Wave Therapy for Chronic Proximal Plantar Fasciitis	Clinics in Podiatric Medicine and Surgery, October 2002, Vol. 19, No. 4	W. Strash, DPM, FACFAS	Article reporting 74% excellent to good results after twelve weeks and 87% excellent to very good results after 6 months with 48 human feet with high energy ESWT.
Plantar Fasciitis	Extracorporeal Shock Wave Therapy (ESWT) for the Treatment of Chronic Plantar Fasciitis: Indications, Protocol, and a Comparison of Results to Fasciotomy	The Journal of Foot & Ankle Surgery, June 2002, Vol. 41, Number 3	L. Weil, Jr., DPM	Study with mean follow-up of 8.4 months reporting 82% good to excellent results with high-energy electrohydraulic ESWT.
Plantar Fasciitis	Shock Wave Therapy for Patients with Plantar Fasciitis: A One-Year Follow-up Study	Foot & Ankle International, March 2002, Vol. 23, Nov. 3	C. Wang, MD	One year follow-up study reporting greater than 93% success and retention post high-energy OssaTron® ESWT.
Plantar Fasciitis	Preliminary Results on the Safety and Efficacy of the OssaTron® for Treatment of Plantar Fasciitis	Foot & Ankle International, March 2002, Vol. 23 No. 3	R. Alvarez, MD	Study reporting safety and efficacy success with 18 out of 20 patients improved/pain free after ESWT with the high-energy OssaTron® device.
Plantar Fasciitis	Shock Wave Therapy for Chronic Plantar Fasciitis: A Meta-Analysis	Foot & Ankle International, April 2002, Vol. 23 No.4	J. Ogden, MD	Analysis reviewed 20 studies on shock wave for plantar fasciitis and concluded that the studies demonstrated that ESWT should be considered before any surgical intervention for plantar fasciitis.
<i>Animal Study*</i>	<i>Neovascularization at the Tendon-Bone Junction: An Experiment in Dogs</i>	<i>The Journal of Foot and Ankle Surgery, Vol. 41, No. 1, January/February 2002</i>	C. Wang, MD	<i>Discusses the effect of shock waves in generating neovascularization and muscularized vessels when shock waves were applied to dogs using the OssaTron®.</i>
<i>Nonunion - Delayed Union*</i>	<i>Extracorporeal Shock Wave Therapy of Nonunion or Delayed Osseous Union</i>	<i>Clinical Orthopaedics and Related Research, Number 387, pp. 90-94, June, 2001</i>	W. Schaden, MD	<i>In 75.7% of treated patients, one treatment with shock waves resulted in bony consolidation with a simultaneous decrease in symptoms.</i>
<i>Nonunion*</i>	<i>Treatment of Nonunions of Long Bone Fractures with Shock Waves</i>	<i>Clinical Orthopaedics and Related Research, No. 387, June 2001</i>	C. Wang, MD	<i>72 subjects with long bone nonunions were studied - 40% had boney union at 3 months, 60.9% at 6 months and 80% at 12 months post-ESWT with the</i>

				OssaTron®.
Plantar Fasciitis	Treatment of Painful Heel Syndrome With Shock Waves	Clinical Orthopaedics and Related Research, Number 387, pp. 41-46, June, 2001	H. Chen, MD	Study reporting 73.5% excellent to good results with 68 heels post-ESWT after twelve weeks and 87% excellent to good results with 54 heels with six months follow-up.
Lateral Epicondylitis	Treatment of Lateral Epicondylitis of the Elbow with Shock Waves	Clinical Orthopaedics and Related Research, Number 387, pp. 60-67, June, 2001	J. Ko, MD	Article demonstrates that healing effect from ESWT is time dependent. 57.9% reporting excellent to good responses at 12 weeks which increased to 73% excellent to good response at 24 weeks post-ESWT.
Plantar Fasciitis	Shock Wave Therapy of Chronic Proximal Plantar Fasciitis	Clinical Orthopaedics and Related Research, Number 387, pp. 47-59, June, 2001	J. Ogden, MD	OssaTron® FDA clinical study involving 302 patients reporting 74% excellent to good results post high energy ESWT.
Plantar Fasciitis	Treatment of Painful Heels Using Extracorporeal Shock Wave	J Formos Med Assoc. 2000, Vol. 99, No. 7	C. Wang, MD	Study reporting 81% excellent to very good results involving 58 patients after 12 weeks with high energy OssaTron® ESWT.

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