Mass General Brigham
Spaulding Rehabilitation

Shockwave Therapy in the management of musculoskeletal injuries: From science to clinical practice

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HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

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Disclosure Statement

- StateFarm
  - Consultant
- Enovis, Storz Medical, Sanuwave
  - Grant/Research Support Recipient
- DOD
  - Grant/Research Support Recipient
- Strava
  - Consultant

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Objectives

- To describe the mechanisms for how shockwave may be effective in treatment of musculoskeletal conditions
- To provide updates on best evidence for use of shockwave treatment for musculoskeletal conditions
- To discuss new organization American Society for Medical Shockwave Treatment (ASMST)

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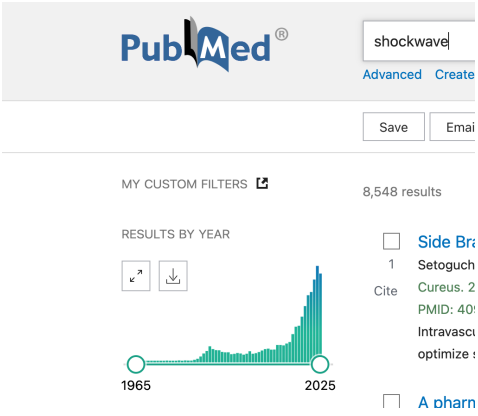
Growth of ESWT Seen in USA and Globally

- Patients want non-invasive treatments
- Knowledge and use for sports medicine and orthopedics
- Technological development
- High prevalence of orthopedic indications



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PM R 10 (2018) 1385-1403

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Narrative Review

Effect of Shockwave Treatment for Management of Upper and Lower Extremity Musculoskeletal Conditions: A Narrative Review

Julia M. Reilly, MD, Eric Bluman, MD, PhD, Adam S. Tenforde, MD

PRACTICE MANAGEMENT

PM&R

Best practices for extracorporeal shockwave therapy in musculoskeletal medicine: Clinical application and training consideration

Adam S. Tenforde MD[1] | Haylee E. Borgstrom MD, MS[1] |
Stephanie DeLuca MD[1] | Molly McCormack BA[1] | Mani Singh MD[2] |
Jennifer Soo Hoo MD[3] | Phillip H. Yun MD[4]

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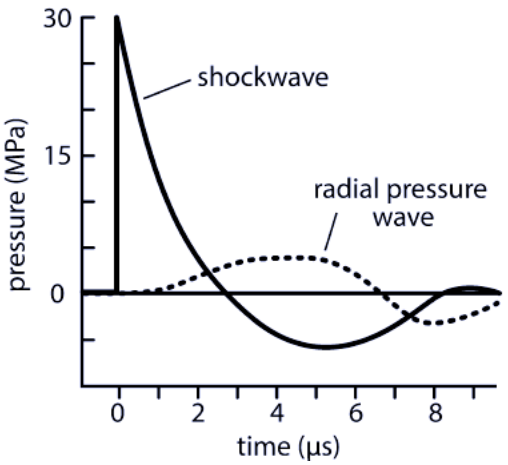
What is Shockwave?

- Extracorporeal shockwave therapy (ESWT) is external source of energy
- Can produce variable energy based on device settings and type of shockwave
- Each may produce different effects on target tissue



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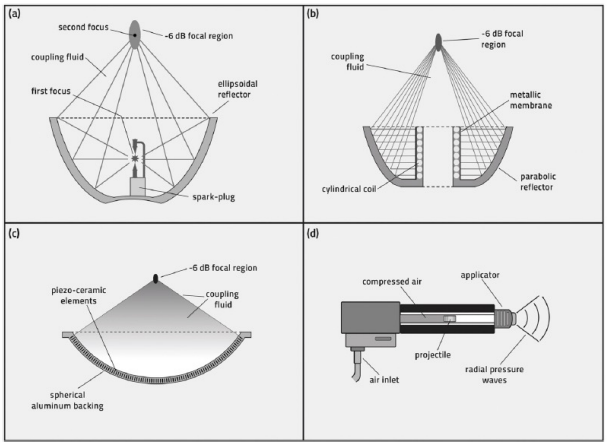
What is Shockwave?



- **Common Focused Shockwave devices include electrohydraulic, electromagnetic and piezo-electric (Panels A-C)**
- **Radial Shockwave is commonly produced using pneumatic compressive pressure waves (Panel D)**

Moya, et al. Role of extracorporal shockwave in treatment of musculoskeletal disorders. JBJS, 2018.

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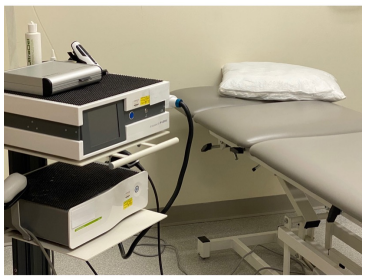
What is Shockwave?

Early devices large and cumbersome



Current Device – size of a desktop computer

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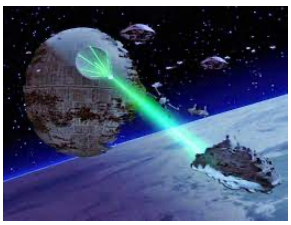
What is Shockwave?

Radial Pressure Wave

- Highest energy at surface
- Waves dissipate energy to deeper structures

Focus Shockwave Device



- Highest energy concentrated to one point

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Mechanism of Action

Proposed mechanisms of action for shockwave

Neovascularization at tendon-bone junction	Wang 2002, Wang 2003	Tissue remodeling
Destruction of calcifications	Peters 2004	
Increased collagen synthesis/tissue remodeling	Bosch 2007, Vetrano 2011	
Leukocyte infiltration	Rompe 1998	
Proliferation of tenocytes	Chen 2004	
Increased glycosaminoglycan, increased protein synthesis	Bosch 2007	
Increased IL-6, IL-8, MMP-2, MMP-9, increased collagen synthesis	Waugh 2015	
Increased TGF-β1 and IGF-1, increased collagen synthesis	Wang 2002, Chen 2004	Pain modulation
Mechanotransduction, increased collagen synthesis	Bosch 2007	
Increased osteoprogenitor differentiation	Wang 2002	
Stimulation of nociceptive C-fibers and resulting neuropeptide release	Klonschinski 2011	
Nociceptor hyperstimulation/Gate-control theory	Saggini 2015, Wess 2008, Vahdatpour 2013, Zimmerman 2008	
Increase in local pain-inhibiting substances	Saggini 2015, Wess 2008, Vahdatpour 2013, Zimmerman 2008	
Impaired cell membrane receptor potential	Wess 2008	

IL = interleukin; MMP = matrix metalloproteinase; TGF-β1 = transforming growth factor–beta 1; IGF-1 = insulin-like growth factor 1.

Reilly, Bluman and Tenforde. Narrative Review of Shockwave Treatment. PM&R Journal, 2018

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Advantages of shockwave

- Non-invasive
- Favorable side effect profile
- Activity/sport may continue during treatment

Systematic review

Use of extracorporeal shockwave therapies for athletes and physically active individuals: a systematic review

Hye Chang Rhim [1,2] Jaehyung Shin [2] Jane Kang,[3] Paige Dyrek,[1] Zack Crockett,[1] Pearl Galido,[4] Carrie Wade,[5] Karsten Hollander [6] Joanne Borg-Stein,[1] Steven Sampson,[7] Adam S Tenforde [1]

healthcare MDPI

Editorial

Utilizing Extracorporeal Shockwave Therapy for in-Season Athletes

Hye Chang Rhim [1], Joanne Borg-Stein [1], Steven Sampson [2,†] and Adam S. Tenforde [1,*,†]

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Achilles tendinopathy

- Growing evidence for shockwave as treatment
- Greater efficacy for mid-portion vs insertional, no Haglund deformity
- Rare risk of rupture, only reports in clinical trials using focused shockwave in non-athletes at older ages

Costa, Shock Wave Therapy for Chronic Achilles Pain. Clin Ortho, 2005.

12

What treatment works best?

Comparative Efficacy and Tolerability of Nonsurgical Therapies for the Treatment of Midportion Achilles Tendinopathy

A Systematic Review With Network Meta-analysis

Hye Chang Rhim,* MD, Min Seo Kim,† MD, Seungil Choi,‡ BS, and Adam S. Tenforde,§‖ MD
Investigation performed at Korea University College of Medicine, Seoul, Republic of Korea

Rhim, et al. Comparative Efficacy and Tolerability of Nonsurgical Therapies for Treatment of Midportion Achilles Tendinopathy. OJSM, 2020

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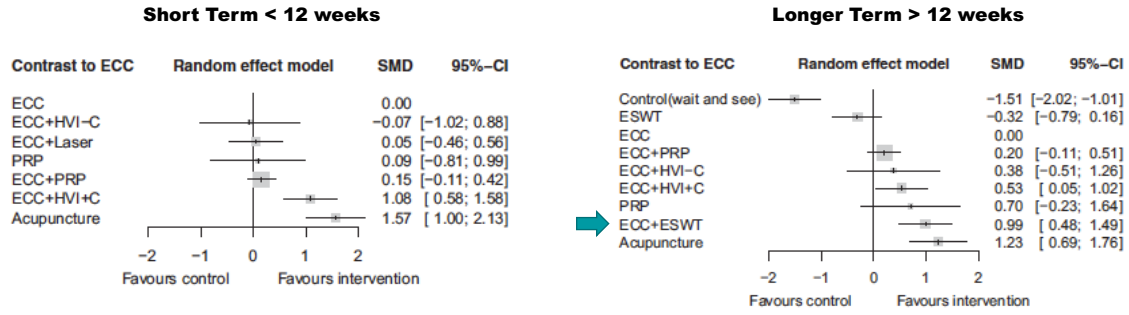
Outcomes favor Eccentric Loading combined with interventions



Rhim, et al. Comparative Efficacy and Tolerability of Nonsurgical Therapies for Treatment of Midportion Achilles Tendinopathy. OJSM, 2020

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Proximal Hamstring Tendinopathy

- **40 professional athletes with insertional tendinopathy, equal assignment to 2 treatment groups:**
  - **Radial shockwave (RSW): 4 weekly sessions**
  - **Control: PT + NSAIDs + structured exercise program**
- **Primary outcomes: >50% pain relief and return to sport**

Cacchio, et al. Shockwave Therapy for Treatment of Chronic Proximal Hamstring Tendinopathy. Am J Sports Med, 2011.

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Proximal Hamstring Tendinopathy

Three Month Outcomes:

- **85% RSW and 10% conventional treatment with >50% pain relief**
- **80% RSW return to sport, none with conventional treatment**

Benefits in shockwave treatment arm sustained at 12 months

Cacchio, et al. Shockwave Therapy for Treatment of Chronic Proximal Hamstring Tendinopathy. Am J Sports Med, 2011.

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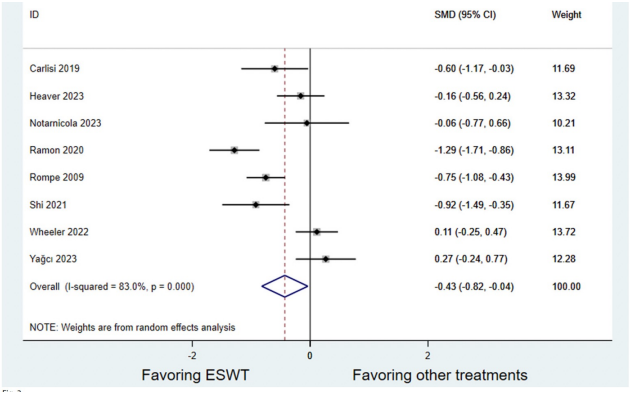
Systematic Review of Greater Trochanteric Pain Syndrome



- **Benefits of ESWT over corticosteroid and exercise programs at 2 and 4 months**
- **Focus ESWT superior to Radial pressure waves**
- **Functional gains at 6 months**

Rhim, et al. Extracorporeal Shockwave For Greater Trochanteric Pain syndrome, JBJS Reviews, 2024

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Plantar fasciitis - Degenerative condition of the fascia overlying plantar aspect of foot

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Meta-analysis of Shockwave Treatment for Plantar Fasciitis

- **Included 1174 participants from 9 RCT that included blinding and use of placebo, no local anesthesia**
- **40-60% experienced reduction in heel pain, 41-61% with reduced first step pain, 49-60% with improved heel pain during ADLs**

Lou, et al. Effectiveness of Extracorporeal Shock Wave Therapy Without Local Anesthesia in Patients With Recalcitrant Plantar Fasciitis. Am J Phy Med Rehabil, 2017.

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Systematic Review of Systematic Reviews: Plantar Fasciitis

Systematic Review

A Systematic Review of Systematic Reviews on the Epidemiology, Evaluation, and Treatment of Plantar Fasciitis

Hye Chang Rhim [1,†], Jangwon Kwon [2,†], Jewel Park [3], Joanne Borg-Stein [4,5] and Adam S. Tenforde [4,5,*]

Rhim et al. Life, 2021.

- **Reviews concluded longer-term outcomes improved with <u>both PRP and shockwave therapy over corticosteroid</u>**
- **Limited head-to-head comparisons to draw conclusions PRP vs shockwave**

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My Experience with Plantar Fasciitis

- **38 patients (31 runners) with chronic plantar fasciitis**
- **Radial treatment or combined (radial + focus shockwave) with physical therapy**
- **Outcome of interest Foot and Ankle Ability Measure (FAAM)**

DeLuca, et al. Similar Functional Gains Using Radial and Combined Shockwave Therapy in the Management of Plantar Fasciitis. JFAS, 2021

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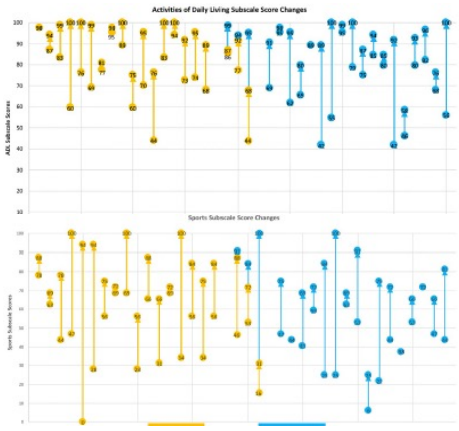
My Experience with Plantar Fasciitis



70% vs 77.8% met success for ADL

75% vs 85% success sports subscale

DeLuca, et al. Similar Functional Gains Using Radial and Combined Shockwave Therapy in the Management of Plantar Fasciitis. JFAS, 2021

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My technique for treating Tibialis Posterior Tendinopathy

- Case series of 10 patients with tibialis posterior tendinopathy
- All treated with minimum 4 sessions of RSW
- Combination of foot core exercises
- 80-90% met FAAM ADL and sport subscale

Robinson et al. Nonsurgical Approach in Management of Tibialis Posterior Tendinopathy With Combined Radial Shockwave and Foot Core Exercises: A Case Series. J Foot Ankle Surg, 2020.

Bone Stress Injury Management

Taki: Series of 5 athletes with non-union stress fractures (mean 1 yr), treatment of tibia (2), 5th metatarsal (1), inferior pubic ramus (1) and medial malleolus of ankle (1) treated with one session focused shockwave (OssaTron 2000-4000 shocks at 0.29-0.40 mJ) with local anesthesia: all with bone consolidation and return to sport 3-6 months (mean 4 months) following one treatment

Moretti: 10 athletes with Jones fracture or anterior tibial diaphysis fracture, each received 3-4 sessions of focused shockwave (Electromagnetic Storz Minilith) for 3-4 treatments every 2-3 days. Bone fusion seen in all within 6-14 weeks, return to sports 3-10 mo (most within 3-4 mo)

Taki., et al. Extracorporeal Shock Wave Therapy for Resistant Stress Fracture in Athletes: A report of 5 Cases. AJSM 2007.
Moretti et al. Shock Waves in the Treatment of Stress Fractures. Ultrasound Med and Biol, 2009.

My Experience Treating Bone Stress Injuries in Runners

- 40 patients with 41 total bone stress injuries based on exam and graded using MRI
- Average of 5 sessions of focus shockwave therapy (electromagnetic device, minimum 0.30 mJ ~3000 shocks per session)
- Nearly all (98%, 39 of 40 runners) returned to pain-free running:
  - Return to run at median 12 weeks for acute injuries, 18 weeks for delayed/non-union
  - One athlete Saxena class II navicular stress fracture required ORIF

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Management of hallux sesamoid pain

- 11 patients with hallux sesamoid injuries including sesamoiditis, AVN and stress fracture
- Electromagnetic shockwave for <0.15 mJ for 1000 or greater shocks 3-4 treatments
- Outcomes of interest FAAM:
  - 8 of 11 (73%) met functional improvement

Schon JM[1], Gureck AE[1], Rhim HC[1], Malik GR[1], Tenforde AS[1,2]

Treatment of Chronic Hallux Sesamoid Injuries with Focused Extracorporeal Shockwave and Physical Therapy in an Athletic Population: A Retrospective Case Series

Behandlung chronischer Hallux-Sesamoid-Verletzungen mit fokussierter extrakorporaler Stoßwelle und physikalischer Therapie bei einer Sportlerpopulation: Eine retrospektive Fallstudie

GERMAN JOURNAL OF SPORTS MEDICINE • 75 • 4/2024

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Cases of para athletes receiving shockwave

CASE REPORT

Improved Function in a Runner With Hereditary Spastic Paraparesis With Use of Extracorporeal Shockwave Therapy

Personal Clinical Experience

Craig Rovito, MD, Sabrina Paganoni, MD, Suma Babu, MD, MPH, and Adam S. Tenforde, MD

American Journal of Physical Medicine & Rehabilitation • Volume 100, Number 5, May 2021

PM R xx (2020) 1-2

www.pmrjournal.org

Clinical Letter

Management of Hamstring Pain in an Elite Female Para-Swimming Athlete Using Radial Shockwave Therapy: A Case Report

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"Can I run while doing shockwave therapy?"

- 25 year-old F runner with 3 months of mid-portion Achilles tendon pain
- Five sessions of radial shockwave applied over 6 weeks leading to Chicago Marathon
- Completed event pain free and qualified for Boston Marathon by time
- Similar high performance within female runner with proximal hamstring tendinopathy -> pain free and 100k ultra-marathon completed 4 months after treatment

Reilly and Tenforde. The Role of Extracorporeal Shockwave in Return to Competition in Endurance Runners. PMRJ, 2020.

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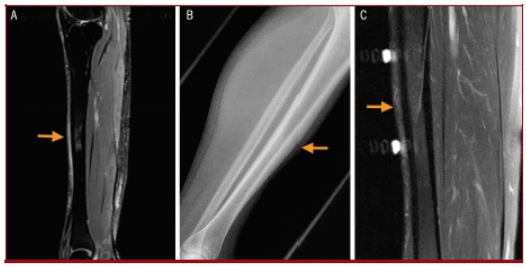
Shockwave in Combination with Gait Retraining

- 34 year-old F runner with 7 years of leg pain with running
- Initial MRI grade 1 BSI, subsequent studies over 3 years with diffuse cortical thickening
- Prior PT with refractory pain
- Goal to return to running



Douglas, Posilkin and Tenforde. Chronic Periostitis of the Anterior Tibia Treated with Combination of Shockwave Therapy and Gait Retraining: A Case Report. JOSPT Cases, 2021

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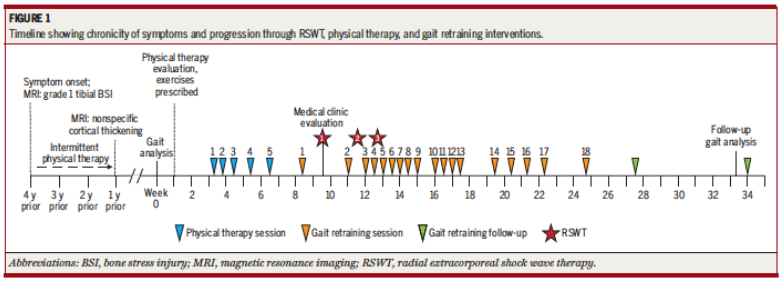
Shockwave in Combination with Gait Retraining

- Pain when initiating gait retraining on attempts to run
- 3 (painful!) radial shockwave treatments
- Full progression to pain free status



Douglas, Posilkin and Tenforde. Chronic Periostitis of the Anterior Tibia Treated with Combination of Shockwave Therapy and Gait Retraining: A Case Report. JOSPT Cases, 2021

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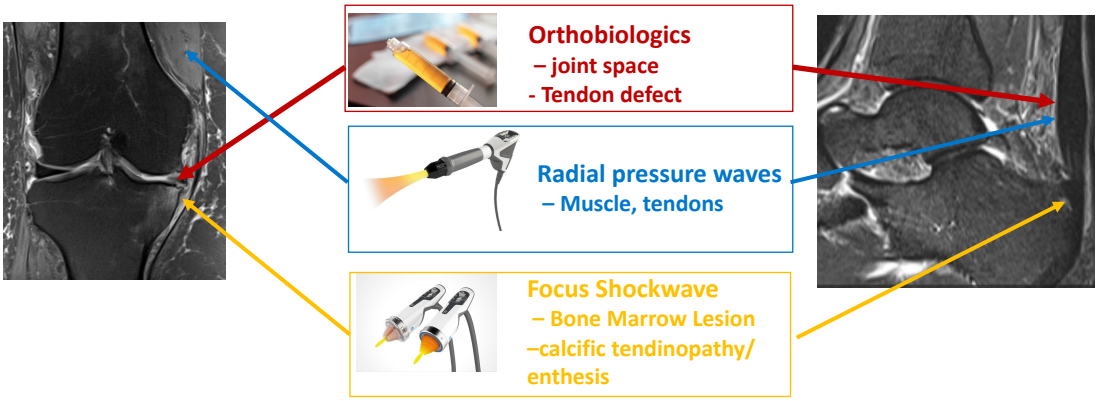
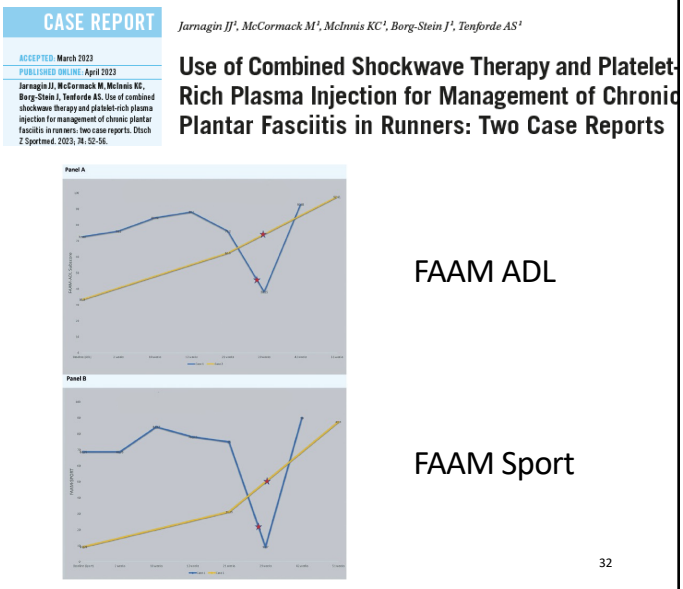
Describing a Team Approach: ESWT and PRP



PRP with ESWT for plantar fasciitis

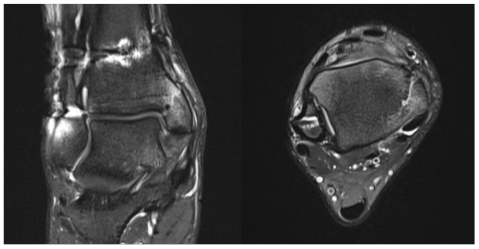
- Cases of 69 yo F and 70 yo M
- Combined (Focus with Radial) ESWT with functional improvement
- Addition of PRP allowed return to running



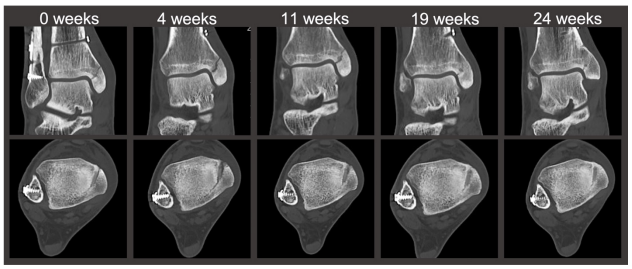
FAAM ADL

FAAM Sport

Combination of Bone Marrow Aspirate and Shockwave



Medial malleolar stress fracture after high ankle sprain with stabilization



Shockwave therapy performed starting week 12, BMAC week 14, serial CT healing

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Current gaps in knowledge

- **Differences in terminology, indications, and protocols across studies**
- **International Delphi statement developed to address these issues**

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Original research

Recommendations for use of extracorporeal shockwave therapy in sports medicine: an international modified Delphi study

Hye Chang Rhim,[1] Mani Singh,[2] Nicola Maffulli ,[3] Amol Saxena ,[4] Carlos Leal,[5] Ludger Gerdesmeyer,[6] Kristina Quirologico,[7] John P Furia,[8] Johannes Zwerver,[9] Chun-De Liao ,[10] Daniel Moya ,[11] Shih-Wei Huang,[12] David M Robinson,[1] Johnny Jarnagin,[1] Joseph Ruiz,[1] Kayle E Noble-Taylor,[13] Hazem Alkhawashki,[14] Brice W Blatz,[15] Joanne Borg-Stein,[1] Lauren Borowski,[16] Jay Bowen,[17] Michael Chin,[18] Robert M Conenello,[19] Michael Fredericson ,[20] Brian W Fullem,[21] Karin Gravare Silbernagel,[22] Karsten Hollander ,[23] Elena J Jelsing,[24] Paul Langer,[25] Kenneth Mautner,[26] Adele Meron,[27] Robert Monaco,[28] Rowan V Paul,[29] Sara Raiser ,[30] James W Ratcliff,[31] Steven Sampson,[32] Wolfgang Schaden,[33] Jay Spector,[34] Wei Sun,[35] Isaac P Syrop,[36] Kenji Takahashi,[37] Benedict Tan,[38] James F Wyss,[39] Dan Zin,[40] Jennifer Soo Hoo,[41] Adam S Tenforde [1]

BMJ Group

Rhim HC, *et al*. *Br J Sports Med* 2025;**0**:1–15. doi:10.1136/bjsports-2024-109082

BASem

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Terminology

Statement	Agreement	Neutral	Disagreement
Shockwave therapy's exact mechanism of action remains unknown but is best thought to be through cellular mechanotransduction where mechanical stimuli lead to cellular migration and proliferation, increased vascularity in addition to acting on pain pathways to decrease pain.	97.6% (41/42)	2.4% (1/42)	0% (0/42)
Focused shockwaves should be referred to as extracorporeal shockwave therapy (ESWT).	88.1% (37/42)	4.76% (2/42)	7.14% (3/42)
Focused shockwave therapy and radial pressure waves should not be referred to as high or low energy shockwaves.	88.1% (37/42)	4.76% (2/42)	7.14% (3/42)
In common practice, ESWT is used to describe both focused and radial shockwaves. However, only focused ESWT generates a true shockwave. Therefore, radial ESWT should be referred to as 'pressure wave therapy' or 'radial pressure wave therapy'. (Statement modified in Round 2)	80.5% (33/41)	9.8% (4/41)	9.8% (4/41)
Energy levels of shockwave therapy are defined as: Low (< 0.10 mj/mm2), Medium (0.10–0.28 mj/mm2), High (≥0.29 mj/mm2).	78% (32/41)	19.5% (8/41)	2.4% (1/41)

Colouring indicates full consensus (■), consensus with one or more disagreement (■) and failure of consensus (■).
Consensus was defined a priori by ≥75% agreement or disagreement.
mj/mm2, millijoules per square millimetre.

- **Shockwave works through mechanotransduction**
- **Focus shockwave is true shockwave, radial is "pressure wave"**
- **Energy settings, not device type, determine energy settings**

Rhim, et al. Recommendations for use of extracorporeal shockwave therapy in sports medicine: an international modified Delphi Study. BJSM, 2025.

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Indications

Conditions	Recommended	Neutral	Not recommended
Plantar fasciopathy	100% (42/42)	0%	0%
Insertional Achilles tendinopathy	100% (42/42)	0%	0%
Proximal hamstring tendinopathy	100% (38/38)	0%	0%
Common extensor tendinopathy	100% (35/35)	0%	0%
Patellar tendinopathy	97.4% (37/38)	2.6% (1/38)	0%
Medial epicondylopathy (Statement added in Round 2)	97.4% (37/38)	2.6% (1/38)	0%
Gluteal medius and minimus tendinopathy	97.1% (34/35)	2.9% (1/35)	0%
Calcific rotator cuff tendinopathy	97.1% (33/34)	0%	2.9% (1/34)
Midportion Achilles tendinopathy	95.2% (40/42)	4.8% (2/42)	0%
Delayed union fractures/bone stress injuries (>3 months of symptoms)	92.3% (36/39)	7.7% (3/39)	0%
Non-union fractures/bone stress injuries (>6 months of symptoms)	92.3% (36/39)	5.1% (2/39)	2.6% (1/39)
Medial tibial stress syndrome (Statement added in Round 2)	92.3% (36/39)	7.7% (3/39)	0%
Distal hamstring tendinopathy	91.9% (34/37)	5.4% (2/37)	2.7% (1/37)
Low-grade partial gluteus medius and minimus tear	91.4% (32/35)	8.6% (3/35)	0%
Greater trochanter pain syndrome	91.2% (31/34)	8.8% (3/34)	0%
Low-grade partial patellar tendon tear	89.5% (34/38)	5.3% (2/38)	5.3% (2/38)
Radial pressure wave therapy for low-grade partial tendon tear (Statement added in Round 2)	87.8% (36/41)	4.9% (2/41)	7.3% (3/41)
Bone stress injury	87.2% (34/39)	12.8% (5/39)	0%
Sesamoiditis (Statement added in Round 2)	86.8% (33/38)	10.5% (4/38)	2.6% (1/38)
Low-grade partial common extensor tendon tear	86.1% (31/36)	13.9% (5/36)	0%
Low-grade partial insertional Achilles tendon tear	85.7% (36/42)	9.5% (4/42)	4.8% (2/42)
Low-grade partial midportion Achilles tendon tear	85.7% (36/42)	9.5% (4/42)	4.8% (2/42)
Low-grade partial proximal hamstring tendon tear	83.8% (31/37)	13.5% (5/37)	2.7% (1/37)
Partial plantar fascia tear	81% (34/42)	11.9% (5/42)	7/1% (3/42)
Focused ESWT for low-grade partial tendon tear (Statement added in Round 2)	76.9% (30/39)	15.4% (6/39)	7.7% (3/39)
Non-calcific rotator cuff tendinopathy	76.5% (26/34)	17.6% (6/34)	5.9% (2/34)

- Complete agreement plantar fasciitis, insertional Achilles tendinopathy, proximal hamstring tendinopathy, extensor tendinopathy of forearm
- Most conditions with low grade, partial tendon tears and non-union fractures with consensus

Rhim, et al. Recommendations for use of extracorporeal shockwave therapy in sports medicine: an international modified Delphi Study. BJSM, 2025.

Procedure Aspects

Statement	Agreement	Neutral	Disagreement
Local anaesthesia is not recommended to be used when performing shockwave on patients.	100% (41/41)	0%	0%
The shockwave dose should start at a low energy level easily tolerated by the patient and then increase to patient tolerance and reach the goal therapeutic energy level.	92.9% (39/42)	2.4% (1/42)	4.8% (2/42)
Shockwave therapy treatment time interval between each session is recommended to be 1–2 weeks.	92.9% (39/42)	2.4% (1/42)	4.8% (2/42)
There is increased benefit to co-treating tendon pathology with combined use of physical therapy exercises and shockwave therapy. (Statement added in Round 3)	92.7% (38/41)	7.3% (3/41)	0%
Total recommended treatment sessions to accurately treat tendon issues vary, but typically between 3–5 sessions.	83.3% (35/42)	9.5% (4/42)	7.1% (3/42)
Low and medium energy levels are best used for treating tendon issues and fasciopathies.	78% (32/41)	12.2% (5/41)	9.8% (4/41)
Clinical focus as opposed to imaging guidance is recommended when performing shockwave on patients.	76.2% (32/42)	19% (8/42)	4.8% (2/42)
If available, it is recommended to use a combined approach of both radial and focused probes when performing shockwave on tendons.	75.7% (28/37)	16.2% (6/37)	8.1% (3/37)

- No anesthesia
- Titrate to tolerance
- Combine with physical therapy
- Treatment of 3-5 sessions
- High energy shockwave reserved for bone pathology

Rhim, et al. Recommendations for use of extracorporeal shockwave therapy in sports medicine: an international modified Delphi Study. BJSM, 2025.

Procedure Aspects: tendon and fascia

Table 4 Procedural aspects for tendon

Statement	Agreement	Neutral	Disagreement
Local anaesthesia is not recommended to be used when performing shockwave on patients.	100% (41/41)	0%	0%
The shockwave dose should start at a low energy level easily tolerated by the patient and then increase to patient tolerance and reach the goal therapeutic energy level.	92.9% (39/42)	2.4% (1/42)	4.8% (2/42)
Shockwave therapy treatment time interval between each session is recommended to be 1–2 weeks.	92.9% (39/42)	2.4% (1/42)	4.8% (2/42)
There is increased benefit to co-treating tendon pathology with combined use of physical therapy exercises and shockwave therapy. (Statement added in Round 3)	92.7% (38/41)	7.3% (3/41)	0%
Total recommended treatment sessions to accurately treat tendon issues vary, but typically between 3–5 sessions.	83.3% (35/42)	9.5% (4/42)	7.1% (3/42)
Low and medium energy levels are best used for treating tendon issues and fasciopathies.	78% (32/41)	12.2% (5/41)	9.8% (4/41)
Clinical focus as opposed to imaging guidance is recommended when performing shockwave on patients.	76.2% (32/42)	19% (8/42)	4.8% (2/42)
If available, it is recommended to use a combined approach of both radial and focused probes when performing shockwave on tendons.	75.7% (28/37)	16.2% (6/37)	8.1% (3/37)
There is increased benefit to co-treating tendon pathology with combined use of orthobiologics (ie, platelet-rich plasma) therapies and shockwave therapy, (Statement modified to replace 'cell-based (ie, platelet-rich plasma)' with 'orthobiologics (ie, platelet-rich plasma)' in Round 3)	52.5% (21/40)	32.5% (13/40)	15% (6/40)

- **Use clinical focusing to direct ESWT**
- **Combine use of focus and radial devices when available**
- **No consensus to combine ESWT with orthobiologics**

Rhim, et al. Recommendations for use of extracorporeal shockwave therapy in sports medicine: an international modified Delphi Study. BJSM, 2025.

Procedure Aspects: tendon and fascia

- **Use moderate energy settings for best effect (0.1-0.25 mJ)**
- **Focused shockwave for 1500-2000 shocks**
- **Radial shockwave for 2000-3000 strikes**
- **Titrate energy to keep VAS pain 6 of 10**
- **Clinical benefits typically seen at 6 weeks**
- **No agreement of ESWT resolving injury; agreement duration of relief ~10 months**

Rhim, et al. Recommendations for use of extracorporeal shockwave therapy in sports medicine: an international modified Delphi Study. BJSM, 2025.

Procedure Aspects: bone and joint

- **Focused shockwave is strongly preferred for joint and bone indications**
- **Orthobiologics combined with ESWT may improve outcomes**
- **High energy settings advised (>0.29 mJ)**
- **Single session treatments are not recommended**

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Post-Procedure Recommendations

Acetaminophen or other non-NSAID medication could be used for pain management throughout the duration of shockwave treatment.	95.2% (40/42)	2.4% (1/42)	2.4% (1/42)
There are no range of motion restrictions or precautions necessary post shockwave therapy treatment of tendon or fasciopathy.	95.2% (40/42)	4.8% (2/42)	0%
There are no weight-bearing precautions necessary post shockwave therapy when treating tendon conditions with low-grade partial tears. (Statement was added in Round 2.)	85% (34/40)	7.5% (3/40)	7.5% (3/40)
NSAIDs should be avoided throughout the duration of shockwave treatments.	78.6% (33/42)	11.9% (5/42)	9.5% (4/42)
There are no weight-bearing precautions necessary post shockwave therapy treatment for tendon or fasciopathy.	78.6% (33/42)	9.5% (4/42)	11.9% (5/42)
Fluoroquinolones should be avoided throughout the treatment window of shockwave therapy.	77.8% (28/36)	16.7% (6/36)	5.6% (2/36)
The use of radial pressure wave application on tendons does NOT require additional activity restrictions outside best practice for the injury being treated. (Statement was added in Round 3 instead of asking 'When do you recommend patients to return to sports after radial pressure wave therapy' in Round 1 and 'When do you recommend patients to return to activities as tolerated after radial pressure wave therapy for tendons?' in Round 2.)	77.5% (31/40)	10% (4/40)	12.5% (5/40)
Radial pressure wave therapy can be performed while the patient is on direct anticoagulants.	67.6% (25/37)	10.8% (4/37)	21.6% (8/37)
Focused ESWT can be performed while the patient is on direct anticoagulants.	66.7% (26/39)	15.4% (6/39)	17.9% (7/39)
The use of focused ESWT application on tendons does NOT require additional activity restrictions outside best practice for the injury being treated. (Statement was added in Round 3 instead of asking 'When do you recommend patients to return to sports after focused or combined shockwave therapy' in Round 1 and 'When do you recommend patients to return to activities as tolerated after shockwave therapy' for bone pathologies in Round 2.)	65% (26/40)	17.5% (7/40)	17.5% (7/40)
The use of radial pressure application on bones does NOT require additional activity restrictions outside best practice for the injury being treated. (Statement was added in Round 3 instead of asking 'When do you recommend patients to return to sports after radial pressure wave therapy for tendons' in Round 1 and 'When do you recommend patients to return to activities as tolerated after radial pressure wave therapy' for bone pathologies in Round 2.)	64.7% (22/34)	26.5% (9/34)	8.8% (3/34)

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- **Avoid NSAIDs throughout**
- **No weight-bearing or ROM restrictions**
- **No added restrictions after radial therapy, no consensus with focused shockwave**
- **Lack of consensus on use with anti-coagulation**

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Contraindications and side effects

Statement	Agreement	Neutral	Disagreement
Malignancy is a contraindication to focused shockwave therapy treatment.	85.3% (35/41)	9.8% (4/41)	4.9% (2/41)
Focused shockwave therapy should not be performed with the lung in the treatment area.	77.8% (28/36)	11.1% (4/36)	11.1% (4/36)
Malignancy is a contraindication to radial pressure wave therapy.	76.9% (30/39)	23.1% (9/39)	0%
Potential side effects of radial pressure wave therapy include pain at the applicator site, skin erythema, skin bruising, haematoma formation, nerve irritation, superficial oedema and headache.	92.5% (37/40)	5% (2/40)	2.5% (1/40)
Potential side effects of focused shockwave therapy include pain at the applicator site, skin erythema, skin bruising, haematoma formation, nerve irritation, superficial oedema and headache.	90.5% (38/42)	7.1% (3/42)	2.4% (1/42)
There is a minimal risk of tendon rupture with the use of focused shockwave therapy.	85.7% (36/42)	7.1% (3/42)	7.1% (3/42)
There is a minimal risk of tendon rupture with the use of radial pressure wave therapy.	82.5% (33/40)	7.5% (3/40)	10% (4/40)

- Not recommended in those with malignancy
- No focused shockwave with lung in treatment area
- Most side effects are minor
- Minimal risk of tendon rupture with focused or radial therapy

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ASMST
American Society for Medical Shockwave Treatment

<u>Our Mission</u>: To advance the applications, uses, and clinical proficiencies of shockwave therapy across multi-disciplines in medicine to treat a wide range of conditions, injuries, disorders, and diseases and improve patient outcomes and experiences.

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Save the date! Our second annual conference is on March 13-15, 2026 in Boston, Massachusetts

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Summary

- Shockwave is non-invasive treatment with good evidence for use in common musculoskeletal injuries
- Most conditions including partial tendon tears can be targeted with shockwave therapy
- Energy settings are different based on pathology

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Summary

- Avoid NSAIDs during therapy
- Structured rehabilitation improves outcomes
- Side effects are mostly minor, tendon tear risk is minimal

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Mass General Brigham

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