“ESWT” use in Foot and Ankle: 19+ year experience

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Disclosures

- Receive research funding, honorarium, travel and equipment from Curamedix, Storz
ESWT Family
Clinically Relevant Effectiveness of Focused Extracorporeal Shock Wave Therapy in the Treatment of Chronic Plantar Fasciitis

A Randomized, Controlled Multicenter Study

Hans Gollwitzer, MD, Amol Saxena, DPM, Lawrence A. DiDomenico, DPM, Louis Galli, DPM, Richard T. Bouché, DPM, David S. Caminear, DPM, Brian Fullem, DPM, Johannes C. Vester, Carsten Horn, MD, Ingo J. Banke, MD, Rainer Burgkart, MD, and Ludger Gerdesmeyer, MD

Background: The effectiveness of extracorporeal shock wave therapy in the treatment of plantar fasciitis is controversial. The objective of the present study was to test whether focused extracorporeal shock wave therapy is effective in relieving chronic heel pain diagnosed as plantar fasciitis.
Shockwave

1. Two types of “ESWT”: focused ESWT (FSW) and radial pressure wave (RPW aka “EPAT”)
2. The technologies work differently and potentially synergistically by stimulating angiogenesis, stem cells, growth factors
3. Has the highest level of evidence of anything you do for musculoskeletal conditions, many bone conditions, and high potential for wounds
4. Is “non-invasive”, most often no “down-time”. Can use while training even daily & half-time!


Shock Wave Therapy For Chronic Achilles Tendon Pain: A Randomized Placebo-Controlled Trial *Clinical Orthopedics and Related Research* (2005)
“Throw the life-preserver out early: get better quicker, don’t dwell”

- 2006 Nike athletes started coming down & Whalen family introduced me to the Alter-G (also coincidently, shockwave research started!)
Indications

1. Approved standard indications
   1.1. Chronic Tendinopathies
   1.1.1. Calcifying tendinopathy of the shoulder
   1.1.2. Lateral epicondylopathy of the elbow (tennis elbow)
   1.1.3. Greater trochanter pain syndrome
   1.1.4. Patellar tendinopathy
   1.1.5. Achilles tendinopathy
   1.1.6. Plantar fasciitis, with or without heel spur
   1.2. Bone Pathologies
      1.2.1. Delayed bone healing
      1.2.2. Bone Non-Union (pseudarthroses)
      1.2.3. Stress fracture
      1.2.4. Avascular bone necrosis without articular derangement
      1.2.5. Osteochondritis Dissecans (OCD) without articular derangement
   1.3. Skin Pathologies
      1.3.1. Delayed or non-healing wounds
      1.3.2. Skin ulcers
      1.3.3. Non-circumferential burn wounds
High-Energy/Low-Energy

- OLD Terminology, Old machines!!!
- **Current Terminology** (since 2006): **Focused** aka “ESWT” (true shockwaves) and **radial** (RSW, SWT, rESWT) “sound/pressure” waves
- Most “shockwave” devices current in US market are radial devices ($16-26K)
- ESWT (focused) devices are $55+K (but have more indications beyond musculoskeletal, ie **wounds**, neuro, GU)
Energy levels: both can produce “High”

New idea

Nano energy
0.01-0.05mJ/mm²

Nano
0.3-1.0bar

Low energy
0.07-0.10mJ/mm²

Low energy
1.1-2.0bar

Medium energy
0.12-0.25mJ/mm²

Medium
2.1-5.0bar

High energy
>0.25mJ/mm²

Not clinically useful

Nano-energetic

SPORTPRAXIS
PROF. DR. MED. K. KNOBLOCH
How does it work?

- Causes pain, release & depletion of Substance P
- Creates micro-trauma, releases growth factors, neovascularization, re-introduces a healing response
- Can induce stem cell release in bony & fatty areas
Shockwaves exert high energy for very short time.
The Effects of SHOCK WAVE

- Reduces/eliminates pain
  - Effect on nociceptors: → c-fibres (slow)
  - Inhibited by a-delta-fibres (fast)
  - Analgesic effect
- Increases circulation and metabolism
- Stimulates neovascularization
- Stimulates tissue and bone growth
  - Tissue engineering (mense)
  - Biological mechano-transduction
  - Cell proliferation (neuland)
- Dissolves calcium deposits
- Reduces muscle tension
- Antibacterial effects
BIOLOGIC EFFECTS OF ACOUSTIC PRESSURE WAVES

- Disruption of cell membranes

- Neovascularization
- Stimulate osteoblasts, chondroblasts, macrophages
Biologic Effects of Acoustic Pressure Waves

ACOUSTIC WAVES

Physical S.W. energy

Biological responses

BMP → eNOS → VEGF → PCNA → Neovascularization

Improved blood supply

Bone repair → Tissue regeneration → Tendon repair
Contraindications

- Coagulopathies
- NSAIDS, Gluco-Corticoid tx (wait 6 wks)
- Anti-coagulation therapy (coumadin, etc)?
- Tumors?
- Pregnancy?
- Open growth plates? RSW OK.
- Neurogenic seizure
- Neuropathy/Radiculopathy/Tarsal Tunnel? My have increased pain
Note:

- Some devices require gel &/or mineral oil between application area & device
- Local anesthetic decreases effectiveness
- Much more indications beyond US borders
Note:

- Changing a degenerative state to regenerate
- Creating acute inflammation
- Some data to show treatment of trigger points can be more helpful
Note:

- Patients’ response to pain can be variable but most have some temporary relief after each treatment.
- Variable # of pulses/shocks, may need to space out more treatment sessions if not achieving therapeutic range.
- Having more pain after treatment is not correlated with a better or worse response.
- Can take 10-12 wks to see improvement after completion of treatment!
TIP:

- It’s like re-painting a wall...the colors take a while to match!
- Like painting, may need “touch-up” treatment @ 6 & 12 wks.
- Some athletes have used RSW during sports competition (half-time), daily, & “annually”
Working principle of focused and radial extracorporeal shock wave technology.

In case of focused shock waves, single acoustic pulses are generated either with a spark-gap (electrohydraulic principle), a technology similar to a loudspeaker (electromagnetic principle) or piezocrystals (piezoelectric principle).

By means of reflectors of certain shape, the acoustic pulses are converted into a focused acoustic pressure wave/shock wave with a point of highest pressure at the desired target within pathological tissue.

In case of radial shock waves, a projectile is fired within a guiding tube that strikes a metal applicator placed on the skin. The projectile generates stress waves in the applicator that transmit pressure waves into tissue.
Devices

- ESWT aka “focused”, ultrasonic
- RSW: radial, acoustic sound wave, “Extracorporeal Pulsed Activation Treatment” aka “EPAT”, RPW
- “V-actor”-vibration therapy used for muscle spasm/trigger point therapy
- Different applicator “tips” change depth penetration
- Getting FDA approved: “EMTT” Electromagnetic Transduction Therapy
Duolith (fESWT)
Orthopulse: RPW aka “EPAT”
# Energy setting based on device

<table>
<thead>
<tr>
<th>Bar</th>
<th>Duolith (mJ/mm²)</th>
<th>EnPuls (mJ)</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.7</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.12</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>2.4</td>
<td>0.15</td>
<td>110</td>
<td>Achilles, medial tibial stress syndrome &amp; other superficial areas (tennis elbow, patellar tendon, hip &amp; elbow bursitis)</td>
</tr>
<tr>
<td>3</td>
<td>0.2</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.25</td>
<td>150</td>
<td>Plantar fascia, hamstring, muscle strains, rotator cuff</td>
</tr>
<tr>
<td>5</td>
<td>0.3</td>
<td>185</td>
<td></td>
</tr>
<tr>
<td>0.3-0.55</td>
<td>Non-union, AVN, stress fractures (may need local anesthesia proximal to area)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: contraindication is coagulopathy, nsaids

Note: tx settings are typical but can be a range, usual session is 2500 pulses, larger areas can adjust up to 5000 pulses

Note: with Duolith apply mineral oil between head every 3 tx

Note: with Duolith, D Actor & Orthopulse, use ultrasound gel between applicator tip & patient’s skin

Note: with EnPuls, may need blue cap for superficial areas (eg Achilles) & mineral oil (not US gel) between tip & skin

Note: radial devices can be used daily, but focused ESWT (Duolith) should be used 2-14 days apart for musculoskeletal & 4-6 wks for bone
Benefits

- Ideally, NO “downtime” for most conditions, no immobilization, (No Boot! -but some protection, ankle brace, orthosis), great for athletic & active patients
- Better not to use NSAIDS concurrently
- Few relative contra-indications (coagulopathies)
Note on study Levels

- Level I: **highest** (blinded, randomized, placebo-controlled)
- Level II: randomized, placebo controlled
- Level III: non-randomized, case-cohort, prospective
- Level IV: retrospective
- Level V: expert opinion
Have to use the best evidence!

1. Need to use facts & data
2. Resist the temptation to use unproven therapies
3. Do not try to gain fame (it’s not about you)
2018: 3 Excellent Reviews

- Reilly et al. Narrative review on the effect of shockwave treatment for management of upper and lower extremity musculoskeletal conditions. Phys Med Rehab 2018
Extracorporeal Shockwave Therapy in Lower Limb Sports Injuries

Haylee E. Borgstrom¹ · Amol Saxena² · Adam S. Tenforde¹

Published online: 3 June 2019
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Abstract
Purpose of Review To outline current evidence on the use of ESWT for the treatment of lower limb sports injuries.
Recent Findings There is growing evidence to support the use of extracorporeal shockwave therapy (ESWT) for a variety of musculoskeletal conditions in the general population. However, research focused on the use of ESWT specifically for lower extremity injuries in the athletic population is more limited. Athletes represent a subgroup of patients that may benefit from ESWT. Compared with injections or surgical interventions, athletes undergoing ESWT often are able to continue sports participation with fewer limitations in activity during treatment.
Summary The review identifies considerable variability in study design and treatment protocols that affect the overall quality of evidence. Sports participation was allowed in most studies. One case of plantar fascia tear was identified during ESWT treatment; this injury was self-limited. Most studies report pain-relieving and/or functional benefit with the use of ESWT for common lower extremity tendinopathies, plantar fasciitis, and medial tibial stress syndrome. This review highlights the need for further investigations on optimal methods of ESWT use in athletes given the high prevalence of lower extremity injuries and favorable safety profile for treatment.

Keywords  Athlete · Sport · Extracorporeal shockwave therapy · ESWT · Lowerextremity injury · Tendinopathy
The Role of Extracorporeal Shockwave Treatment in Musculoskeletal Disorders

Daniel Moya, MD, Silvia Ramón, MD, PhD, Wolfgang Schaden, MD, Ching-Jen Wang, MD, Leonardo Guiloff, MD, and Jai-Hong Cheng, MD

- Increasing evidence suggests that extracorporeal shockwave treatment (ESWT) is safe and effective for treating several musculoskeletal disorders.

- Two types of technical principles are usually included in ESWT: focused ESWT (F-ESWT) and radial pressure waves (RPW). These 2 technologies differ with respect to their generation devices, physical characteristics, and mechanism of action but share several indications.

- Strong evidence supports the use of ESWT in calcifying tendinopathy of the shoulder and plantar fasciitis.

- The best evidence for the use of ESWT was obtained with low to medium energy levels for tendon disorders as well as with a high energy level for tendon calcification and bone pathologies in a comprehensive rehabilitation framework.
Acute Plantar Fasciitis (<6 wks)

- Rompe et al (2010) RCT. ESWT vs. Plantar fascia specific stretching for acute plantar fasciitis (<6wks) showed that stretching is superior\(^1\). **Level I**

- Mardani-Kivi et al (2015) RCT. ESWT vs. Corticosteroid for acute plantar fasciitis (<6wks). Corticosteroid injection showed more effectiveness for the acute condition\(^2\). **Level II**
Plantar Fasciitis tx “early” vs “traditional”) ie 6+mos

- Saxena et al (2016) Prospective analysis. Early implementation of RSWT on subacute plantar fasciitis (for symptoms <3 months) vs. Standardized implementation of RSWT on chronic (>6 months) plantar fasciitis was analyzed. Better outcomes with early implementation with VAS and RM scores at 12 months, faster RTA & significantly more likely to continue sport/activity 2017 J Foot Ankle Surg Level III
Chronic Plantar fasciitis (6+ mos) 3 Level 1 Studies!!

- Gollwitzer et al (2015) Multicenter RCT. Focused ESWT vs. Placebo showed favorable VAS and RM outcome of ESWT. **Level I**
- Saxena et al (2013) Case-controlled study on athletes. Comparing endoscopic plantar fasciotomy (EPF) vs. Focused ESWT. EPF with better outcome but ESWT preferable since they can remain active during treatment. **Level II**
- Malay et al (2006) RCT. ESWT vs. Placebo with better VAS outcome of ESWT. **Level I**
Platinum Evidence!

5 RCT’s with positive outcome 1b (Platinum evidence)

Current protocol

- Offer earlier after they’ve tried insoles, stretch, icing, nsaid (stop 6 wks before)
- ESWT 3-5 sessions
- Stretching arch
- Comfortable insoles/orthoses
- Foot & posture strengthening
- Ice as needed
- Tape, night splint?
Achilles Tendinopathy: 3 Level 1 studies

- **Saxena et al (2011)**. Prospective study. RSW for para, proximal, and insertional Achilles tendinopathy. Significant improvement in RM score for Achilles tendinopathy. 75% effective Level III

- **Rompe et al (2009)**. RCT. RSWT vs. Eccentric + ESWT with favorable outcome for the combined group. Level I


- **Rasmussen et al (2008)**. RCT. ESWT vs. Placebo ESWT. Better outcome with the ESWT. Level I

- **Furia (2008)**. Case control study. RSWT vs. Control (traditional conservative method). Better outcome with ESWT. Level III
Review

Current evidence of extracorporeal shock wave therapy in chronic Achilles tendinopathy

Ludger Gerdesmeyer\textsuperscript{a, e}, Rainer Mittermayr\textsuperscript{b}, Martin Fuerst\textsuperscript{a}, Munjed Al Muderis\textsuperscript{c}, Richard Thiele\textsuperscript{a}, Amol Saxena\textsuperscript{d}, Hans Gollwitzer\textsuperscript{e}

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HIGHLIGHTS

• This review shows efficacy of extracorporeal shock wave therapy.
• Focused and radial shock waves both show efficacy in chronic Achilles tendinopathy.
• All treatments should be done without local anesthesia.

ARTICLE INFO

Article history:
Received 30 June 2015
Accepted 15 July 2015
Available online 29 August 2015

ABSTRACT

Chronic Achilles tendinopathy has been described as the most common overuse injury in sports medicine. Several treatment modalities such as activity modification, heel lifts, arch supports, stretching exercises, nonsteroidal anti-inflammatories, and eccentric loading are known as standard treatment mostly without proven evidence. After failed conservative therapy, invasive treatment may be considered. Extracorporeal shock wave therapy (ESWT) has been successfully used in soft-tissue pathologies like lateral epicondylitis, plantar fasciitis, tendinopathy of the shoulder and also in bone and skin disorders. Conclusive evidence recommending ESWT as a treatment for Achilles tendinopathy is still lacking. In plantar fasciitis as well as in calcific shoulder tendinopathy shock wave therapy is recently the best evaluated treatment option. This article analysis the evidence based literature of ESWT in chronic Achilles tendinopathy. Recently published data have shown the efficacy of focused and radial extracorporeal shock wave therapy.

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Combined ESWT & RSW Therapy for Achilles Tendinopathy: A Prospective Study

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DOI:
10.32098/mltj.04.2019.10

LEVEL OF EVIDENCE:

SUMMARY
Achilles tendinopathy is one of the most common overuse injuries of the foot and ankle in the active population. Many studies have shown radial sound wave therapy (RSW) or extra-corporeal shockwave therapy (ESWT) to be a safe and effective conservative treatment options when used independently. In this prospective study, we examined the outcomes of treatment on Achilles tendinopathy combining these two modalities. We hypothesize improved results with the combination therapy and compare this with previous studies. The current study observes a cohort of 24 patients, who received the both treatments with mean age of 47.2±12.9 years at the time of study. Each patient received three treatments initially and then subsequent treatments at 6 and/or 12 week follow up. Pre-treatment VAS score was 6.3±1.3 and RM score was 3.5±0.5. Ultimately, these were reduced to 1.2±1.6 (P=0.00001) and 1.6±0.9 (P=0.00001) respectively at 17±4.5 month follow-up. Patients with paratendinous had better outcomes than insertional Achilles pathology. Our results show a significant improvement in outcome measures in patients treated with ESWT and RSW, as compared to other studies. We conclude that the dual treatment method is a safe and improved method of treatment for Achilles tendinopathy compared to isolated use of ESWT or RSW.

KEY WORDS
Achilles, radial soundwave, extra-corporeal, shockwave
ESWT & RSW for Achilles

- Saxena et al 2019 Musc Lig Tend J Combined treatment is better compared to just RSW
- 38 pts tx w both, 7 had surgery after (1 prior), 7 lost to f/u. 24 all RTA w sig improvement
- Statistical improvement at 3 mos w VAS & RM scores, and sig better at 12+ mos post-tx
- So far, compared to radial studies, adding ESWT appears better
- 50% were pain-free & at 100% activity level @ 1+ yr
Medial Tibial Stress Syndrome (Shin Splints)

- Rompe et al (2010) Retrospective cohort study. Radial ESWT + home training program vs. Home training program only. ESWT combined group out-performed the other group. Level II

- Moen et al (2012) Prospective study comparing ESWT w a gradual RTRunning program. RTA sig faster (P=.008, 60 vs 92days). Level II
Medial Tibial Stress Fracture: 17 Wks later, Olympic Gold
Review

Current concepts of shockwave therapy in stress fractures

Carlos Leal a,*, Cristina D'Agostino b, Santiago Gomez Garcia c, Arnold Fernandez a

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b Institute Panamerican, Milan, Italy
c Unidad Medica Deportiva, Policía Nacional de Colombia, Bogota, Colombia

HIGHLIGHTS

- Extracorporeal shockwave treatments (ESWT) stimulate bone turnover and neovascularization in delayed unions and avascular necrosis.
- ESWT is a safe and effective non-invasive outpatient procedure.
- Medium and high energy focused ESWT has shown excellent results in treating stress fractures, with faster return to competition and athletic activity.

ARTICLE INFO

Article history:
Received 29 June 2015
Accepted 20 July 2015
Available online 25 August 2015

Keywords:
Shockwave therapy
Stress fractures
Bone turnover
Bone overuse
Mechanotransduction

ABSTRACT

Stress fractures are common painful conditions in athletes, usually associated to biomechanical overloads. Low risk stress fractures usually respond well to conservative treatments, but up to one third of the athletes may not respond, and evolve into high-risk stress fractures. Surgical stabilization may be the final treatment, but it is a highly invasive procedure with known complications. Shockwave treatments (ESWT) based upon the stimulation of bone turnover, osteoblast stimulation and neovascularization by mechanotransduction, have been successfully used to treat delayed unions and avascular necrosis. Since 1999 it has also been proposed in the treatment of stress fractures with excellent results and no complications. We have used focused shockwave treatments in professional athletes and military personnel with a high rate of recovery, return to competition and pain control. We present the current concepts of shockwave treatments for stress fractures, and recommend it as the primary standard of care in low risk patients with poor response to conventional treatments.

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Metatarsal 5 fx in soccer athletes

<table>
<thead>
<tr>
<th>Metatarsal 5 stress fx</th>
<th>N</th>
<th>Bony healing</th>
<th>Return to sport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw only</td>
<td>13</td>
<td>10,4 weeks</td>
<td>11,7 weeks</td>
</tr>
<tr>
<td>Screw + 3x fok. ESWT</td>
<td>5</td>
<td>7,8 weeks</td>
<td>8,0 weeks</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
<td>2,6 weeks</td>
<td>3,7 weeks</td>
</tr>
</tbody>
</table>

18 days 26 days
17 yo HS football player re-frx Sept of Sr yr Tx 3x 0.30mJ/mm²
RTA Bootx2 wks, Practice in 6 wk, played 6 games inc state champs
Type 1 NSF x6 mos in elite sprinter (need <1mm cuts)
Healed in 3 mos, 6wks NWB BK boot & 3 Tx w ESWT @ .40mJ/mm², 2500 pulses
Sesamoiditis

- One series reported in the literature.
- Saxena et al (2017) JFAS “prospective” analysis-pilot study. ESWT treatment for sesamoidopathy with failed other conservative treatments. 90% RTA. Stat sig improvements in both VAS and RM score. Mean return to activity $10.1 \pm 15.6$ weeks (biased by 1 pt who waited a year to RTA!-really only 5wks). **Level III**
ESWT in Sesamoiditis

The Journal of Foot & Ankle Surgery xxx (2016) 1–3

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

and Series

undwave for Sesamoidopathy in Athletes: A Pilot Study

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5 of Musculoskeletal Disorders, Faculty of Medicine and Surgery, University of Salerno, Salerno, Italy
Non-Unions

- Furia et al. (2010) Retrospective cohort. ESWT vs. Intramedullary screw for 5th metatarsal metaphyseal-diaphyseal fracture non-union treatment. ESWT showed comparable results\textsuperscript{13}. Level I

- Cacchio et al. (2009) Prospective, randomized, multicenter trial. ESWT vs. surgical treatment for long-bone non-unions. Found comparable results\textsuperscript{14}. Level I
EBM : non union

Literature in Peer Reviewed Journals (127):
25 Publication: basic science
55 Publication: animal trials
47 Publication: clinical trials

JBJS:

Extracorporeal Shock-Wave Therapy Compared With Surgery For Hypertrophic Long-Bone Nonunions
A. Cacchio, L. Giordano, O. Colafarina, J. D. Rompe, E. Tavernese,
F. Ioppolo, S. Flamini, G. Spacca, V. Santilli

Shock Wave Therapy as a Treatment for Nonunion of the Proximal Fifth Metatarsal Metaphyseal Diaphyseal (Jones) Fracture
J. Furia, P. Juliano, A. Wade, R. Mittermayr, W. Schaden
ESWT versus surgery „Golden Standard“

ESWT
Group 1: n:42 (Dornier Epos Ultra 0.40 mJ/mm2)
Group 2: n:42 (Storz Modulith; 0.70 mJ/mm2)
- 4 Tx, 1 weeks interval, LA
- cast immobilization 6 weeks

surgery
Group 3: n:42
- Implantat removal
- Decortication
- Resection of interface
- Re-opening of the IM canal
- Reposition
- Re-osteosynthesis (10x plate; 25x IM nail, 7x Fix. ext.)
- Spongiosaplasty
- Partial WB 6 – 12 weeks
ESWT versus surgery „Golden Standard“

The primary end point of this study was healing of the nonunion as determined with an independent and blinded radiographic assessment at six months.

A nonunion was judged to be healed when callus bridged the nonunion site on all four cortices (X-ray or CT scan).

<table>
<thead>
<tr>
<th>Group</th>
<th>3 Mo</th>
<th>6 Mo</th>
<th>12 Mo</th>
<th>24 Mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>40</td>
<td>37</td>
<td>37</td>
<td>36</td>
</tr>
<tr>
<td>Healed</td>
<td>22 (55)</td>
<td>26 (70)</td>
<td>31 (84)</td>
<td>34 (94)</td>
</tr>
<tr>
<td>Not healed</td>
<td>18 (45)</td>
<td>11 (30)</td>
<td>6 (16)</td>
<td>2 (6)</td>
</tr>
<tr>
<td>Group 2</td>
<td>39</td>
<td>38</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>Healed</td>
<td>21 (54)</td>
<td>27 (71)</td>
<td>31 (82)</td>
<td>35 (92)</td>
</tr>
<tr>
<td>Not healed</td>
<td>18 (46)</td>
<td>11 (29)</td>
<td>7 (18)</td>
<td>3 (8)</td>
</tr>
<tr>
<td>Group 3</td>
<td>40</td>
<td>38</td>
<td>38</td>
<td>37</td>
</tr>
<tr>
<td>Healed</td>
<td>21 (52)</td>
<td>28 (74)</td>
<td>33 (87)</td>
<td>35 (95)</td>
</tr>
<tr>
<td>Not healed</td>
<td>19 (48)</td>
<td>10 (26)</td>
<td>5 (13)</td>
<td>2 (5)</td>
</tr>
</tbody>
</table>

After 6 month: 70%, 71%, and 74% healed

after 12 month: 84%, 82%, and 87% healed

After 24 month: 94%, 92%, and 95% healed
9 mos non-union: 
Tx 2x @ .40mJ/mm²

- Still healed @ 6 mos
- Ongoing study of midfoot non-unions in Seattle, WA. R Bouché, DPM (86% healed)

IRB @ PAMF: 188 Lisfranc’s fusions: Non-union 9.6% 1\textsuperscript{st} TMT, 2\textsuperscript{nd} TMT 5.6%, 3\textsuperscript{rd} TMT 2.1%, NC 15.9%
Current Studies on wounds


55 yo F, 3 cm wound
non-smoker
S/p BCC
excision
4/19, non-
healing after
wide-
excision 1/20

- Re-bx of wound negative
- Small peroneal artery blockage re-vascularized 2/20
- Hx of VV ligation
- Lymphedema
- Normal BMI
- Not Diabetic!
Start of ESWT: lateral ankle
After 6 ESWT 1000 pulses@.10 mJ/mm² & RSW 1500 @ 1.0 Bar, 4-8Hz
Initial PICO @ 1wk
2 wks after PICO & Grafix
Use VAC codes & new CPT tracking codes
PLATINUM LEVEL OF EVIDENCE

- With so many positive Level I-III studies, Cochrane Reviews has designated “Platinum Standard” beyond “Gold Standard”
- Nothing else this rigidly studied in musculoskeletal medicine
- At least 9 Level I, 4 Level II & 4 Level III Foot & Ankle studies...what are people waiting for?
The Future:

- ESWT, RPW & EMTT, plus appropriate eccentrics (avoid negative for insertional) and heel cushions/insoles
- Other tendinopathies such as Post Tib (JFAS 2020 Tenforde et al) & Peroneal (underway)
The Future: “EMTT” (Electromagnetic Transduction Therapy aka PEMF)
Electromagnetic Transduction Therapy for Achilles Tendinopathy: A Preliminary Report on a New Technology

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Abstract
A parallel prospective feasibility study was performed on 53 patients with chronic midportion Achilles tendinopathy (age 44.7 ± 9.1 years). Of the 53 patients, 28 (active group) were treated using a new electromagnetic (pulsed electromagnetic field) transduction therapy device (CellActor™ MT1) and heel cushions. The device produces an electromagnetic field of 80 milliTesla; a total of 8 treatments was performed within 8 weeks in an outpatient setting without anesthesia, immobilization, or rest. A control group of 25 patients with a similar duration of symptoms was treated with heel cushions only. At the 12-week assessment point, the visual analog scale scores in both groups had significantly decreased, although the active group had significantly improved visual analog scale scores compared with those of the controls. The Role-Maudrey scores had also significantly improved in both the active and the control groups (p < .00001 and p = .0002, respectively). Electromagnetic transduction therapy could potentially be a useful modality for the treatment of Achilles tendinopathy. It should be compared with the current reference standard of extracorporeal shockwave therapy/radial soundwave therapy with similar level I, II, and III studies.

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EMTT & Achilles

- Cohort study comparing 1cm heel cushion to 8 sessions of EMTT plus heel cushion
- Gerdesmeyer et al 2017 JFAS
- Eval @ 12 wks, no increase in activity level
- Significant improvement in both groups with VAS & RM, but significantly better with adding EMTT
- FDA approval
- Other studies published on shoulder, knee & back pain
References


References (continued)


References (continued)

O Reilly et al. Narrative review on the effect of shockwave treatment for management of upper and lower extremity musculoskeletal conditions. Phys Med Rehab 2018
THANK YOU