The Journal of Foot & Ankle Surgery 56 (2017) 985–989

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Treatment of Medial Tibial Stress Syndrome With Radial Soundwave Therapy in Elite Athletes: Current Evidence, Report on Two Cases, and Proposed Treatment Regimen

Amol Saxena, DPM, FACFAS [1], Brian Fullem, DPM [2], Ludger Gerdesmeyer, MD, PhD [3,4]

[1] Podiatrist, Department of Sports Medicine, Palo Alto Foundation Medical Group, Palo Alto, CA
[2] Podiatrist, Elite Sports Podiatry, Clearwater, FL
[3] Orthopedist, Department of Orthopaedic Surgery and Traumatology, University Schleswig-Holstein, Campus Kiel, Kiel, Germany
[4] Orthopedist, Department of Orthopaedic and Traumatology, Technical University Munich, Klinikum Rechts der Isar, Munich, Germany

ARTICLE INFO

Level of Clinical Evidence: 4

Keywords:
antigravity
athlete
extracorporeal shockwave therapy
leg brace
Olympian
radial soundwave therapy
stress fracture
vitamin D

ABSTRACT

Two case reports of high-level athletes with medial tibial stress syndrome (MTSS), 1 an Olympian with an actual stress fracture, are presented. Successful treatment included radial soundwave therapy, pneumatic leg braces, relative rest using an antigravity treadmill, and temporary foot orthoses. Radial soundwave therapy has a high level of evidence for treatment of MTSS. We also present recent evidence of the value of vitamin D assessment. Both patients had a successful outcome with minimal downtime. Finally, a suggested treatment regimen for MTSS is presented.

The purpose of the present study was to evaluate the current treatment options for medial tibial stress syndrome (MTSS) and discuss the use of radial soundwave therapy (RSWT) in the treatment of elite athletes. A proposed treatment regimen is also introduced for consideration and further study. Shin soreness or "shin splints" was first described in 1958 by Devas (1) from England. Devas (1) described 16 cases of shin pain and subsequent stress fracture of the tibia (2).

Most randomized controlled trials (RCTs) for MTSS have been performed in the military population. In 2009, Moen et al (2) reviewed the published data and concluded that no evidence has shown that any treatment other than rest is effective for MTSS. However, rest alone might not be appropriate nor conducive for elite athletes who require short healing periods. Moen et al (2) also stated that the cause of MTSS is "periostitis as a result of traction. It is caused by bony resorption that outpaces bone formation of the tibial cortex." Evidence for this overloaded adaptation of the cortex can be found in several studies describing the MTSS findings on bone scan, magnetic resonance imaging (MRI), high-resolution computed tomography, and dual energy x-ray absorptiometry. Fredericson et al (3) described a classification system using MRI that was validated by Nattiv et al (4).

Bouché and Johnson (5) defined MTSS as a tibial "fasciitis": "the tenting effect of the posterior tibial, flexor digitorum longus, and soleus tendons caused by muscle contraction exerts a force on the distal tibial fascia that is directed to its tibial crest insertion." This anatomic area in the region of MTSS was described in a cadaveric study by Saxena et al (6), confirming the distal fascial attachments and crossing of the posterior tibial tendons and flexor digitorum longus that can create traction in the medial aspect of the lower third of the tibia. If this "fasciitis" aspect of MTSS has any credence, extracorporeal shockwave therapy (ESWT) would be an excellent treatment according to the evidence-based medicine, which supports the use of shockwaves as a proven therapy for other enthesopathies (7).

The review by Hamstra-Wright et al (8) of all the RCTs for MTSS found 21 studies that met their criteria for inclusion and found >100 risk factors mentioned. The most likely factors associated with MTSS were a high body mass index, an increased navicular drop, increased hip external rotation, and increased ankle plantarflexion (8). Therefore, addressing the most common risk factors during treatment is paramount to successful outcomes, in addition to considering the use of shockwave therapy.

Financial Disclosure: The shockwave machines used in this investigation were donated by Storz and Zimmer Medzin. Amol Saxena is a stock holder in AlterG.

Conflict of Interest: Dr Fullem was awarded a $1500 honorarium by Zimmer Medzin to speak at the Midwest Podiatry Conference, Chicago, IL, April, 28, 2017.

Address correspondence to: Brian Fullem, DPM, Elite Sports Podiatry, 1700 N. McMullen Booth Road, Suite C-2, Clearwater, FL 33759.

E-mail address: BFullem1@aol.com (B. Fullem).

1067-2516/$ - see front matter © 2017 by the American College of Foot and Ankle Surgeons. All rights reserved.
http://dx.doi.org/10.1053/j.jfas.2017.06.013

At least 3 RCTs on the use of shockwave therapy for MTSS have included nonmilitary populations (7,9,10). Moen et al (9) performed a prospective controlled study using focused ESWT and found a statistically significant favorable difference in the group that received focused ESWT. Both groups participated an exercise program, with a gradual return to running. The study by Moen et al (9) used 5 treatment sessions but with a suboptimal number of shocks (1000 in the first session and 1500 for the remainder) and a subtherapeutic energy level for the first 3 treatment sessions. Most studies used ≥2000 shocks or pulses (7,9,10).

Rompe et al (10) reported a retrospective study using RSWT. The study sample was divided into 1 group, which performed stretching, strengthening, and a gradual return to running, and a second group, the treatment group, which added RSWT to the treatment plan. Three treatment sessions of 2000 shocks at 2.5 Bar (0.16 mJ/mm^2) were performed at weekly intervals. The RSWT group improved at a greater rate, with increased improvement for ≤15 months of the follow-up period.

The study by Newman et al (11) is the only level 1 study yet reported on MTSS with ESWT used as treatment. Several limitations of their study included a subtherapeutic number of shocks and dosage used, because they followed the protocol used by Moen et al (9). Schmitz et al (12) indicated that for ESWT/RSWT to be effective, 2000 shocks at each treatment session are required. Another limiting factor of the study by Newman et al (11) was the low number of participants (n = 28) and that 4 participants who failed to complete the study were reported as having no improvement, meaning that 14% failed to complete the study. The sham group received a low level of energy instead of no energy in the study by Gollwitzer et al (7) on focused ESWT for plantar fasciitis. Therefore, the "placebo" group in the study by Newman et al (11) cannot be considered a true placebo or control group. Finally, no other treatment intervention was given to the patients with MTSS in the study by Newman et al (11), which will limit the success of any treatment plan, because rest has been found to be effective and a plan for a gradual return to running also has some merit (2,3). Bouché and Johnson (5) also recommended consideration of corticosteroid injection and fascial stripping for tibial fasciitis. However, this has not been reported as treatment of tibial stress fractures.

Zimmerman et al (13) reviewed the published data for exercise-induced leg pain in military recruits. They provided the standard treatment and protocol for treatment of exercise-induced leg pain for Dutch military members. One aspect they included as a part of the treatment plan was RSWT. They found that allowing the patient to hold the device's handpiece helped patients manage the discomfort that occurs during treatment (Fig. 1). Their treatment plan revolved around mitigating the common risk factors associated with MTSS, as discussed.

Other treatment considerations for MTSS include leg braces and orthoses. In 1991, Whitelaw et al (14) described their success with treatment of tibial stress fractures in athletes using a pneumatic leg brace. Their study included 17 athletes with 20 tibial stress fractures that were confirmed by bone scan and 25 patients who had received a diagnosis of "shin splints" (14). Using the brace, they were walking pain free within 1 week and their time to return to activity (RTA) was 3.7 weeks and to competition was 5.3 weeks, which included basketball. No regression to complete fracture occurred. No RCTs have investigated the use of leg braces to treat MTSS.

Foot orthoses for MTSS, shin splints, and stress fractures have been studied, including in RCTs. Louden and Dolphino (15) found that off-the-shelf orthoses and stretching resulted in a 50% reduction of pain in runners within 3 weeks. They emphasized that these items should only be a part of the treatment process (15). In the Cochrane review by Yeung et al (16) of soft tissue leg injuries, they found some evidence for custom-made biomechanical foot orthoses compared with no insoles for MTSS in 1 study of 146 military recruits (95% confidence interval 0.08 to 0.69).

Fig. 1. Provider initiating radial soundwave therapy on patient's shin.

The present report includes the cases of 2 elite athletes who were "in-season" in 2016. We have described their care and outcomes. It should be noted that these were individual cases of athletes highly motivated to return to their sport as soon as possible and might not be representative of all athletes with MTSS.

Case Report

Case 1

An 18-year-old high school basketball player, height 6 ft. 5 in., presented in late winter of 2016 with right medial leg pain of 3 weeks' duration, which had caused him to limp. He had a positive "hop" test result (16). The findings from plain radiographs were negative,

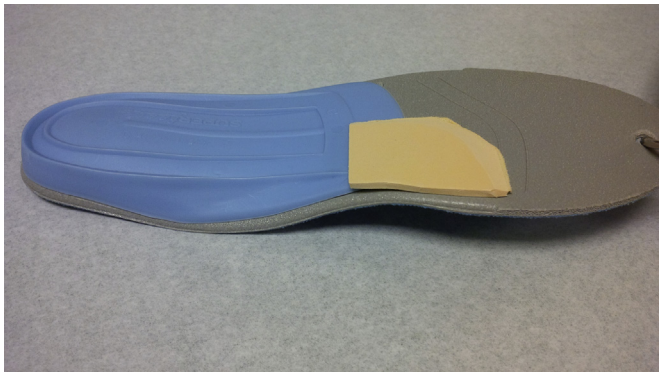

Fig. 2. Medial forefoot varus wedge on an insole.