Extra Corporeal Shockwave Therapy - Shockwave Therapy in Plantar Fasciitis
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Introduction:
The initial use of shock wave therapy in humans began in the 1980s with the investigation of its use in the
treatment of renal and biliary lithiasis. In 1986, further research demonstrated the effect of shock waves on
bone formation by way of osteoblast activation. Subsequent analysis has revealed widespread
applications of shock wave therapy in the musculoskeletal system. These include: tendinopathies,
enthesopathies, lateral epicondylitis, patellar tendonitis, plantar fasciitis, Achilles tendonitis, shoulder
calcification, stress fractures, delayed and nonunions.

Basic science:
A shock wave is defined as the resultant acoustic energy wave of an explosion and has the following
properties:

i. High pressure amplitude
ii. Rapid rise times
iii. Short cycle
iv. Large frequency spectrum
v. Force vector

Shock waves differ from other forms of acoustic energy, including ultrasound, because the force
generated creates change in stress, density, and temperature over the region to which it is applied. Wave
speed increases as amplitude rises. As a result, shock waves can alter the properties of the media
through which they travel. Shock wave generation is performed one of three ways: piezoelectric method,
electromagnetic method, or electrohydraulic method. The latter has been shown to be superior for most
orthopaedic applications due to its relatively larger focal area and more rapid rise times.

A shock wave is created in the electrohydraulic method by generating an explosion under water. A spark
plug is housed in a water-filled container. The electrical generator initiates a spark between the tips of a
spark plug gap and the vaporization of the water molecules produces an explosion within a self-contained
device. The resultant spherical is reflected toward a predetermined focal point, thus creating directed
force.

Clinical Application:
High energy technology (Ossatron) approved for use by FDA in October 2000 for the treatment of chronic
proximal plantar fasciitis that has been present for a minimum of six months and has failed all
forms of reasonable conservative management. (FDA also approved Dornier Epos for plantar fasciitis
in 2002 and then Siemens Sonocur low energy shock wave therapy for lateral epicondylitis in 2002).
CPT code for high energy application for plantar fasciitis is 28890.

While there are no absolute contraindications special attention in decision making and treatment should be
directed at the following groups of patients because no specific testing has been performed: tarsal tunnel
syndrome/other neuropathies, diabetic neuropathy, fractures, peripheral vascular disease, children,
pregnancy, severe DJD, RA, osteoporosis, metabolic bone disease, malignancies, Paget's disease, osteomyelitis, bleeding diathesis/anticoagulated patients, cardiac pacemakers, chemotherapeutic agents, potential health risks/sequelae of treatment, pain, focal neuropathy, local subcutaneous bleeding, neurovascular injury, complications arising from anesthesia (high energy), plantar fascial rupture.

**Debate: low vs. high energy**
High energy is one session at 1500 impulses of 18kV and requires anesthesia. Complications include pain and focal neurologic symptoms. Low energy is 3 sessions of 1000-2000 impulses and can be performed by technician in office setting. Minimal risk of side effects. Results suggest 76-80% G/E with success with high energy and 56-62% with low. Results pending on whether this is maintained at 5 years (low = high?). While there is low risk insurance companies are still debating whether to reimburse.

**Sonocur technique (low energy):**
Patient presents to the office without assistance. No local or regional anesthesia necessary. Non-certified technician capable of providing treatment (physician does not need to be physically present). Coupling gel is applied at the area of desired targeting (area of maximum tenderness). The device is placed in contact with the targeted body part. Each treatment is individualized in regard to number of impulses and energy level (shock wave energy and density). Typically, a total of 2000 shocks is applied at an energy level of 1-8, achieving a density of 0.05 mJ/mm². It is recommended that the initial treatment parameters be lowered somewhat (e.g., 1800 shocks, energy level 1) and gradually increased to the desired protocol so the efficacy and the tolerance of the patient for the procedure may be assessed. Total treatment time is approximately 13 to 15 minutes. The patient is allowed to weightbear without protection immediately and may drive home alone. It is repeated weekly for three weeks. Patient cost is $450-650/treatment.

Post-procedure instructions: Activity as tolerated. Use over the counter anti-inflammatories. Heel cushions or orthosis prn. Continue pre-op stretching. Clinical improvement may be noted for 12 weeks after last treatment.

Results: Blinded study underway at OrthoCarolina. Over 200 patients enrolled. No complications or side effects reported. Anecdotal results approximate 85%. Short follow-up only. Rompe has shown similar results (1995, 1996, 2002, 2003)

**Ossatron technique (high energy):**
This unit is typically located at a hospital or surgery center. The procedure requires a physician in attendance, performing the procedure in association with a technician. The procedure is painful and requires an anesthetic – IV sedation, general, regional block. It is usually a one-time application, at a cost considerably higher than low energy. As an example only, an average hospital cost is $4500-5500 with a physician charge of $650/side. A free standing surgery center may charge $1100 for one side or $1650 for bilateral. There is also an anesthesia charge.

Post-procedure: patient is usually able to full weightbear. A family member or friend drives them home. Patient instructed in avoiding the use of anti-inflammatory medications. The recovery time averages 12-16 weeks.


**Summary:**
ESWT is still experimental as studies are from a small population of researchers with relatively low numbers and short follow-up. The data is conflicting due to the lack of uniform protocols or comparison to conservative methods. However, the results are encouraging and the risks are low. While the insurance companies are currently hesitant to reimburse, the long-term results may find that even a relatively low success rate is cost-efficient compared to surgical intervention. Multi-center randomized studies are currently underway. The low energy form has advantages of cost and convenience.