Two Emerging Technologies for Achilles Tendinopathy and Plantar Fasciopathy

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KEYWORDS

- Achilles tendinopathy • Plantar fasciitis • Extracorporeal shock wave therapy
- Percutaneous tenotomy • Percutaneous fasciotomy

KEY POINTS

- Some overuse musculoskeletal injuries can be resistant to standard therapies. Alternative therapies may be considered earlier in the continuum of care and before surgical options are pursued.
- Extracorporeal shock wave therapy is becoming a more commonly used treatment modality in sports medicine and provides a noninvasive treatment option for tendon and fascia injuries.
- Ultrasound-guided percutaneous tenotomy/fasciotomy is a newer, minimally invasive technology that provides additional treatment options that may be considered before more invasive surgical interventions.

By some estimates 10% to 25% of individuals affected by Achilles tendinopathy and plantar fasciitis fail conservative treatment.[1–3] For those individuals who fail nonoperative modalities, operative intervention is often the next option. Recently, 2 other treatment options have shown potential as viable options for treatment of these conditions before surgery.

EXTRACORPOREAL SHOCK WAVE THERAPY

The use of acoustic energy in the form of unique sets of "high-energy" acoustic pressure waves or sound waves to treat musculoskeletal injuries has been around for approximately 30 years and the volume of research on effect, potential benefit, and

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mechanism of action continues to grow. Shock wave therapy (SWT) is a relatively new technology that has become increasingly popular as a treatment for musculoskeletal conditions, in part because it is noninvasive and clinically and economically effective. It also allows athletes to remain active during the treatment process. SWT is approved and/or cleared by the US Food and Drug Administration for treatment of musculoskeletal pain, plantar fasciitis, and lateral epicondylitis, and has been used for other off-label indications, including tendonopathies and other musculoskeletal conditions.[4] Overall, research is mixed in terms of the effectiveness of SWT.[4–7] A significant limitation to drawing definitive conclusions about the effectiveness of SWT is the variability in study design and methods, which makes it difficult to pools results. More research needs to be done to better elucidate effectiveness, optimal methodologies, adjunctive treatments, and posttreatment protocols.

Background and Technology

In the 1980s, shock waves began to be used to treat kidney stones.[8] The research on animals that preceded this clinical use suggested that there were also potentially beneficial effects on musculoskeletal structures. Subsequent research on the effects on bone, cartilage, muscle, tendon and ligaments eventually led to other clinical applications and SWT has become increasingly popular as a treatment modality. SWT is often called extracorporeal SWT.

Therapeutic shock waves are unique sets of acoustic pressure waves directed through a medium. They are typically classified as either focused or unfocused. Focused waves were used more commonly in the earlier days of clinical application, but recently unfocussed (or, as they are more commonly called, “radial”) pressure waves are used with increasing frequency. Radial pressure waves are used increasingly more often because they can be applied without local anesthesia and have the potential to be less injurious. In addition, improved technology makes the machines less costly to own and operate, and more convenient to use in clinical settings.[3,9] Multiple investigators have concluded that no evidence clearly favors either focused or radial shock wave therapy.[4,10] Other authors have shown that extracorporeal SWT delivered without local anesthesia was more effective compared with delivery under local anesthesia.[11,12] Because radial SWT (RSWT) is being used more commonly in clinical settings and can be delivered without local anesthesia, it is the focus of this review.

Ogden and colleagues[13] described therapeutic shock wave as a “controlled explosion” that will be reflected, refracted, transmitted, and dissipated as it travels through tissue. As it travels, a pressure phase is followed by a low-pressure or tensile phase, and then cavitation follows. Any change in tissue type presents a boundary, and it is at these boundaries or tissue interfaces where the biological effects of cavitation occur.[14,15] Structures like cartilage and bone reflect the energy of the wave, whereas structures with high collagen content, such as tendon, ligament, and joint capsule, tend to absorb the wave.[16,17]

The shock wave can be generated in a number of different ways, but the most commonly used and clinically validated method for RSWT is pneumatic. The energy content of the pressure wave can be varied depending on the selected settings and equipment; the propagation of the wave will vary with tissue type. With radial acoustic pressure waves, the skin is subjected to the greatest concentration of energy; as the wave travels through other tissues, a steep drop off of energy occurs. Structures that are close to the skin surface are especially impacted by SWT (**Fig. 1**).[4]

The acoustic pressure wave can be manipulated in a number of ways, one of which is by varying the amount of energy per unit area per pulse. This is known as the energy