CHAPTER **39**

EXTRACORPOREAL SHOCK WAVE THERAPY IN CHRONIC PLANTAR FASCIITIS

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Heel pain comprises 20-30% of the presenting complaints to the foot and ankle specialist's office. Plantar fasciitis is a condition that responds well to multiple forms of conservative therapy. The inflammation and stretching of the plantar fascia as a result of multiple micro-tears can result in significant pain for the patient. This condition has been noted in various patient populations, and many treatment modalities have been used including anti-inflammatory medications, stretching, functional support, injections, physical therapy, occasionally immobilization, and even surgical intervention in the most resistant cases. The use of extracorporeal shock wave therapy (ESWT) allows physicians a noninvasive alternative in the treatment of chronic plantar fasciitis without the postoperative recovery and potential complications associated with surgical procedures.

EXTRACORPOREAL SHOCK WAVE THERAPY

Extracorporeal shock wave therapy (ESWT) was first introduced in the treatment of renal stones in the 1980s. Over the past 10 years this modality has expanded its potential into many orthopedic applications. A shock wave is a sound wave (sonic pulse) produced through various mechanisms that changes as it passes through different mediums. The energy originally produced is transferred into the tissues resulting in 2 effects: direct explosive effect and an indirect cavitation or implosion. This energy must be focused so that it can be directed at the region of injury.

Shock waves are generated by one of three techniques, electrohydraulic, electromagnetic, and piezoelectric. The electrohydraulic technique (OssaTron device, High Medical Technology, Kreuzlingen, Switzerland) produces shock waves through the use of an electrode to produce a spark that is transformed into a sonic pulse in a water-filled ellipsoid. This pulse is focused at a focal point to allow application of the shock wave to the treatment region. The electromagnetic technique (Epos, Sonocur) passes electricity through a coil propagating a wave through interaction with adjacent membrane and fluid membrane with the shock wave focused by a lens at the therapeutic site. The piezoelectric technique uses large numbers of piezocrystals that are deformed by electric current and the shock wave is propagated through a water medium with the wave focused by the position of the crystals. Each technique produces a shock wave that is focused at a site to produce the desired effect within the tissue.

Shock waves are used in lithotripsy to disintegrate stones with the wave attenuating based on the tissue it interacts with. The effect of shock waves on osseous tissue produce osteogenesis with the activation of osteoblasts. The specific mechanism of action on soft tissue structures, tendons and ligaments, has not been established. It is hypothesized that the trauma creates microdisruption resulting in vascular ingrowth with restructuring of chronically inflamed tissue resulting in decreased pain and increased healing potential. ESWT has been used in the treatment of plantar fasciitis, lateral epicondylitis (tennis elbow), calcific tendonitis of the shoulder, and nonunions. The use of the FDA approved electrohydraulic method with the OssaTron device has produced positive outcomes in the treatment of chronic plantar fasciitis.

Odgen et al performed a randomized double-blind, multi-center study involving 256 patients which studied the following parameters: investigator heel pain assessment, subject self-assessment of pain, subject self assessment of activity, and use of pain medications. Each patient received 1,500 shocks at 18,000 kilovolts. Success was determined by meeting preset values for all 4 parameters and upon final evaluation 12 weeks postprocedure the success rate for the active treatment group was 56% higher than the placebo group. Eight complications occurred related to the procedure including mild neurologic symptoms with one patient sustaining a plantar fascia rupture.

Chen et al evaluated the effectiveness of ESWT with the electrohydraulic method with patients receiving 1,000 shocks at 14 kilovolts in 80

patients. Pain and function were evaluated on 100-point scoring system with patient's symptoms reducing postprocedure. Six weeks after the procedure, 44.1% of the patients related they were significantly better or complaint free. The clinical effects appear be be time-dependant because 85.2% of the patients related they were significantly better or complaint free at 6 months postprocedure. No device-related complications were reported.

Both groups of investigators surmised that the results showed a high benefit ratio with minimal potential complications. Neither group recommended this as a first line treatment for plantar fasciitis, but instead, as a step in the treatment algorithm prior to surgical intervention, following at least 6 months of other forms of functional conservative therapy. Similar results have been reproduced in the study of other anatomic regions including the elbow, shoulder, and in delayed or nonunions of long bones.

INDICATIONS

The Food and Drug Administration indicates ESWT in the treatment of chronic plantar fasciitis. This condition is defined as pain at the plantar medial calcaneal tubercle present for greater than 6 months and not responding adequately to other forms of conservative therapy. The evaluation of the patient with heel pain must be complete, and effectively rule-out other potential etiologies because ESWT is indicated specifically for chronic plantar fasciitis and has not been evaluated in the treatment of other conditions. The numerous differential diagnosis for heel pain include entrapment of the first branch of the lateral plantar nerve, calcaneal stress fractures, infracalcaneal bursitis, soft tissue or osseous tumors, tarsal tunnel syndrome, inflammatory arthropathies, infection, gout, and other metabolic conditions. An appropriate history and physical examination, in addition to diagnostic testing including radiographic evaluation, must be performed prior to undergoing any treatment alternatives. The effect of ESWT on patients with the following medical conditions is not known and must be used with caution including: pregnancy, immature skeleton, cancer, nerve conditions, acute fractures, bleeding disorders, rheumatoid arthritis, vascular compromise, and infection.

PROCEDURE

The preoperative assessment should include a complete history and physical, radiographic evaluation, complete blood count, prothrombin time (PT), and partial thromboplastin time (PTT). The application of the high-energy shock wave produces pain and appropriate local or regional anesthesia with sedation will influence the preoperative assessment. Hearing protection should be used by the patient, treating physician, and all ancillary staff during the procedure to prevent permanent hearing impairment.

The site of maximum tenderness is marked preoperatively. The patient is placed on a procedure table in a supine position with the knee bent and foot positioned to allow adequate contact between the water-filled dome and the foot (Figure 1). Pillows may be used under the leg to assist in positioning. Coupling gel is applied to the foot to allow adequate transmission of the pulse. The clinician maintains the foot in contact with the dome while manipulating the foot for the entire treatment sequence while the technologist modifies treatment parameters based on physicianís orders. Following adequate anesthesia, 25 test shocks at 14 kV are applied to test for anesthesia, with additional shocks applied in series of 25 shocks at 15 kV and 16 kV prior to initiation of therapy. The procedure consists of 1,500 shock pulses at 18,000 volts applied at the frequency of 2.0Hz to the identified region of tenderness with the foot periodically repositioned to insure treatment of the entire region. Care must be taken to avoid large nerves or vessels and isolate treatment at the injured region.

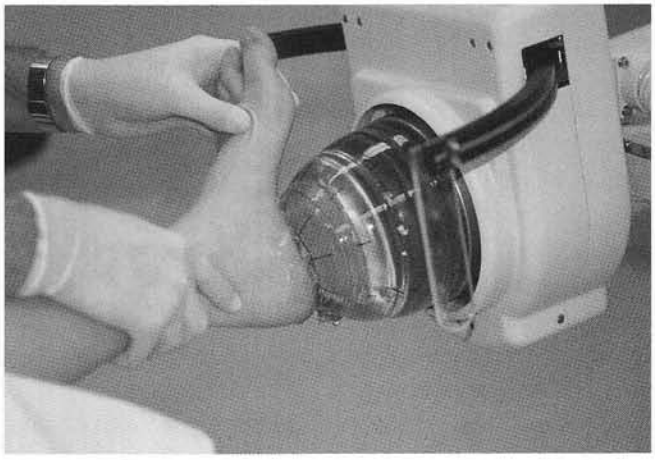

Figure 1. Positioning of patient's heel in contact with water-filled focal ellipsoid dome.

Following treatment, the patient is maintained supine while recovering from anesthesia. If necessary, postprocedure analgesia is administered. Once stable, the patient is allowed to ambulate with tennis shoes with functional support maintained. Continued stretching is recommended of the calf during the postprocedure period. Limitations of athletic activities are usually imposed for approximately 4 weeks to decrease potential for rupture. Common postprocedure side effects may include ecchymosis, mild-moderate pain, and paresthesia which all tend to be self-limiting. Patients are seen for follow-up at 1 week, 4 weeks, and 3 months and are progressed to full range of activity at the 4 week follow-up. If inadequate response occurs after 3 months, a second treatment may be indicated.

The use of ESWT in the treatment of chronic plantar fasciitis has served as an excellent adjunctive therapy prior to surgical intervention. Proper postprocedure instructions are necessary so that the clinician-patient team have similar expectations and understanding regarding both the postprocedure care plan, and gradual progression and healing which occur in the reduction or complete elimination of the patientís presenting symptoms. This procedure offers a nonsurgical alternative to the patients who have not responded to more conservative methods of therapy and continue to experience pain from chronic plantar fascitis.

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