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EMERGING TECHNOLOGY IN THE TREATMENT OF PLANTAR FASCIITIS AND LATERAL EPICONDYLITIS

Abstract: Chronic proximal plantar fasciitis is an extremely common clinical entity seen in the practice of many medical and surgical disciplines. Resolution of this painful condition can be accomplished in 95% of cases with nonoperative care, the cornerstone of which is an aggressive heel cord and plantar fascial stretching regimen. Recalcitrant cases of proximal plantar fasciitis in the appropriately selected patients may respond very favorably to extracorporeal shockwave orthotripsy, an ambulatory, closed (no incision) procedure.

Fifty-five million Americans are treated yearly for foot problems. More than 60 percent of these patients are treated nonoperatively for plantar fasciitis. Ninety-five percent of these patients will improve with nonoperative care. There is a subset of patients with chronic recalcitrant plantar fasciitis, however, in whom pain can persist for more than six months despite nonoperative treatment by many modalities.

Proximal plantar fasciitis, sometimes referred to as heel pain syndrome or the heel spur syndrome, is characterized by pain and tenderness at the origin of the plantar fascia and the medial calcaneal tuberosity. It may be of insidious onset or exacerbated by overuse. Classically these patients complain of morning and start-up pain. The patient's plantar heel pain is often better after the first several steps in the morning, stretching or taking a warm shower. The pain can resolve during the day, but is exacerbated by prolonged standing, walking or running. Proximal plantar fasciitis occurs in overweight, as well as normal weight individuals.

Proximal plantar fasciitis is characterized by tenderness at the proximal origin of the plantar fascia only. This pain does not radiate, is not necessarily worse with dorsiflexion of the toes, and is not associated with bone tenderness, painful percussion or subcalcaneal soft tissue insufficiency. Patient's with such symptoms and exam findings may have subcalcaneal pain due to a disorder other than proximal plantar fasciitis (consider calcaneal stress fracture, calcaneal periostitis, tarsal tunnel syndrome, peripheral neuropathy or other etiologies).

It should be noted that there is absolutely no correlation between plantar fasciitis symptoms and the presence or absence of a radiographic “spur”.

Nonoperative treatment for the heel pain syndrome and proximal plantar fasciitis involves stretching as the cornerstone of therapy.

Other methods of nonoperative treatment that have met with a certain degree of success include the use of oral anti-inflammatory agents, orthotic devices, night splint to hold the ankle dorsiflexed, massage, physical therapy with and without modalities, and shoewear and activity modification. Many patient’s symptoms will resolve after injection of local anesthetic and corticosteroid at the origin of the plantar fascia.

In the early 1980’s the first experiments for the medical applications of extracorporeal shockwaves were undertaken. By the late 1980’s extracorporeal shockwave lithotripsy for disintegrating kidney

stones was well established. In the 1990's orthopaedic indications for extracorporeal shockwave treatment were pioneered in Europe.

Dr. Quill performing Ossatron Orthotripsy for treatment of plantar fasciitis.

FDA approval of Ossatron orthotripsy, treatment for chronic proximal plantar fasciitis, was achieved in the year 2000. In March of 2003 the FDA approved the use of orthotripsy and extracorporeal shockwaves for the treatment of chronic lateral epicondylitis (tennis elbow). Since the mid 1980's extracorporeal shockwave treatment for tissue healing and skin grafts, the treatment of nonunion fractures, and other interesting medical applications have been pioneered. There is a good body of literature supporting the use of extracorporeal shockwave therapy for calcific tendinitis of the rotator cuff, medial and lateral elbow epicondylitis, treatment of insertional Achilles tendinopathy, and even in the technique of cement removal in revision total hip arthroplasty.

Methods of generating an extracorporeal shockwave include electrohydraulic, electromagnetic and piezoelectric techniques. The electrohydraulic method appears to be the most efficient and clinically effective way of generating an energy wave for orthopaedic indications. The electrohydraulic method employs an electrode (spark plug) which is submerged in a water-filled housing. The electrical generator initiates the shockwave by an electrical spark much like spark plugs in an automobile. The vaporization of water molecules between the tips of the plug produces the explosion, thus creating a spherical shockwave. The metal ellipsoid reflects the spherical wave to a focal point at the area of clinical concern and tendinopathy.

A shockwave is the resultant acoustic energy wave of an explosion. High pressure amplitudes (500 bar), with rapid rise times (less than 10 nanoseconds), and short life cycle (less than 10 milliseconds), and a frequency spectrum ranging from the audible to the ultrasonic region (16 hertz to 20 megahertz) are some of the unique characteristics of shockwaves. For lithotripsy and orthotripsy, the shockwave must be focused to specifically apply the energy wave to the desired area to be treated.

Shockwaves are different from other forms of acoustic energy such as ultrasound in that the wave front in which the compressive forces exist is a region of sudden and forceful change in stress, density and temperature. Because of these properties, shockwaves can alter the mechanical, electrical and thermal properties of the media through which they travel, including the patient's insertional tendinopathy. The shockwave must be focused to apply the energy and alter the media through which it travels.

Extracorporeal shockwave therapy for fracture healing is thought to be effective by forming micro fractures disrupting sclerotic bone at the site of nonunion. Subperiosteal hemorrhage is observe on microscopic tissue samples stimulating healing of fracture and nonunion. In the case of treating tendinopathies with extracorporeal shockwaves, micro hemorrhage, thrombus formation and stimulation of healing has been observed. The profound neovascularization at the otherwise relatively dysvascular or avascular insertional tendinopathy site has been observed. Pivotal studies regarding the use of extracorporeal shockwave treatment of delayed union in tibial fractures are in progress here in Louisville and at the University of Kentucky.

Under discussion with the FDA currently are extracorporeal shockwave indications for the treatment of adhesive capsulitis of the shoulder (frozen shoulder), trochanteric bursitis and additional foot and ankle indications, especially those in the retrocalcaneum.

Indications for the treatment of chronic proximal plantar fasciitis with orthotripsy (extracorporeal shockwave therapy) include healthy patients without bleeding diathesis and anticoagulation therapy, fracture, peripheral neuropathy and narcotic addiction who have proven refractory to six months of conservative care as described above.

Intravenous sedation or regional ankle block anesthesia is recommended. Two thousand shocks at a maximum kilovoltage of 18 at a rate of 4 hertz are applied to the area of pathology using the orthotripsy machine. The area of tendinopathy is placed in contact with the bellows of the machine after applying ultrasound gel to the patient's foot. The foot and ankle are dorsiflexed, and while tension is held on the plantar fascia, the foot is continuously moved in a systematic fashion delivering 2,000 shocks to the area of concern over a period of less than nine minutes.
We insist on continuing the treatment regimen of stretching, orthotics and shoes after the orthotripsy procedure. The patient may walk the very day of the procedure and resume low or no-impact activities right away. No incisions are made. The patient is advised not to run or perform high-impact activities for three months after orthotripsy for plantar fasciitis.

It is recommended that the patient decrease weight bearing for the first 72 hours after the procedure, and that standing be limited for about a week. Shoes are worn at all times while weight bearing and it is even recommended that shower sandals be used when bathing. A light Achilles stretch is done, and further corticosteroid injection is ill advised.

The author’s series of the first 49 consecutive patients treated for proximal plantar fasciitis with orthotripsy included 51 heels (two patient's were treated for bilateral fasciitis, but neither was treated simultaneously). The patient’s mean age was 44 years with a range from 32 to 57 years. There were 31 females and 18 males in this study group. The mean duration of preoperative symptoms ranged from 9 months to 120 months and averaged 17 months.

At most recent follow-up, 46 of 51 heels are pain free with a mean follow-up of 9 months (range equals 6 to 30 months). There have been no re-treatments in this study group. There has been one recurrence of heel pain in a 46-year-old male runner who had an initial analgesic response after treatment for proximal plantar fasciitis of three years duration. This gentleman returned to running 40 miles a week within a month of the procedure, which was not advised. Longer follow-up is certainly needed and is ongoing.

The author's experience with elbow orthotripsy for lateral epicondylitis includes four patients, two of whom had medial epicondylitis and two of whom had lateral epicondylitis. There were 3 males and 1 female in the procedure. The woman in this series had a prior open release and tenoplasty for a workman's compensation injury. All four patients are currently pain free with minimum six month follow-up. The three men have returned to tennis and golf without limitations.

It has been the author's experience that an early analgesic response that is very dramatic often occurs in the appropriately selected patient. The treating physician can expect improvement for up to 16 to 18 weeks, however, even in diabetics who undergo the procedure. The author would recommend avoiding retreatment with orthotripsy as long as improvement continues. The author avoids simultaneous bilateral treatment and one should think twice in treating the obese (body mass index greater than 30) patient. It is important to make sure preoperatively that the working diagnosis and indication are truly proximal plantar fasciitis as patient selection is critical. Patients with diagnoses other than this will not respond favorably to orthotripsy. Methodical perioperative care and patient education are critical to a successful result.

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