CHAPTER **29**

PRELIMINARY RESULTS: Extracorporeal Shock Wave Therapy

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The use of extracorporeal shock wave therapy (ESWT) for the treatment of chronic plantar fasciitis is rapidly becoming the surgical treatment of choice. The rise in favorability is a result of a number of factors, including the lower rate of complications, the treatment is non-invasive, has a faster recovery time, the public is more technology driven, and the effectiveness of the therapy. Heel pain is a common ailment afflicting millions of individuals each year. There are a number of etiologies of heel pain, though ESWT is only approved for plantar fasciitis. It is important to rule out such conditions as entrapment neuropathy, tarsal tunnel syndrome, calcaneal bursitis, infectious processes, metabolic disease, inflammatory arthropathies, calcaneal stress fractures, and soft tissue or osseous tumors. The initial evaluation for heel pain should include a thorough history and physical examination with the appropriate diagnostic studies to determine a more accurate diagnosis. The standard conservative measures for heel pain such as strapping and paddings, injection therapy, anti-inflammatory medications, stretching exercises, alteration of shoe gear, immobilization with splints, orthotics, and alteration in life style are often effective in 90% of the patients. In the cases of resistant heel pain lasting for six months or more, extracorporeal shock wave therapy is a valid treatment option.

Extracorporeal shock wave lithotripsy was approved by the FDA in the early 1980s and now is the standard of care for urinary stone treatment. The use of extracorporeal shock wave therapy for musculoskeletal conditions has been available in many parts of the world for a number of years. The effect of the shock wave on soft tissues has not been established, though it has been theorized that the micro disruption caused by the trauma causes vascular in growth allowing the chronic inflamed tissues to heal. The indications and limitations of the technology are still being investigated and have already been expanded to calcific tendonosis, delayed and non-unions, and tendon injuries.

The generation of shock waves is by three methods, electromagnetic, electrohydraulic, and piezoelectric. The electromagnetic type of shock wave has been manufactured by Dornier's Epos Ultra and Siemens' Sonocur. The electrohydraulic method is manufactured by Healthtronics' Ossatron. This article will focus on the electromagnetic technique for producing a shock wave and specifically the Dornier device (Figure 1). A pulsed electrical current passes through a coil with a thin membrane that when the membrane is repelled by the magnetic field, a shock wave is generated. The shock wave is focused by an acoustic lens at the treatment site. The energy for the Epos Ultra can range from a similar low level (level 1) as the Sonocur to a higher level (level 9) than the Ossatron.

The Dornier device utilizes an ultrasound unit to direct the treatment as the shocks are being delivered. A study by Vohra, et al used ultrasonography to evaluate symptomatic and asymptomatic plantar fascial bands. They concluded that the average thickness for a band that was symptomatic was 5.35 mm and an asymptomatic band was 2.70 mm. Another study utilized ultrasound before treatment with ESWT and six months after treatment. The study concluded that there was no significant difference in thickness of the plantar fascial band between the opposite extremity and the treated one. The ability to visualize the area of treatment allows the user to constantly control the

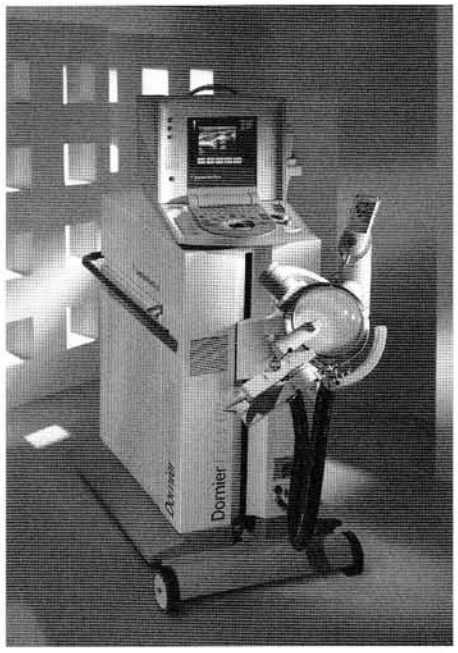

Figure 1. The Dornier Epos Ultra.

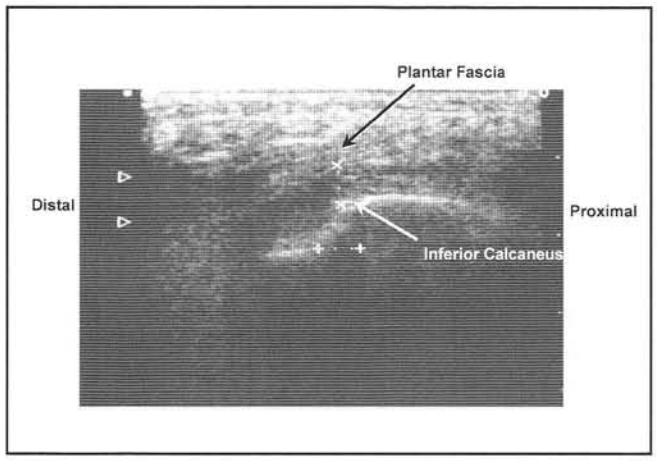

Figure 2. The ultrasound image during treatment.

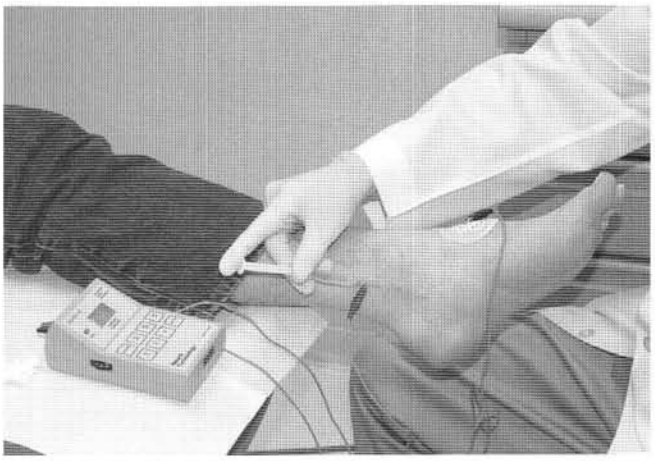

Figure 3. The use of a nerve stimulator for the ankle block.

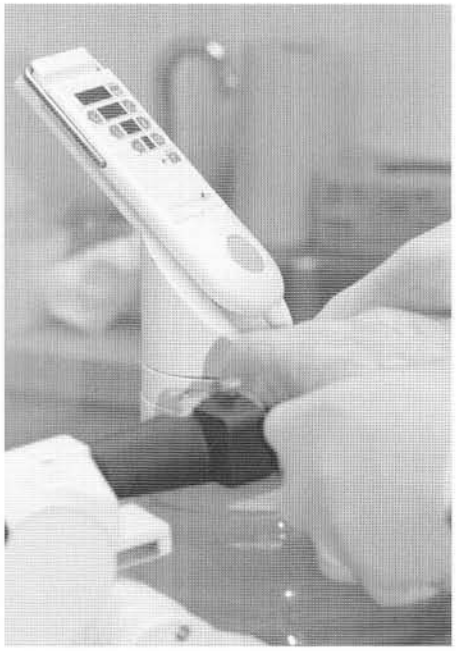

Figure 4. Initial patient position for treatment.

Figure 5. Final patient positioning and treatment.

delivery of the shock waves (Figure 2). Therefore, the use of the ultrasound unit can better determine the area of maximum inflammation and direct the treatment accordingly.

A number of studies have been performed to better determine the effectiveness of extracorporeal shock wave therapy in chronic plantar fasciitis. The literature reports success rates of 56-82 % with significant improvement in heel pain from 3-12 months after the procedure. In general there are fewer complications encountered with ESWT as compared to traditional plantar fascial surgery. In most cases, postoperative care is drastically different in ESWT versus traditional plantar fascial surgery. The ability of patients undergoing ESWT to return to work and activities within a few days or weeks is far less debilitating than the traditional six weeks of inactivity with traditional surgery. All of the current studies discuss the use of stretching exercises and/or orthoses after the procedure is performed. The ideal postoperative plan has to be tailored to each patient.

The procedure is primarily performed in an office setting, or in an ambulatory surgical facility or hospital. The procedure is routinely performed with a local anesthetic, though intravenous sedation or a light general anesthetic may be utilized. In an office setting an oral sedating agent, such as valium is administered to help relax

the patient. An equal mixture of 1% lidocaine and 0.25% bupivicaine is infiltrated about the ankle, to include the posterior tibial and sural nerves (Figure 3). After the foot is anesthetized, the patient is appropriately positioned on a treatment table or chair (Figure 4). The therapy is then administered with a sequential increase in energy and number of shocks, which produces a TENS effect (Table 1). The patient is then repositioned and an additional number of shocks are delivered at level 7 or 8 (Figure 5). The treatment time averages from 15-20 minutes. The patient will then begin ambulating in a tennis shoe with an orthotic or an air cast walker, depending on the patient and clinical symptoms. An aggressive stretching regiment is continued for six weeks. The patient may develop some mild pain, ecchymosis, or mild paresthesias, during the initial postoperative period. These side effects are usually mild and transient. The patient is evaluated in three weeks, eight weeks, and twelve weeks following the procedure.

The preliminary results of 81 patients that had 91 treatments reveal a modest success rate. The average length of heel pain for each patient was 2.7 years, which quickly dispels the myth that some physicians feel that all heel pain will resolve. The average level of pain before the procedure, on a scale of 0-10, was 8.9. After the procedure, the level of pain was 3.7. This data collection represents a follow up time of 89.7 days. There have been no re-treatments of this initial group of patients. The side effects that were encountered were minimal with 6 out of 91 treatments having injection soreness or bruising. The preliminary results show that 82.4 % of the patients showed a significant or moderate improvement in their symptoms.

Table 1

SHOCK WAVE PROTOCOL

Level	Energy of Shocks	Number	Frequency
1	0.03 mJ/mm2	50 (=/- 10)	60 shocks/min
2	0.06 mJ/mm2	50 (=/- 10)	90 shocks/min
3	0.08 mJ/mm2	50 (=/- 10)	120 shocks/min
4	0.15 mJ/mm2	50 (=/- 10)	150 shocks/min
5	0.21 mJ/mm2	50 (=/- 10)	180 shocks/min
6	0.29 mJ/mm2	50 (=/- 10)	210 shocks/min
7	0.36 mJ/mm2	3550 (=/- 10)	240 shocks/min

The survey found that 77 out of 81 patients would recommend the procedure to a friend or family member.

Extracorporeal shock wave therapy is a technology that has a lot of potential uses. The ultrasound imaging system on the Dornier unit provides precise localization and excellent imaging quality, allowing the user to continuously observe and control the therapy. The type of energy that is delivered has also caused much debate. However, all the low energy studies have failed to show that ESWT is effective in treating plantar fasciitis, which is probably because the low energy devices do not generate enough power to penetrate the thicker heel structures. ESWT is not effective in all patients, though early results of the procedure are very promising with significantly less complications. The next treatment site that is being investigated is the posterior heel syndrome. ESWT is a technology that has shown great success in treating chronic heel pain and will drastically reduce the number of traditional heel surgeries being performed.

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