Ultrasound Guided Partial Plantar Fasciectomy (USGPPF) with Allograft Tissue Transfer

Surgical Protocol

Ultrasound is the gold standard in establishing the diagnosis of plantar fasciopathy. It can also be utilized in the treatment of it. By using ultrasound guidance to fenestrate, debride and place allograft tissue, the surgeon can be assured that the appropriate tissue is being treated with higher efficacy than any blind technique. The following is the surgical technique used when treating plantar fasciopathy with ultrasound-guided partial plantar fasciectomy and allograft tissue transfer.

Indications

This technique is indicated for patients with recalcitrant plantar fasciopathy or those with severe plantar fasciopathy as determined by high-resolution diagnostic ultrasound (DUS) of a grade of III-B to IV-C (Table 1). Patients with the most severe grading, usually grades IV-B and IV-C, should be advised preoperatively that intervention with this technique is usually successful, but may require additional surgery (up to 15-20% of the time), with techniques such as an endoscopic plantar fasciotomy (EPF). Anatomical zone delineation can be seen in Photos 1a, 1b, and 2. Normative sagittal plane plantar fascia measurements can be seen in Charts 1, 2 and 3.[1]

Table 1

Plantar fasciopathy can be reliably and objectively graded with high resolution diagnostic ultrasound (DUS), which allows the surgeon to intervene earlier with definitive and efficacious techniques such USGPPF with allograft tissue transfer (Stem Cells), which do not interfere with biomechanical function.

Clinical Grading System Used to Direct Treatment When Using Diagnostic Ultrasound to Evaluate the Thickness of the Plantar Fascia

Barrett Plantar Fasciopathy Ultrasound Grading System

Plantar Fascia Thickness (mm)

		I	II	III	IV
Severity of Hypoechoic Signal/Sign	A	<4mm	4mm – 5.5mm	5.5mm – 7.5mm	
		None or Mild	None or Mild	None or Mild	
	B	<4mm*	4mm – 5.5mm	5.5mm – 7.5mm	>7.5mm
		Moderate	Moderate	Moderate	Moderate
	C		4mm – 5.5mm	5.5mm – 7.5mm	>7.5mm
			Severe	Severe	Severe

Staging	
Stage 1	Symptoms present <6 months
Stage 2	Symptoms present <2 years
Stage 3	Symptoms present >2years

Treatment Plan	
	Conservative Care
	Non-invasive intervention
	Aggressive Intervention

Charts 1, 2 and 3

These charts represent measurements taken from the heels of 98 patients who had never had heel pain. Chart 1 shows the average, maximum and minimum measurements of the different areas in the different zones. Chart 2 illustrates the normative measurements for the medial, central and lateral bands in zone B. Chart 3 shows the normative measurements for the medial band in zones A, B and C. Please note that any zone C measurement in the medial band greater than 2.0mm is highly correlated to severe pain experienced clinically by patients.

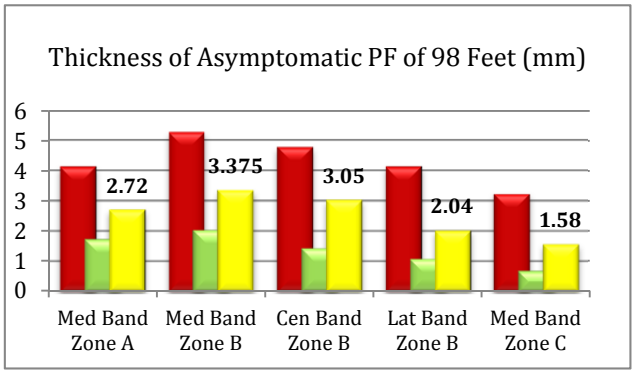

Chart 1

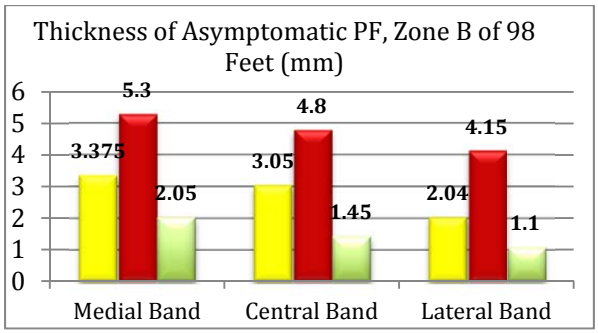

Chart 2

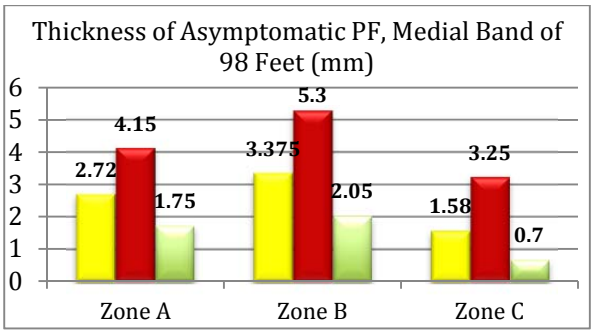

Chart 3

Average Maximum Minimum

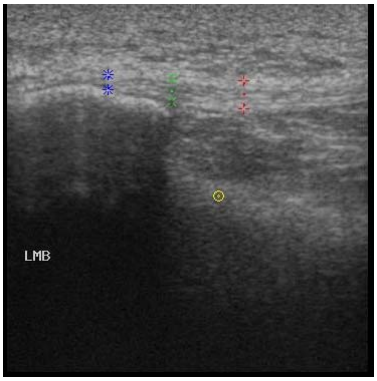

Photo 1a: A normal, asymptomatic fascia is show, which has a normal thickness in all three zones and normal echogenic signal intensity.

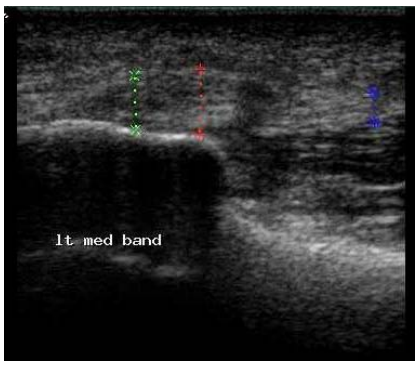

Photo 1b: There is significant thickness of Zone C and a very hypoechoic signal intensity. The fascia seen in Photo 1b would be graded as a III C.

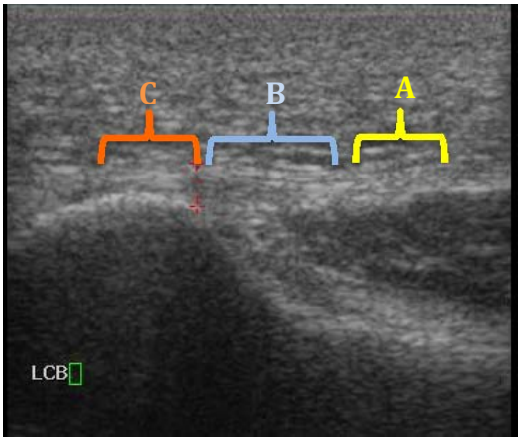

Photo 2: Zones of the PF
C: infra **C**alcaneal
B: where the fascia originates at the **B**one
A: **A**nterior to the origin

Surgical Technique

1. The patient is placed in a supine position with the feet hanging off the table to provide accessibility with the ultrasound probe, and prepared and draped in the standard manner.
2. No tourniquet is needed, but can be used if desired.
3. The ultrasound machine is best placed on the lateral side of the extremity being addressed.
4. Pre-emptive local anesthesia (usually lidocaine) is infiltrated proximally—NOT into the region of the plantar fascia as this is known to decrease tenocyte regeneration.[2]
5. Incision placement is determined via visualization of placement of a 25-gauge needle into the medial aspect of the plantar fascia with DUS. The surgeon should center the incision placement on the medial aspect of the heel so the needle is placed and visualized in the center of Zone B both dorsally and inferiorly as well as posterior to anterior. Proper DUS placement of the needle is seen in Photos 3a and 3b. In Photo 4, the incision placement is mapped out based on the DUS visualization.

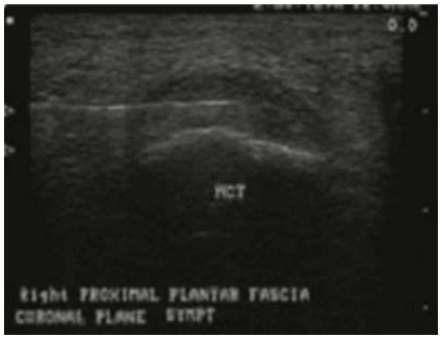

Photo 3a: This DUS photo is a coronal or transverse axis view. This shows the needle placement in the midpoint from inferior (top) and superior (bottom) of the fascia (DUS photos are inverted).

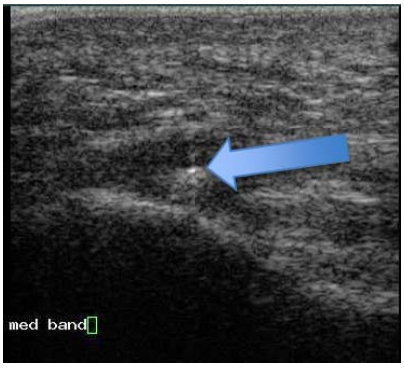

Photo 3b: This DUS photo shows the needle placement into the central aspect of Zone C in the sagittal plane. The needle can be seen as the very hyperechoic "dot."

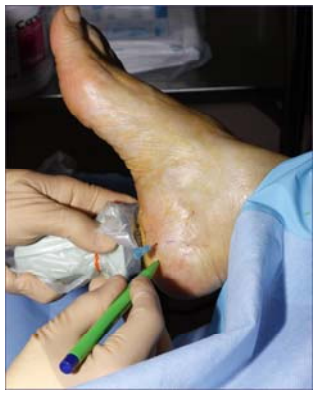

Photo 4: After proper placement of visualization of the 25-gauge needle, the incision placement is mapped out with a surgical marker.

6. The surgeon should move, and visualize with the DUS, the needle into all 3 zones and from inferior to superior (Photo 5). This needling should be carried out to the extent that the plantar fascia is prepared via this fenestration to accept placement of the mini-fascia rasp. Also, the surgeon can appreciate the correlation of the tactile feel of the resistance against the needle and its location in the different hypoechoic areas being treated. There usually will be very little resistance in the degenerative areas of the plantar fascia as compared to more resistance within healthier tissue. Occasionally in very severe disease states there is calcification, which provides for more needle resistance than normally expected.

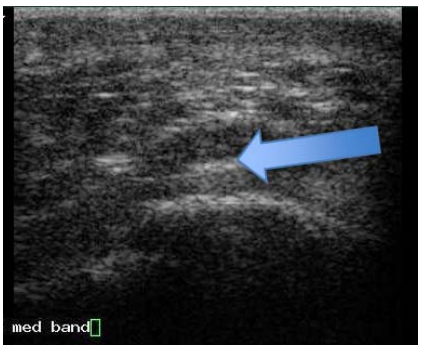

Photo 5: This DUS transverse axis shows the mini-fascia rasp coming from the medial side on the right into the plantar fascia. The fascia is debrided with the mini-fascia rasp from inferior (top) to superior (bottom), which is adjacent to the inferior aspect of the calcaneus. All three zones should be debrided in this manner.

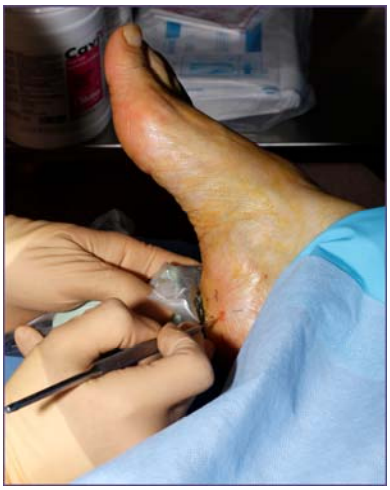

Photo 6: Making the incision with a #11 blade, about 3mm, with caution about depth of the tip of the blade to avoid possible medial calcaneal nerve injury.

7. The 3mm incision will be made with a #11 blade, being careful not to bury the blade past the dermis (Photo 6), which assures that any subcutaneous medial calcaneal nerve branch will not be injured.
8. The mini-obturator/cannula (Photo 7) is then placed through the incision until the medial aspect of Zone B is felt by the resistance. The obturator is then removed. The use of the cannula prevents the inadvertent possibility of introduction of epidermal cells into the plantar fascia when the mini-fascia rasp (Photo 8) is used.

Photos 7 & 8: Mini obturator/cannula and mini-fascia rasp

9. The cannula is then removed. It is very important NOT to introduce the tissue allograft infiltration through this instrumentation, as some would leak out back through the cannula.
10. In order to assure the least amount of leakage of the tissue allograft, it is recommended that the incision be covered with a steri-strip or op-site and the infiltration be done just proximal. This infiltration should be visualized in real time with the DUS (Photo 9).
11. Placement of Ropivicaine (least cytotoxic) is done proximal, both medial and lateral, to provide long lasting postoperative analgesia. Direct placement of the local anesthetic into the plantar fascia could negate optimal outcomes for the technique. DO NOT USE ANY CORTICOSTEROIDS!!!
12. Because the incision is kept to less than 3mm, combined with the thickness of the epidermis typically encountered in this area, there is usually no need for a suture.

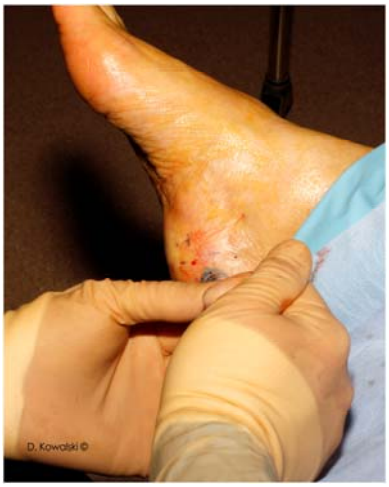

Photo 9: Infiltration of the allograft tissue proximal to the incision with an op site dressing placed over the small incision to minimize leakage.

Postoperative Management

1. Prescribe necessary postoperative pain medications, however, do not prescribe any NSAIDs or combination drugs which contain an anti-inflammatory component. The goal is to create a new tissue-healing cascade of which inflammation is the vital first phase.
2. Minimize weight bearing on the heel for 10-14 days with a Zero gravity boot.
3. When returning to full weight bearing, advise the patient to avoid barefoot walking, especially on hard surfaces, and use a soft, comfortable, shock-absorbing shoe.
4. The first postoperative DUS assessment should be done no earlier than 6-8 weeks as no tissue regeneration will be noted until that time. Changes in signal intensity will be seen prior to decreases in PF thickness. Clinical experience has shown that while

preoperative assessment of thickness is critical in making an accurate diagnosis, this does not correlate to patient outcomes (Photo 10).

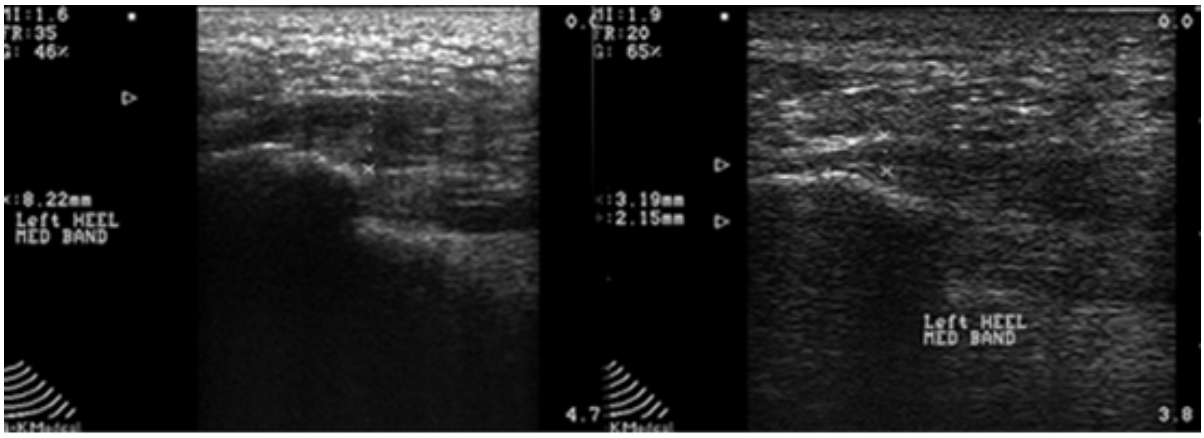

Photo 10: A before and after USGPPF showing the change within the plantar fascia. Note that the fascia is not only thinner at 3 months postoperative, but the signal intensity has a normal echogenic pattern.

5. If a patient is still experiencing pain 8 weeks post-procedure, the surgeon should consider an infiltration of a steroid, under DUS guidance, to alleviate any chronic inflammation from the surgery. Patients do occasionally experience true chronic inflammation from the PF debridement, which is in contradistinction to the preoperative condition of plantar fasciopathy that is degenerative and not inflammatory. This injection should be done after a posterior tibial nerve block at the tarsal tunnel level (just posterior to the medial malleolus) and under DUS visualization. The efficacy is increased when done this way and you can typically use a lower dose. The infiltrate should be placed into the substance of the PF—not around it.
6. If a patient still has heel pain from plantar fasciopathy after this treatment, consideration can be given to a second USGPPF with tissue allograft.

Potential Complications

As this procedure is a minimally invasive, regenerative technique using non-immunogenic biologics, complications from this surgery are rare. Potential complications could include cellulitis, swelling, injury to a medial calcaneal nerve branch and skin reaction to the steri-strip.

References

1. Tassone J, Barrett, S.L.: **Diagnostic Ultrasound of the Foot and Ankle**. Baltimore, MD: Data Trace; 2013.
2. Piper SL, Laron D, Manzano G, Pattnaik T, Liu X, Kim HT, Feeley BT: **A comparison of lidocaine, ropivacaine and dexamethasone toxicity on bovine tenocytes in culture**. *The Journal of Bone and Joint Surgery British Volume* 2012, **94**(6):856-862.