CHAPTER **12**

ENHANCED TENODESIS AND RETROCALCANEAL EXOSTECTOMY

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Posterior heel pain is a relatively common and disabling problem seen in patients presenting to the foot and ankle surgeon for evaluation and treatment. Pain in this area is frequently due to calcification at the insertion of the tendo Achilles in the posterior one-third of the heel. Calcification within the tendon itself may also be present. Clinically, these patients will exhibit erythema and edema at the insertion of the tendo Achilles. An enlarged bursa may also be present. Unfortunately, conservative treatment options for this clinically entity are limited and are often unsuccessful. When conservative treatment modalities have failed and activities of daily living become a routine challenge, patients frequently request surgery as a last resort.

The surgical management of this clinical entity, much like the conservative treatment, has been a challenge for many years. Recent technologic advances have resulted in the development of several anchor devices which vary in many ways including the anchor material itself, its mechanism of action, the presence or absence of one or more sutures with or without attached surgical needles, its size and bulk and the absorption properties of the materials employed. A number of postoperative problems can arise due to the location of the device and the inherent lack of significant overlying soft tissue coverage.

Although most patients are significantly improved postoperatively and would choose to undergo the same procedure again, there is a subtle reluctance to be overly enthusiastic. Low-grade discomfort of an aching nature accompanied by a low-grade inflammation for a prolonged period of time seems to occur relatively frequently postoperatively. A 6 to 9 month or even up to one-year recovery time is not unusual. The etiology of this persistent local inflammatory reaction at the reattachement site is somewhat of an enigma. It is the senior author's opinion that this represents a combination of factors, some of which are related to the anchor devices themselves.

Surgical resection of the retrocalcaneal exostosis entails not only a partial or complete resection of the exostosis, but also removal of intratendinous calcifications as well as recontouring of any abnormal posterior, posterolateral and/or posteromedial osseous prominences. In addition, hypertrophic or dystrophic changes of the tendon itself are likely to require surgical debridement as is any reactive soft tissue, cystic or bursal tissue. The extent of tendon "detachment" will vary, depending on the extent of the osseous pathology, intratendinous pathology, and the philosophy, experiences and preferences of the surgeon. There is clearly no one unanimously accepted superior technique at this time.

The type of device employed to assist in the reattachment of the tendo Achilles is also an important consideration. Devices which consist of one or more strands of nonabsorbable braided suture (i.e. polyester) are potentially very reactive and can contribute significantly to the persistent postoperative low grade inflammatory process. Even the newer, synthetic absorbable sutures are irritating to the overlying skin and tissues due to the stiffness and prolonged presence of the material. The presence of multiple knots of one or more anchors in the same patient contributes even more to this foreign body reactive process. The use of two or three anchors is not uncommon when performing retrocalcaneal surgery. The senior author has previously recommended that knots be buried within or deep to the tendo Achilles itself when used in this procedure.

A predictable secure reattachment of the tendo Achilles is essential to a successful functional outcome following any surgery involving partial or complete release of the tendon, as well as in cases of spontaneous or traumatic avulsion or rupture. Most current tendon/ligament reattachment devices concentrate their effectiveness in a very small area. While most of the adjacent tendon will be in close proximity to the bone surface, only a very small surface is actually fixed or compressed against that surface. In the past, the senior author has used a

low profile staple to achieve a more secure attachment of the tendon to the posterior aspect of the calcaneus; a traditional screw and polyacetal washer can also be used, but it is generally avoided due to its noncompatable size and configuration. The purpose of this paper is to describe an anchor device and surgical technique that have greatly enhanced the outcome of retrocalcaneal surgery, especially when significant detachment of the tendon has been necessary.

THE SPIDER PLATE

The TiMAX Spider Plate is one of five plates that comprise the Depuy Ace TiMAX Pe.R.I. (Periarticular Reduction Implant) Small Fragment Lower Extremity System. These plates are of titanium composition and have proven very successful for a variety of orthopedic and trauma procedures. The tensile strength is greater than 316 surgical grade stainless steel. Because it has a low modulus of elasticity compared to other commonly used biomaterials, stress shielding should be minimized. In addition, fatigue strength is increased while decreasing the friction characteristics, notch sensitivity, and the likelihood of galling. The material promotes osteointegration, is notably biocompatible, has increased corrosive resistance as well as superior MRI and CT imaging compared to stainless steel.

The Spider Plate is circular in its overall shape with a smooth posterior surface and a series of spiked blunt projections on the anterior surface. The purpose of these projections is to engage comminuted bone fragments, distribute load in osteoporotic bone and anchor tendon and ligaments to bone making it very useful in reconstructive surgery. The devices are available in different sizes measuring 16 mm (small device), 20 mm (large device) and 25 mm (large offset device). The device is anchored to the underlying bone with a fully threaded 3.5 mm cortical screw or 4.0 mm cancellous screw. Partially threaded 4.0 mm (lag design) cannulated or non-cannulated screws are also available. Each of the various screws is self-drilling and self-tapping for faster insertion. The screws boast a unique thread design with superior pullout strength and greater head torque strength. Centered and offset hole designs make application and insertion easier and facilitate tendon reattachment. A K-wire hole is also present to help complete the application and placement. Rigid internal compression of the tendon to the posterior surface of the calcaneus is readily and predictably achieved. Intraoperative x-rays or C-arm fluoroscopy are effective to visualize proper placement of the devices and screw.

Surgical Technique

Although any incisional approach can be used and is the preference of the surgeon, a longitudinally oriented linear or curvilinear incision provides the best overall exposure to the entire insertion of the tendo Achilles and posterior calcaneus. The incision is deepened to the level of the tendon and medial and lateral wound margins retracted; silk sutures are helpful to maintain retraction with minimal trauma to the skin edges. Gentle handling of the medial and lateral margins is extremely important to minimize postoperative wound complications.

The insertion of the tendo Achilles is examined and studied carefully to identify the extent of osseous pathology. Pathological soft tissues are identified and excised (ie. bursa, cyst, etc.). The tendon is incised or split in a longitudal manner (vertical) from the superior aspect of the calcaneus to just inferior to its insertion identified by the posterior osseous ridge (exostosis). A transverse incision is made overlying the exostosis creating an inverted A"T" incision though the tendinous expansion of the insertion. The tendon is meticulously dissected off the calcaneus from distal to proximal working outward (medially and laterally) from the central vertical split. The dissection is tedious and must be done with great care to fully appreciate the extent of the osseous and tendon pathology. A cavalier, non-anatomic, haphazard or traumatic dissection technique will result in increasing frustration as the case progresses.

The full extent of the exostosis is directly visualized and resected with a bone rongeur; in more severe cases an osteotome and mallet are used. The remaining bone is contoured and smoothened with a power reciprocating or hand held rasp. All osseous projections must be removed. In some cases the posterior superior aspect of the calcaneous will also be prominent and require remodeling and recontouring. Cautious resection of the superior section of the calcaneus is absolutely essential to ensure that the tendon is not reattached to the superior surface rather than the posterior

surface of the calcaneus. To facilitate reattachment of the tendo Achilles, the upper posterior one-third of the calcaneus, which is covered by a smooth, fibrocartilaginous surface can be drilled or roughened. In some cases a calcaneal wedge osteotomy may be necessary in addition to or in lieu of a retrocalcaneal exostectomy due to an abnormal architectural configuration of the bone creating a very prominent posterior calcaneus.

The tendo Achilles is carefully inspected and any diseased tendon and calcifications excised. Multiple calcifications within the tendon substance itself are not uncommon and are usually readily identified on pre-operative radiographs or other specialized studies. The first 2 cm of the tendon may demonstrate significant thickening and degeneration as evidenced by its yellowish color, bogginess and loss of the normal longitudinal configuration of tendon fibers. A #11 blade may be helpful to thin the tendon when excising the degenerative or anterior diseased tendon tissue. This excised tissue is wedge shaped; it is thinner at its medial and lateral margins and thicker centrally. The most medial and lateral expansions of the tendo Achilles insertion are usually not disturbed. Periodic dorsiflexion of the foot during the course of dissection confirms preservation of the attachment of the medial and lateral insertional expansions.

Intraoperative x-rays are recommended to confirm removal of the posterior exostosis, remodeling of the posterior calcaneus and excision of all peritendinous calcifications. The tendon is now ready for reattachment to the posterior surface of the calcaneus. A heavy gauge, nonabsorbable polyester suture is temporarily attached to the distal end of the tendon and used to place distal traction on the tendon distally over the posterior surface of the calcaneus. Simultaneous plantarflexion of the foot and ankle will facilitate the reattachment process. The appropriate sized Spider Plate is determined and placed directly over the tendon. A temporary K-wire can be inserted to help maintain position of the device. The K-wire usually passes between the medial and lateral components of the vertical split. A guide wire is then inserted into the body of the calcaneus through the hole for the screw. Its orientation is most commonly parallel to the plantar aspect of the foot. The typical screw length is between 30-40mm. The screw is then inserted and tightened providing a very secure attachment of the tendo Achilles to the calcaneus. Significant compression is created over a large surface area. Although not necessary, insertion of the K-wire and screw can be done under fluoroscopic visualization; final radiographic confirmation is encouraged and recommended to ensure proper placement of the device. An excessively long screw improperly orientated could conceivably enter the subtalar joint complex creating a serious post-operative complication.

The distal edge of the proximal tendon is sutured to the distal periosteal flap to further secure the tendo Achilles. The portion of the vertical split of the tendon not under the spider plate is repaired with 0 or 2-0 synthetic absorbable suture of choice; an inverted over and over stitch is recommended to bury the knot within or deep to the tendo Achilles itself. The wound is irrigated, the tourniquet released and hemostasis confirmed prior to closure of the subcutaneous tissue and skin. The subcutaneous tissues are reaproximated with synthetic 4-0 absorbable suture and the skin via a subcuticular stitch with 5-0 synthetic absorbable suture of choice and/or a running stitch or simple interrupted stitches of synthetic non-absorbable material of choice. Wound closure strips are usually applied to maintain apposition and minimize tension on the skin edges; they are typically left in place throughout the period of cast immobilization (usually 5-6 weeks).

POSTOPERATIVE MANAGEMENT

Patients are routinely managed with a Jones compression bandage to maintain position of the foot and ankle at 90 degrees and minimize postoperative edema. A dressing change is performed 5-7 days following surgery. A cast is then applied with the foot and ankle at 90 degrees. A thin layer of non-adhering foam over the posterior aspect of the heel helps to protect the area, minimize edema and promotes tendon adhesion effectively minimizing post-operative fibrosis and scar tissue formation.

Patients are maintained non-weightbearing for 3 weeks. Weight bearing without ambulation is permitted in week 4. Weightbearing with ambulation for 1-2 additional weeks is permitted. The cast is removed 5-6 weeks postoperatively. Full ambulation and weight bearing are encouraged as tolerable. Physical therapy is employed to assist with triceps surae strengthening and resolution of

residual edema and inflammation. Strenuous activities are discouraged for a minimum of 3 months.

Compression stockings or sleeves help to resolve edema and provide a comfortable heel cushion posteriorly and plantarly. Two common devices are employed; the Bauerfeind Achillotrain and the Silopos Achilles Heel pad. These devices have usually been previously dispensed to the patients as part of the conservative treatment regimen prior to surgery.

COMPLICATIONS

Surprisingly, the Spider Plate rarely requires removal based on the authors' experience to date. Although seemingly bulky, when properly inserted, is not readily palpable. Patients do not express concern over temperature sensitivity as one might expect and anticipate although all patients are informed of their potential removal sometime in the future. When removal is necessary it is easy to perform through either a longitudinal or transverse incisional approach.

Screw loosening is also a complication of the technique although not encountered by the senior author to date. Excellent purchase of the screw has been a consistent experience. Inadequate screw purchase could occur in severely osteopenic bone, necessitating the use of a larger screw. Recurrent exostosis formation and peritendinous calcifications have been seen in several of our cases. This postoperative event is not unique to this technique but seems inherent to retrocalcaneal surgery in general. Interestly, it has not been of symptomatic concern and no patient to date has required a revision surgery for the purpose of removal of a recurrent calcifications or exostosis formation. It is the authors contention that this phenomenon represents an aspect of this clinical entity that is still not well understood and continues to be the ongoing subject of further study, controversary and debate. More likely than not, retrocalcaneal exosotosis and peritendinous calcifications represent a combination of systemic, metabolic, biomechanical and mechanical factors not yet well understood. Elucidation of the precise etiology of this entity is desired by all physicians and surgeons dedicated to its treatment. Other complications including wound dehisence, hypertrophic or keloid scars as well as muscle atrophy are not directly related to the implant itself but are consequences of this type of surgery in general. No increased incidence of infections has been appreciated to date.

SUMMARY

Retrocalcaneal exostosis, tenocalcinosis and related disorders of the posterior aspect of the calcaneus can be challenging and difficult entities to treat. Recent advances in technique and technology have improved our ability to detach and reattach the tendo Achilles. The use of the Spider Plate has proven to a very effective device for reattachment of the tendo Achilles when performing retrocalcaneal surgery.

Although the authors' experience is limited to only six cases, the results have been very promising to both patients and physician alike. The technique, although tedious, is not excessively demanding or difficult. It is both clinically effective and cost effective. In cases where significant compromise of the tendo Achilles insertion is present, whether due to a traumatic event or surgical procedure, a very secure reattachment can be attained with the Spider Plate.

Figure 1. Posterior view demonstrating incision planning. A linear central incision directly over the insertion of the tendo Achilles is drawn.

Figure 2. Dissection through the subcutaneous tissue to the level of the tendon. Undermining is done along the tendon. The medial and lateral incisional margins are retracted with silk retention sutures. Some degeneration of the tendon is appreciated lateral to midline.

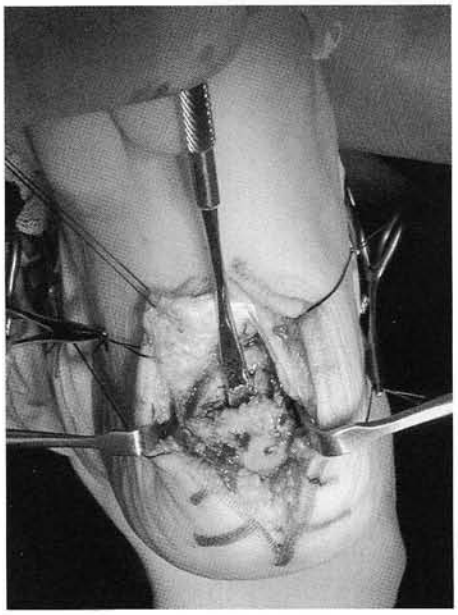

Figure 3. Reflection of the tendon with retraction using nonabsorbable suture. The extent of the retrocalcaneal spur is appreciated. A freer elevator is used to explore the extent of the recess anterior to the osseous ridge.

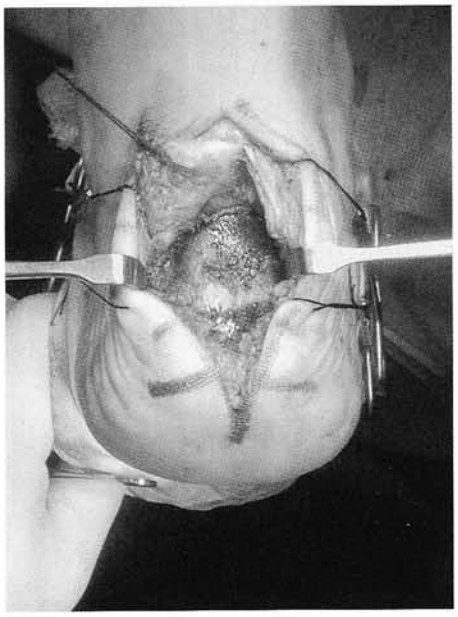

Figure 4. Appearance of the posterior aspect of the calcaneus following resection of the exostosis and recontouring of the bone.

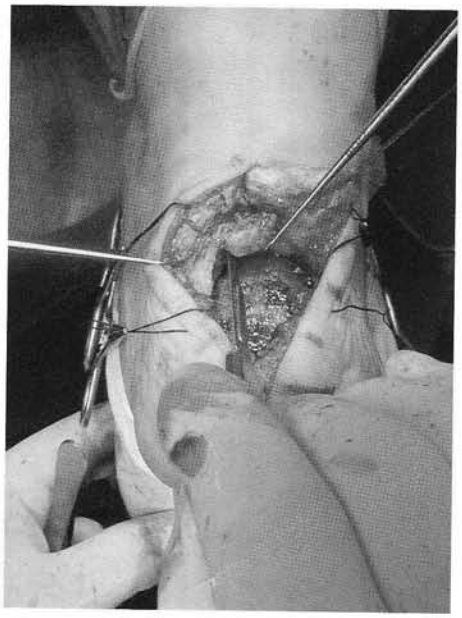

Figure 5. Process of excision of large intratendinous calcification from the tendo Achilles. A skin hook is being used to place tension on the bone fragment to facilitate retrieval of the bone.

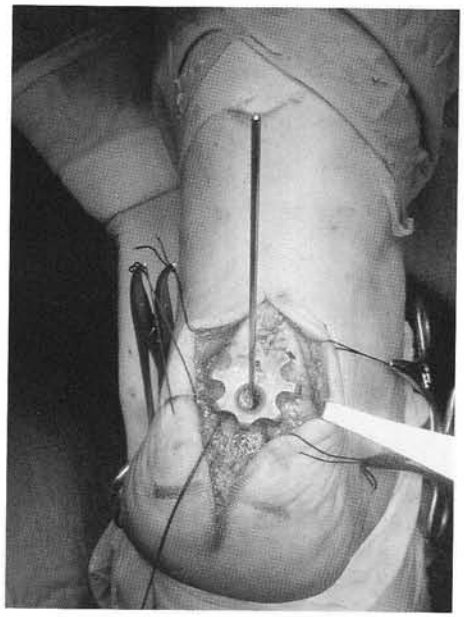

Figure 6. Selection of large Spider Plate and placement over the tendo Achilles prior to anchoring the device with a canulated partially threaded cancellous screw.

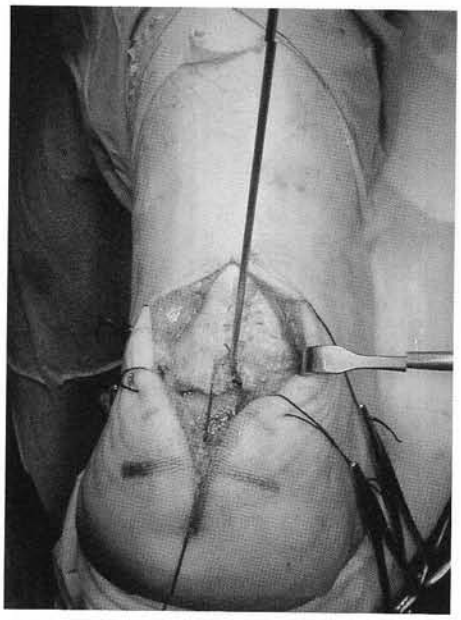

Figure 7. Appearance of the tendo Achilles following repair of the vertical split in the tendon. In this case the repair has been done prior to application of the plate.

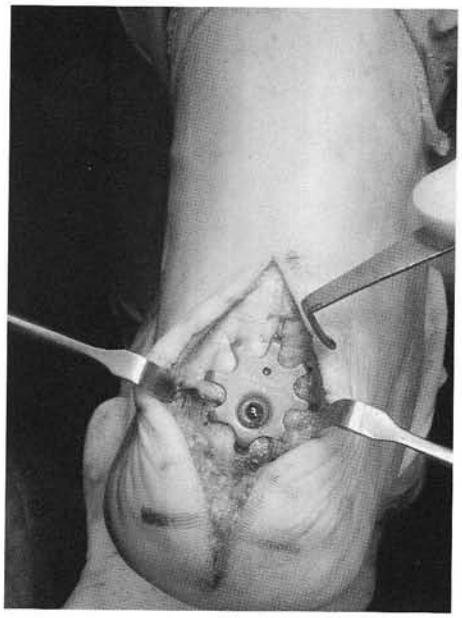

Figure 8. Final appearance after reattachment of the tendon using a large spider plate and screw. Note the small hole to receive one of the plate spikes inferiorly enhancing the compression of the tendon to the bone.

Figure 9. Preoperative lateral radiograph. Note the presence of a large retrocalcaneal exostosis as well as intratendinous calcifications.

Figure 10. Postoperative lateral radiograph following resection of the retrocalcaneal exostosis, intratendinous calcifications and diseased tendon. Note the orientation of the screw approximating a parallel relationship with the plantar aspect of the foot.

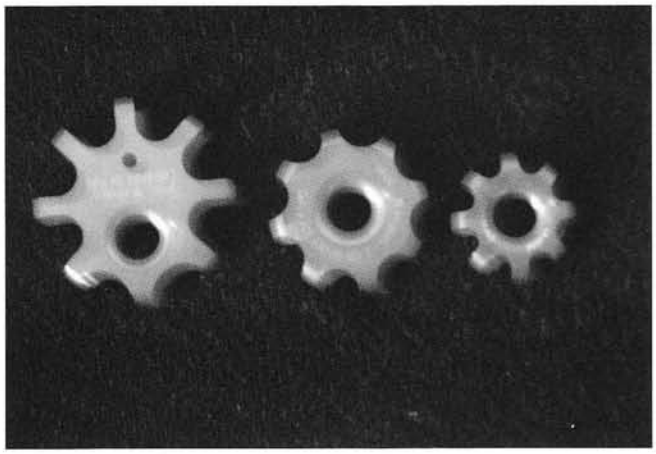

Figure 11. Three sizes of spider plates.