Technique Tip

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Percutaneous Zadek Osteotomy for Insertional Achilles Tendinopathy and Haglund Deformity: A Technique Tip

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Introduction

Insertional Achilles tendinopathy (IAT) is a common surgical pathology treated by orthopaedic surgeons.[4] IAT may be associated with Haglund deformity, and several surgical approaches exist to correct IAT; the most frequently used technique is the open midline splitting approach. More recently, minimally invasive surgery (MIS) to address common foot and ankle conditions has increased in use and popularity.

The Zadek dorsal closing wedge calcaneal osteotomy (DCWCO) was first published by Zadek in 1939 for treatment of Haglund syndrome and was performed through an open approach.[8] The Zadek osteotomy includes the reduction of the Achilles tendon impingement by rotating the posterosuperior corner of the calcaneal tuberosity anterior and elevating the Achilles tendon insertion.[4] This technique has been used to treat IAT, with or without associated Haglund deformity. More recently, this strategy has been modified through the use of minimally invasive techniques, including the percutaneous Zadek osteotomy.[5] A percutaneous approach, in comparison to the standard open technique, allows for fewer postoperative complications, improved clinical function, and decreased pain.[5,6] Accordingly, we present a novel technique for performing the percutaneous Zadek osteotomy in an effort to improve accuracy of resection and selection of appropriate incisions.

Surgical Technique

The patient is positioned in the lateral decubitus with a beanbag with the operative foot hanging off the end of the operating table. The fluoroscopic imaging device is used as a table to perform the osteotomy (Figure 1). Either mini-C arm or large C-arm can be used. A tourniquet is not used for this procedure.

Figure 1. Position of the leg in the lateral position on the mini C-arm to perform the Zadek osteotomy.

The safe zone of the calcaneus defined by Talusan is identified under fluoroscopic imaging (Figure 2).[7] Two

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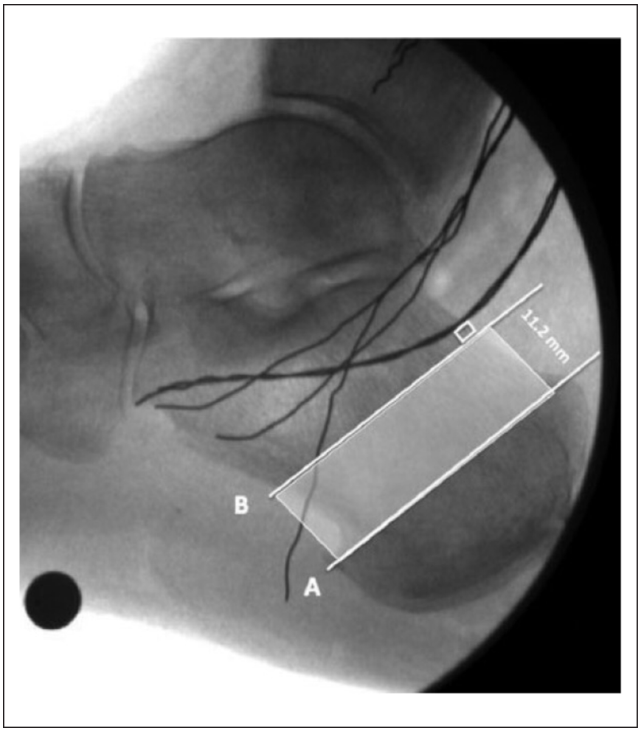

Figure 2. The safe zone of the calcaneus defined by Talusan et al.[7]

percutaneous Kirschner (K) wires are used to mark out the osteotomy and act as a cut guide for the osteotomy. The first K-wire is placed dorsal to plantar along the planned posterior border of the osteotomy. This wire starts just anterior to the Haglund deformity and ends just anterior to the insertion of the plantar fascia. The second K-wire is placed at the apex of the plantar hinge, just anterior to the insertion of the plantar fascia, and inserted into the dorsal calcaneus to create a 7- to 10-mm wedge. The authors typically recommend a dorsal resection amount of approximately 7 to 10 mm as previously described by Nordio et al[5] to decompress the Achilles insertion and allow for improved ankle dorsiflexion (Figure 3A and B). A plantar hinge of 5-8 mm should be preserved to minimize plantar cortex violation and fracture, which potentially increases risk of nonunion.[2,3,5]

At this point, a 5-mm incision is made in the safe zone to avoid the sural nerve, and blunt dissection with a mosquito is preformed down to the calcaneus. Next, either the 3 × 20-mm or 3 × 30-mm Shannon burr is used to complete the dorsal closing wedge osteotomy along the marked out trajectory within the K-wire guides. This is performed with the operative foot on the C-arm. Like most percutaneous calcaneal osteotomies, in the coronal plane, the osteotomy should be completed lateral to medial in quadrants to ensure sufficient bone resection. The surgeon should pause every 3-5 seconds to allow the burr to cool and clean the cutting flutes in order to avoid heat generation and thermal necrosis. Copious refrigerated normal saline via bulb syringe is used to cool the burr during use. In the sagittal plane, we prefer to divide the osteotomy into 3 sections: the plantar third, middle third, and dorsal third. Each section is then divided into a posterior and anterior section (Figure 4A and B). This allows the burr to be surrounded by bone on all sides and allows for ease of osteotomy to ensure all bone is removed in each section in both the sagittal and axial plane. Starting at the junction of the middle and plantar third, the posterior plantar third is removed from lateral to medial. Then the anterior plantar third is removed, with special care being taken to maintain the plantar hinge. Next, the surgeon will remove the middle posterior third and the middle anterior third, followed by the dorsal posterior third and dorsal anterior third.

Once the osteotomy is complete, the ankle is dorsiflexed to close down the osteotomy, providing good bony apposition. If the osteotomy does not reduce, the surgeon may need to remove more plantar bone or check for any incongruent bone within the osteotomy or any remaining bone bridges. Again, care should be taken when removing more plantar bone to avoid violation of the plantar cortex of the calcaneus. One sign of sufficient bone removal and adequate osteotomy reduction is that the K-wires should go from an oblique to parallel position, which can be visualized with fluoroscopy (Figure 5A and B).

To maintain reduction during fixation, the surgeon can either have an assistant hold the ankle in dorsiflexion or Coban can be wrapped from the ankle around the toes to maintain dorsiflexion (Figure 6). One or 2 K-wires are placed for 7.0-mm cannulated, headless compression screws and confirmed on lateral and Harris axial calcaneal fluoroscopy views. Although 1 screw may be sufficient, the authors prefer to use 2 screws because most nonunions in the literature have occurred from violation of the plantar hinge; therefore, we add a plantar screw to protect the plantar cortex. The superior screw is placed first to allow better compression and reduction of the osteotomy; the plantar screw is then added second to protect the plantar hinge. At this point, the wires are drilled and screws are placed in standard fashion (Figure 7A and B).

Postoperatively the patient is splinted in neutral ankle dorsiflexion and made nonweightbearing for 2 weeks. At 2 weeks, the patient begins progressive weightbearing as tolerated in a short CAM boot and then subsequently weaned out of the boot into a supportive shoe at 6 weeks postoperatively. Low-impact exercise activity may begin after postoperative week 6. We recommend gradual strengthening at postoperative week 8 with progression to full activity by week 12. Patients should be counseled that they should expect plantar and lateral heel pain for 6 weeks to 3 months postoperatively.

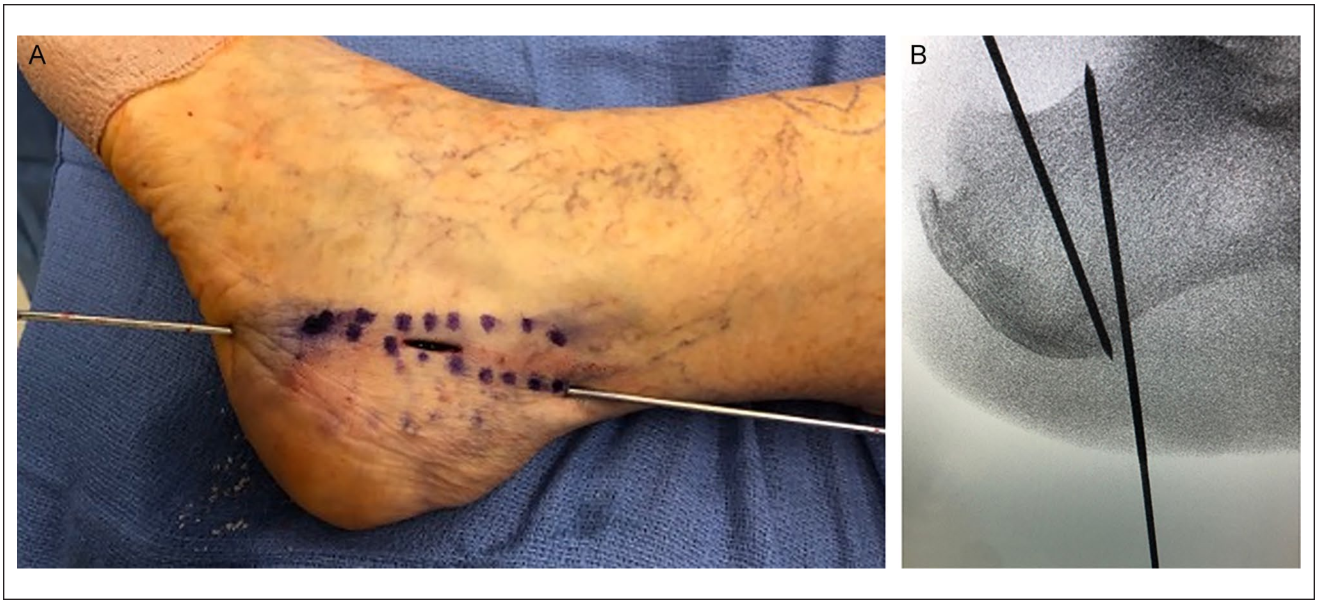

Figure 3. (A) Clinical photograph showing position of percutaneous K-wires acting as a cut guide for the Zadek osteotomy. (B) Radiograph image of the K-wire placement acting as a cut guide for the Zadek osteotomy.

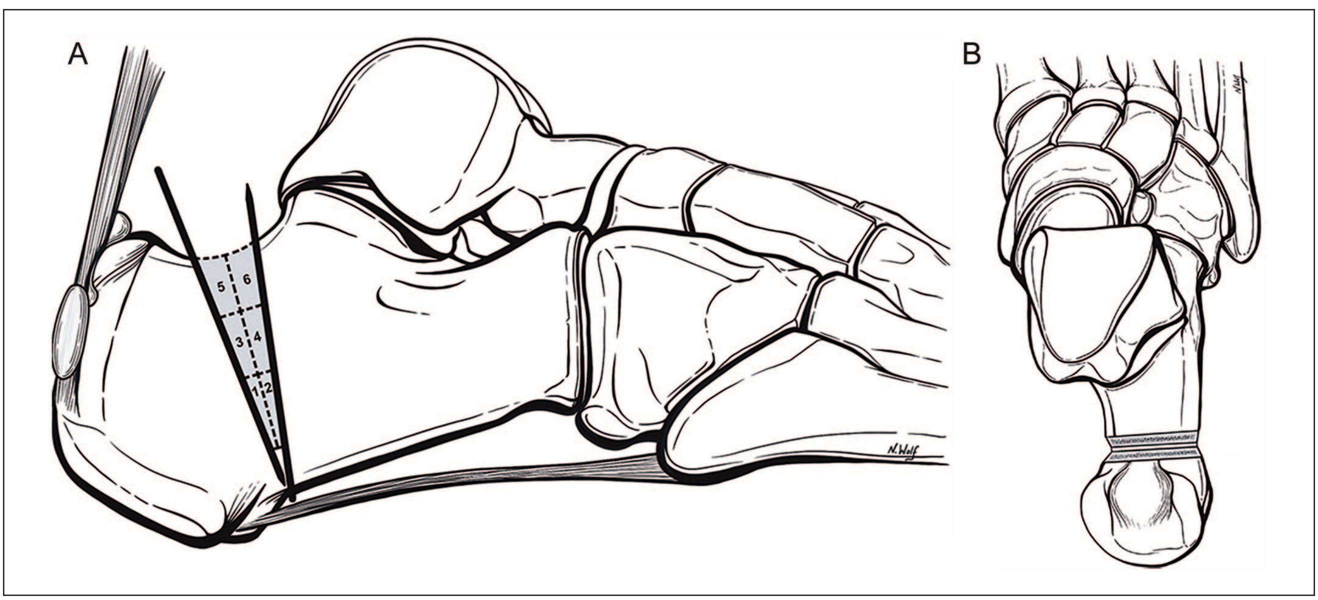

Figure 4. Schematic drawing of cut technique using quadrants in the (A) sagittal and (B) axial plane.

Discussion

Minimally invasive surgery has become increasingly popular within the field of orthopaedic surgery, including the subspeciality of foot and ankle. The percutaneous Zadek osteotomy is a safe and effective surgical approach to insertional Achilles tendinopathy and Haglund deformity.[3,5] In a prospective study, Georgiannos et al[3] found that the Zadek osteotomy provided significant symptomatic relief, improved postoperative outcome scores, and reduced recovery times. Additionally, multiple studies have investigated open vs percutaneous approaches to retrocalcaneal disorders, including Haglund syndrome.[5,6] Nordio et al[5] found that the percutaneous Zadek osteotomy had decreased postoperative healing times and complications compared to the open approach.

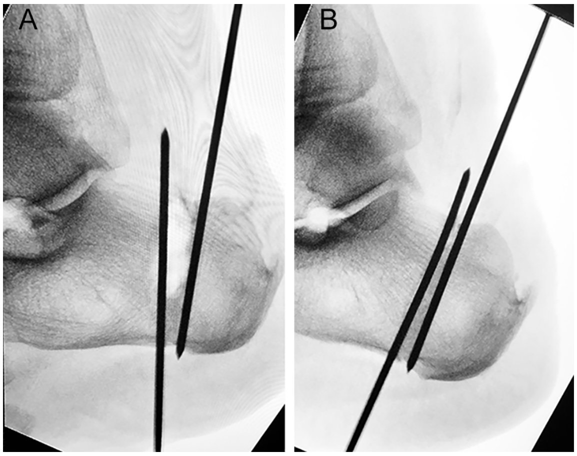

Figure 5. (A) Fluoroscopic imaging showing oblique position of K-wires prior to reduction maneuver. (B) After dorsiflexion of the ankle, the osteotomy closes down and now K-wires become parallel implying appropriate reduction of the osteotomy.

Figure 6. Utilization of Coban wrapping technique to create a hands-free reduction maneuver and hold the reduction for K-wire and screw placement.

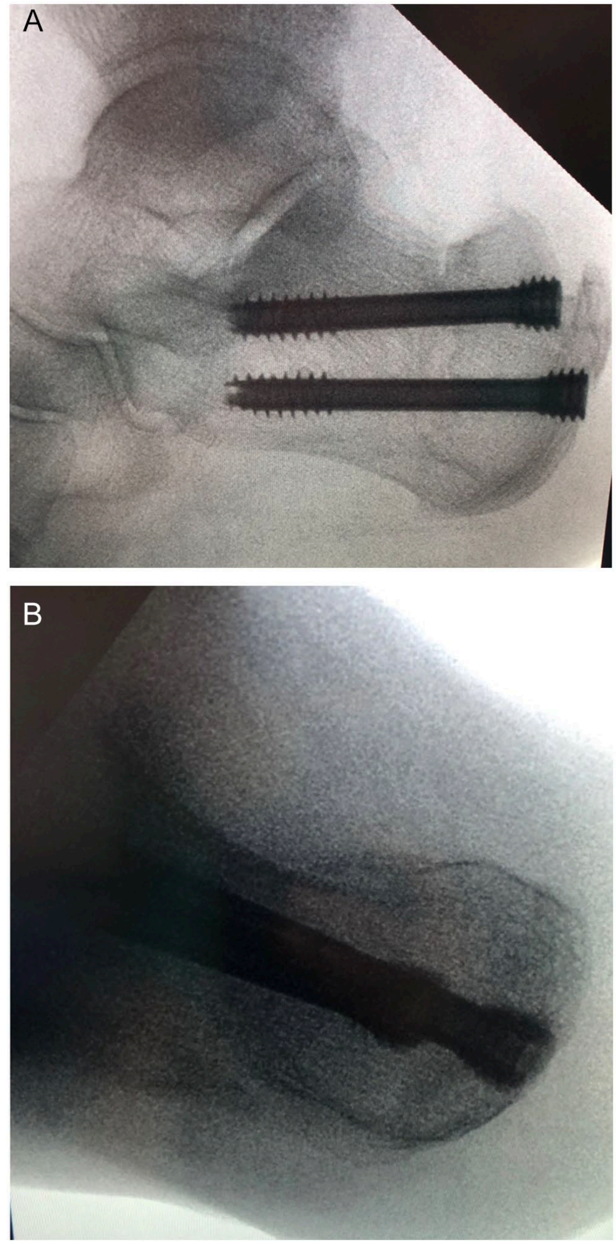

Figure 7. Final fluoroscopic images of calcaneus showing screw placement. (A) Lateral view. (B) Harris axial view.

Conclusion

Our proposed percutaneous Zadek osteotomy technique allows for accurate identification of the osteotomy site while minimizing risk of wound complications, infections, and sural nerve injury. Literature has shown that regardless of procedure type, minimally invasive surgery is often associated with a significant learning curve.[1] We believe our cut guide and quadrant technique will help surgeons perform a more accurate osteotomy and allow for a more rapid procedure, which may lessen the learning curve, though more research is necessary to assess this.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Jonathan R. M. Kaplan, MD, Oliver N. Schipper, MD, Ettore Vulcano, MD, and Tyler Gonzalez, MD, MBA, report consulting fees from Novastep. ICMJE forms for all authors are available online.

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