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Technique Tip: Subtalar Joint Fusion Using a Parallel Guide and Double Screw Fixation

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ABSTRACT

A wide range of techniques has been described to achieve subtalar (talocalcaneal) arthrodesis using interfragmental screw fixation. In this technical report, we describe a method that enables us to accurately position 2 screws across the subtalar joint in order to achieve arthrodesis between the talus and calcaneus. Careful attention to the tips described in this report should minimize the risk of aberrant placement of the screws while expediting the process of osteosynthesis.

Subtalar joint arthrodesis is a surgical option for patients with pain, instability, or deformity who have failed nonoperative treatment. The goal of any subtalar joint fusion is the elimination of motion of the subtalar joint complex, thus eliminating pain for patients, allowing them to return to their past level of activity (1). Isolated subtalar arthrodesis has been shown to result in good to excellent outcomes with high patient satisfaction, with reported fusion rates with the use of screw fixation often exceeding 90% (1, 2). Arthrodesis can be used in patients with prior trauma, such as calcaneal or talar fracture, resulting in degenerative joint changes (1). Subtalar joint fusion has also been described in patients with primary subtalar degeneration, inflammatory arthropathies, rearfoot coalitions, neuromuscular dysfunction, and following infectious degenerative changes. Subtalar joint arthrodesis can also be useful in residual congenital hindfoot deformities, as well as rearfoot deformities such as rigid pes planovalgus and cavus foot. Arthrodesis also restores hindfoot alignment and improves function (2). Wilson (3) was the first to describe isolated subtalar joint arthrodesis in the English literature, and used the fusion to treat patients with intra-articular damage following calcaneal fracture. Since then, many forms of fixation have been described for fusion of the subtalar joint. Internal screw fixation has become an established form of fixation (4). Accurate placement of screw fixation is imperative because improper positioning and application of fixation can lead to poor outcomes affecting the function of the entire lower extremity (5). In this report, the authors share a systematic, reliable, reproducible way to perform a subtalar joint fusion with excellent anatomical placement of screw fixation.

Surgical Technique

The patient is positioned supine on the operating table with bump placement under the ipsilateral hip for needed internal rotation to properly visualize the lateral aspect of the foot. If the surgeon prefers, a tourniquet can be applied to the ipsilateral thigh for hemostasis. The subtalar joint is approached laterally with an incision, which extends from the tip of the fibula to the calcaneocuboid joint. The distal portion of the incision can be extended to the base of the fourth metatarsal if a triple arthrodesis is being performed (Figure 1). The incision is deepened through the subcutaneous tissue with atraumatic technique, with particular care to avoid the communicating branch of the sural nerve. The extensor digitorum brevis muscle belly is reflected dorsally or distally, and the fatty plug (Hoke's tonsil) is removed from the sinus tarsi. The subtalar joint is then prepared for fusion using the preferred technique of the surgeon; our preferred technique is curettage with subchondral drilling. It is imperative that all cartilage is removed and healthy bleeding bone is visualized, which is optimal for fusion. A lamina spreader may be used to visualize the medial portion of the subtalar joint for joint preparation. If a talocalcaneal coalition is present, it should be resected in order to prepare the remainder of the joint. Following joint preparation, rearfoot alignment should be inspected and any deformity correction such as heel varus should be performed through osteotomies or bone block

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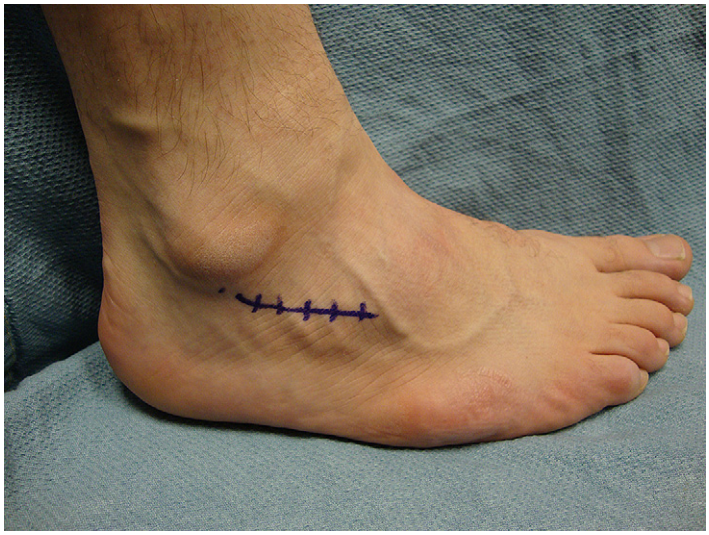

Fig. 1. Incision placement for lateral access to the subtalar joint. The incision extends from the tip of the fibula to the calcaneocuboid joint. The incision can be lengthened distally to the base of the fourth metatarsal for a triple arthrodesis.

placement. Bone graft, bone morphogenic protein, and/or platelet-rich plasma may also be added to the prepared joint to aid timely fusion.

The dorsal surface of the talar neck is then approached using an approximately 2-cm midline incision (Figure 2). This location can be visualized under fluoroscopy using a metal object such as a Freer elevator to locate the proper position. The interval for the incision is located between the tibialis anterior and the extensor hallucis longus tendons. This interval is safe relative to position of the dorsalis pedis artery and deep peroneal nerve, and it is imperative to locate the proper interval between the tibialis anterior and extensor hallucis longus to avoid any neurovascular damage. The skin incision is made, and blunt dissection is then carried down to the neck of the talus. A small portion of the periosteum is removed using a Key elevator in the area of planned screw placement. A guide pin is then inserted from the anterior incision through the neck of the talus, crossing the subtalar joint, into the calcaneus (Figures 3 and 4). Before crossing the posterior facet of the subtalar joint, the foot should be placed in the appropriate position for subtalar fusion. The proper frontal plane positioning of the rearfoot is typically 5° of valgus, which allows motion at the midtarsal joint. It is important to remember that the subtalar joint influences the midtarsal joint, and if placed in varus, the midtarsal joint will remain locked at all times during the gait cycle. Attention must also be paid to obtaining the desired sagittal and transverse plane alignments, which vary depending on the individual patient's needs and anatomy.

Next, proper placement of the guide pin should be verified in multiple planes before application of screw fixation. The lateral image will show proper placement in the sagittal plane, and should show the guide wire clearly crossing the talocalcaneal joint (Figure 4). An anteroposterior (AP) ankle view should show the guide wire properly placed within the talus, whereas a calcaneal axial view should show the wire within the calcaneal body. Although the lateral fluoroscopic image is an advantageous view, the other images can help prevent placement of hardware within problematic areas such as the ankle gutters and tarsal tunnel. Once correct guide pin placement is noted under fluoroscopy, a 6.5-mm partially threaded long thread pattern screw is inserted (Figure 5). This screw is inserted using standard osteosynthesis lag technique, with aggressive countersinking to avoid anterior ankle impingement. Headless screws are also an option so as

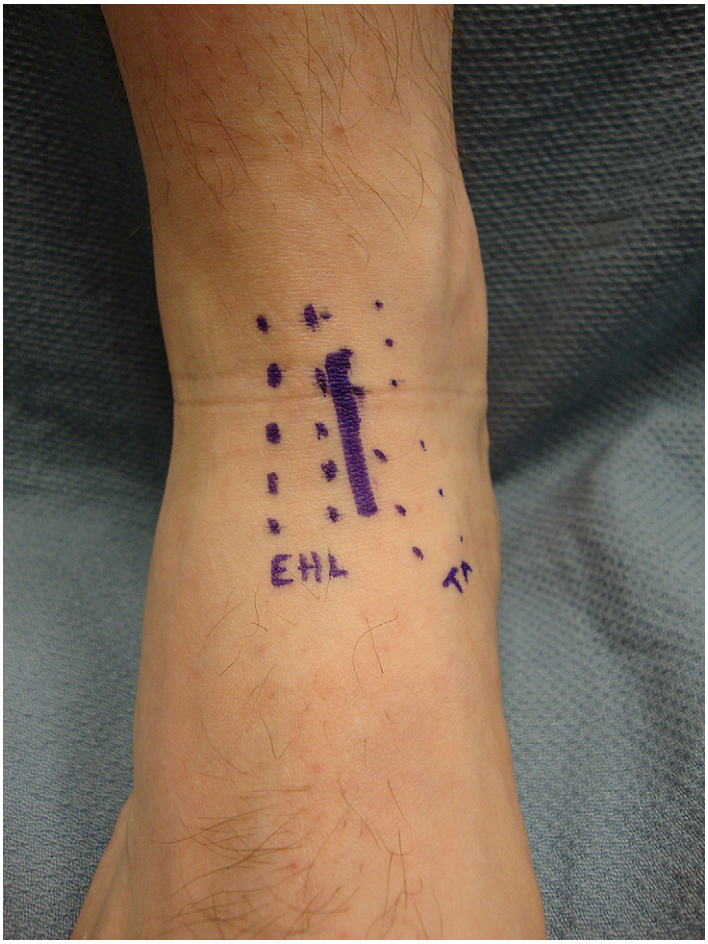

Fig. 2. Incision placement for access to the talar neck. Proper location can be verified with a lateral fluoroscopic image before incision. The interval for the incision is between the tibialis anterior and extensor hallucis longus tendons. This interval is a "safe zone" away from the anterior neurovascular bundle, but the soft tissues must be retracted with care.

to prevent anterior ankle impingement. Proper screw placement should include the neck of the talus to the body of the calcaneus, with care taken to avoid violation of the inferior cortex of the calcaneus. Once proper screw placement is noted in all planes, the anterior to posterior guide pin is then advanced until it exits the heel (Figure 6).

Using the guide wire, which exits the posterior heel, a parallel drill guide is used for placement of the posterior to anterior screw (Figure 7). Proper screw placement for the posterior to anterior screw should include avoidance of the plantar aspect of the calcaneus, as well as the posterior surface of the calcaneus, which can result in screw prominence against the last of the shoe. The guide wire should cross the posterior facet of the subtalar joint and enter the talar body (Figure 8). A 6.5-mm partially threaded short thread pattern screw should be inserted using standard osteosynthesis lag technique (Figure 9, 10). Aggressive countersinking should be used to prevent screw prominence. With either the anterior to posterior screw, or the posterior to anterior screw, if screw threads are crossing the posterior facet, the surgeon can overdrill the proximal segment so as to convert screw placement to lag by technique. Both guide pins are then removed, and proper fixation and alignment should be noted by direct visualization and image intensification fluoroscopy. The area should be flushed with sterile saline, after which proper layer closure is performed. The lower extremity can then be placed in a posterior splint and managed with avoidance of weight bearing on the operated extremity.