Chronic Syndesmotic Injuries and Reconstruction

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Abstract: Chronic instability of the distal tibiofibular syndesmosis is associated with poor functional outcomes and the development of arthritis. Stabilization of the distal tibiofibular joint after a neglected or recurrent diastasis can be accomplished using a variety of surgical procedures; however, no 1 technique has shown clear superiority. Arthrodesis is considered the most reproducible means of restoring stability at the distal tibiofibular joint; however, the limitation of motion can be associated with ankle pain and may exacerbate symptoms from early ankle degenerative disease. This article presents an algorithmic approach using a double limb allograft reconstruction for symptomatic patients with persistent radiographic widening and either subtle syndesmotic instability or significant disruption and lateral talar shift due to attenuated or disrupted syndesmotic ligaments. The technique primarily reconstructs the interosseous ligament and does not attempt to individually recreate each ligament of the syndesmosis to preserve physiological fibula rotation and translation. Early outcomes have been excellent.

Level of Evidence: Diagnostic Level V. See Instructions for Authors for a complete description of levels of evidence.

Key Words: syndesmosis, chronic injury, allograft reconstruction, distal tibiofibular joint

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HISTORICAL PERSPECTIVE

The anatomic relationship of the distal tibia and fibula is critical to maintain the mechanics of the ankle mortise. The distal tibiofibular joint is stabilized by a series of 4 ligaments, referred to as the syndesmosis. It consists of the anterior-inferior tibiofibular ligament (AITFL), posterior-inferior tibiofibular ligament (PITFL), interosseous ligament (IOL), and the transverse ligament.[1] When intact, it prevents lateral translation of the fibula during weight-bearing which enables the fibula to bear up to 17% of the weight-bearing load during gait.[2] A disrupted syndesmosis however, results in abnormal transfer of forces to the tibiotalar articulation, which results in a nonphysiological increase in external rotation of the talus.[3]

Injuries to the syndesmosis may be purely ligamentous, or more commonly, may occur in association with a rotational ankle fracture.[4,5] In the setting of a fibula fracture with rupture of the deltoid, anatomic reduction of the ankle mortise relies on the fibula to "push" the talus into alignment. In the presence of a concomitant syndesmotic injury that is either undiagnosed, not treated or undergoes early failure, the fibula cannot maintain the talar reduction resulting in recurrent lateral talar shift. Tibiotalar malalignment due to distal tibiofibular instability has also been shown to lead to early posttraumatic osteoarthritis and poor functional outcomes.[4,6–11]

When diastasis of the distal tibiofibular joint persists for more than 3 months the injury is considered chronic.[2] Chronic injuries pose a unique challenge to the orthopedic surgeon. Despite a variety of described procedures, no universally accepted surgical technique currently exists. For patients without diastasis, arthroscopic debridement with or without transyndesmotic fixation is the most appropriate initial therapeutic option. In a prospective randomized trial of 20 patients, Han et al[12] showed no statistical difference in American Orthopaedic Foot and Ankle Society (AOFAS) scores in patients with arthroscopically diagnosed instability who were treated with arthroscopic debridement with or without screw fixation. Arthroscopic debridement is reserved for patients with normal radiographic alignment and no bony abnormality (eg, fibular or posterior malleolar malunion) or as an adjunct to a reconstructive procedure.

In the setting of diastasis syndesmotic reconstruction is necessary as arthroscopy alone is incapable of addressing any underlying deformity. An evolution in technique has been shown in the literature, beginning with debridement and repeat fixation to the use of free hamstring graft.[13–16] Arthrodesis is the most reliable option to ensure long-term stability, provided a successful union occurs, but the elimination of normal distal tibiofibular joint motion may lead to abnormal loading of the talar articular surface and long-term ankle arthrosis. To make matters worse, achieving the correct sagittal and coronal plane alignment is difficult and may contribute to abnormal forces on the talar dome articular cartilage. Furthermore, following joint preparation compression of the fibula against the tibia will result in increased talar constraint unless bone graft is used to perfectly recreate the normal distance between the 2 bones.

Despite these theoretical concerns there is some evidence to suggest the contrary.[2,17,18] Olson and colleagues described debriding the distal tibiofibular joint and stabilizing the arthrodesis with two 3.5 mm tetracortical screws in lag manner. At an average follow-up of 41 months, mean AOFAS scores increased from 37 ± 15 to 87 ± 11. They also noted an increase in the Kellgren and Moore grade of arthritis in 2 of the 10 patients, with 1 of 2 patients having a normal ankle preoperatively.[18] These results support earlier findings by Pena and Coetzee[17] who recommended arthrodesis for patients with an injury older than 6 months, severe incongruity, or a recurrence of diastasis after removal of fixation. However, the senior author has noted post-arthrodesis ankle pain and case examples of rapid ankle arthrosis in his personal experience and recommends a reconstructive procedure unless advanced preexisting arthritis is noted.

Syndesmotic reconstruction using a free tendon graft allows for restoration of the tibiofibular relationship while theoretically maintaining physiological motion of the fibula. Limited series using various surgical techniques show promising results and suggest that arthrodesis may be best suited for

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patients with existing degenerative changes. In the setting of an intact AITFL, bone block advancement has been shown to be a viable option. In their prospective study, Wagener and colleagues osteotomized and mobilized the insertion of the AITFL with a 1×1 cm bone block. A gutter directed medial and proximal to the original insertion was then made in the tibia. After application of maximal compression to the mortise with a pelvic clamp, the bone block was advanced into the gutter and stabilized with screw fixation. In addition, the bone block was supplemented with a tetracortical syndesmotic screw. In 12 patients who underwent treatment more than 2 years after their initial injury, average AOFAS scores improve from 75 to 92 with average follow-up of 25 months.[19]

When the AITFL is ruptured or attenuated, local or free autogenous graft substitute may be used. Grass et al[14] used a split peroneus longus autograft secured with a 3.5 mm screw augmented with a tricortical transfixation screw in a series of 16 patients. At an average follow-up of 16 months, 15 of 16 patients reported pain relief and stated they would undergo the surgery again. Hamstring autograft is another alternative that has shown encouraging results.[16] The technique described by Morris and colleagues anatomically reconstructs the AITFL and the IOL using 2 tunnels. The first tunnel was directed from slightly posterolateral to the fibula to slightly anterior in the tibia. The second tunnel was placed anterior to the fibula below the level of and parallel to the first tunnel. The graft was passed medial to lateral through tunnel 1 and finally looped over the fibula and into tunnel 2. The graft was secured medially and laterally with 15 mm interference screws. Visual analog pain scores improved from 73 preoperatively to 19 postoperatively. Preoperative AOFAS scores were collected retrospectively; however, the average postoperative AOFAS score 85.4.[16]

Lui[20] described a minimally invasive tri-ligamentous reconstruction using 3 tunnels. The first tunnel connects the anterior and posterior tubercle of the distal tibia, followed by a second tunnel joining the fibular insertions of the AITFL and PITFL. The third and final tunnel is made over the lateral malleolus and directed posteromedially above and toward the tibial tunnel. The peroneus longus tendon is harvested and passed through the posterior half of the tibial tunnel exiting the third fibular tunnel reconstructing the IOL. The opposite end of the graft is then passed anteriorly through the fibular tunnel reconstructing the PITFL. The 2 ends are finally sutured to each other and inserted into the anterior half of the tibial tunnel to reconstruct the AITFL. No long-term follow-up or outcomes were reported.

Allograft ligament reconstruction of the syndesmosis is a powerful tool for treatment of chronic syndesmotic injuries. In this article, we present a surgical technique using a double limb semitendinosus allograft. In contrast to previously described methods, this technique focuses on reconstructing the IOL and is augmented with suture-button fixation to obviate a second surgery for hardware removal.[21] This technique does not attempt to individually recreate the AITFL, PITFL, and IOL with a single graft, as this would restrict fibular motion as all 3 limbs are tensioned as one. By fixing the fibula through the center of the bone recreating the IOL, the fibula can rotate physiologically without any lateral translation. Results are excellent with only 1 reported case of a postoperative fibular fracture and all patients reporting that they would undergo surgical intervention again.

INDICATIONS AND CONTRAINDICATIONS

Surgical treatment for chronic syndesmotic injuries is appropriate for patients with continued pain and instability despite nonsurgical treatment. Surgical reconstruction is recommended for patients with continued symptoms and persistent radiographic widening of the distal tibiofibular joint. The use of semitendinosus allograft reconstruction is best indicated for patients with attenuated or disrupted syndesmotic ligaments.

Arthritis of the distal tibiofibular joint is a contraindication to reconstruction and is best treated with an arthrodesis. Early-stage degeneration of the tibiotalar joint does not eliminate reconstruction as a viable option. In the absence of end-stage arthritis, reconstruction can restore normal ankle mechanics and may alleviate a portion of the patient's pain. If the patient has continued pain after reconstruction, an ankle arthroplasty or arthrodesis can be performed given any ankle instability has been corrected.

DIAGNOSIS

Patients with chronic syndesmotic injuries typically complain of persistent pain on weight-bearing after initial injury.[11–13] In cases with prior malleolar fracture, the relevant history is continued pain and stiffness after initiation of weight-bearing. Some may also report continued pain despite additional treatments. In cases without fracture, an injury mechanism of external rotation of the foot relative to the tibia should raise suspicion for a missed syndesmotic injury. Some patients may also complain of instability that is most noticeable during athletic activity.

On physical exam, patients often have swelling at the anterolateral aspect of the syndesmosis.[14–16] Palpation usually elicits tenderness that is distinctly different in quality compared with the contralateral lower extremity. Tenderness of the deltoid ligament may also be present. The squeeze test is positive if pain is elicited in the distal tibiofibular joint with compression of the tibia and fibula above the ankle joint.[22] A stress exam can also be performed by applying an external rotation force on a dorsiflexed ankle.[23,24] Reproduction of pain indicates a positive exam. For patients who complain of instability, the physical exam may reveal a normal anterior drawer and inversion stress test, which favors a diagnosis of syndesmotic injury over a lateral ankle sprain. Unfortunately, the reliability and accuracy of these special tests is limited and should be used in conjunction with imaging and/or arthroscopy.[25,26]

Weight-bearing anterior-posterior (AP), lateral and mortise views of the ankle are typically obtained to evaluate the integrity of the distal tibiofibular joint. Harper and Keller[27] first described the "normal" radiographic relationship of the distal tibiofibular syndesmosis: a tibiofibular clear space on the AP and mortise views of <6 mm; a tibiofibular overlap on the AP view of >6 mm; and a tibiofibular overlap on the mortise view of >1 mm. However, relying on these thresholds can result in failure to treat in addition to overtreatment of patients due to variability in these measurements among normal patients. Shah et al[28] reviewed normal radiographs of 392 patients, including 83 with bilateral radiographs, and found that a lack of overlap on the mortise view can represent a normal variant. Their data form the basis for revised radiographic criteria. The mean overlap was 8.3 mm on the AP and 3.5 mm on the mortise view, whereas the mean clear space was 4.6 mm on the AP and 4.3 mm on the mortise view. The least amount of overlap on the AP view was 1.8 mm. On the mortise view, there was a subset of patients that had a complete lack of overlap (<0 mm) with the greatest gap noted to be 1.9 mm. The relevance of this information is to note that for some patients, the presence of overlap does not guarantee an intact

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syndesmosis and therefore increased vigilance is required when analyzing the syndesmosis.

Owing to the questionable reliability of radiographic parameters, computed tomography (CT) and magnetic resonance imaging (MRI) are often helpful. In the setting of clear diastasis, a CT scan can provide very useful information on the bony anatomy to guide surgical planning. Moravek and Kadakia[21] specifically used preoperative CT to assess fibular length, degenerative changes, presence and location of a synostosis, a malreduced posterior malleolar fracture or osteochondral lesions. In the setting of nondiagnostic radiographs, the use of MRI is superior. In a series of 78 patients, Han et al[12] found MRI to be 90% sensitive and 94.8% specific in diagnosing syndesmotic injury using arthroscopic findings as a definitive diagnostic standard. In a similar study by Oae et al,[29] MRI demonstrated 100% sensitivity and 94% specificity for the AITFL disruption and 100% specificity and sensitivity for PITFL injury.

Ankle arthroscopy is another useful diagnostic tool that also has some therapeutic merit. It is ideal for patients with suspected instability without clear radiographic diastasis. It allows for evaluation of instability by dynamic stress evaluation.[12,24,30,31] Instability is present if there is 2 mm or more of widening after either external rotation stress or a laterally directed force using the arthroscopic probe. Arthroscopy also allows for debridement of fibrous tissue interposed in the distal tibiofibular joint as well concomitant osteochondral defects and synovitis.

PREOPERATIVE PLANNING

Successful treatment of chronic syndesmotic injuries requires a systematic approach with careful preoperative planning. In the setting of a prior fibula fracture, fibular length and rotation must be restored. The syndesmosis cannot be anatomically reduced in the setting a shortened or malreduced fibula. Syndesmotic injuries are also sometimes associated with a fracture of the posterior malleolus. As the PITFL inserts onto the posterolateral tibia, malreduction of the posterior malleolus can result in malreduction of the syndesmosis with posterolateral subluxation of the fibula. Correction of bony malalignment cannot be obtained solely through soft tissue procedures and typically requires osteotomy or other bony procedure.

In the setting of lateral talar translation, the deltoid ligament is by definition lengthened. This laxity, in addition to the common presence of scar in the medial gutter, necessitates a medial arthrotomy in all patients. Anterior tibiotalar osteophytes and anterior osteochondral lesions can be addressed through the arthrotomy as well.

Lastly, the integrity of the articular surface should be evaluated. Any preexisting degenerative changes will not be solved by restoration of the distal tibiofibular anatomy. In such cases, reconstruction of the syndesmosis must be followed by reconstruction of the articular surface either by OATS (allograft or autograft) or arthroplasty. An ankle arthrodesis can be performed in isolation without reconstruction of the syndesmosis as once the tibiotalar joint is fused, the function of the syndesmosis is no longer relevant. A summary of the surgical treatment algorithm proposed by Moravek and Kadakia[21] is shown in (Table 1).

TABLE 1. Surgical Algorithm for the Treatment of Chronic Syndesmotic Diastasis

1. Hardware removal of prior fibular and syndesmotic fixation if present
2. Debridement of the syndesmosis and/or excision of synostosis
3. Posterior malleolar osteotomy if preoperative CT indicates a malunion
4. Transection of the deltoid ligament or medial malleolar osteotomy if malunion present
5. Debridement of medial ankle joint gutter
6. Oblique lengthening fibular osteotomy if a shortened fibula is present
7. Reduction of the syndesmosis with a large tong clamp
8. Suture-button fixation proximal to the proposed graft site
9. Doubled allograft reconstruction of the syndesmosis
10. Removal of the reduction clamp with assessment of syndesmotic reduction and stability
11. Imbrication of the deltoid ligament or reduction and fixation of medial malleolar osteotomy

CT indicates computed tomography.

TECHNIQUE

Patient Positioning

The patient is positioned supine on the operating room table with a slight beanbag bump under the operative leg to place it in neutral rotation. A nonsterile thigh tourniquet (optional) may be applied. The leg is prepped and draped in the usual sterile manner. General anesthesia with a regional nerve block for postoperative pain control is preferred. The lower extremity is exsanguinated and the tourniquet is inflated.

Incision and Dissection

The ankle is approached medially and laterally utilizing previous skin incisions if possible. The lateral incision should extend from the tip of the fibula to at least 8 cm proximally, but can be extended to remove hardware or excise a synostosis. Careful attention must be paid to the superficial peroneal nerve to avoid iatrogenic neuroma formation. Initial attention is directed at removal of existing hardware including syndesmotic fixation.

Dissection is carried anteriorly to expose the syndesmosis over the fibula as well as the tibiotalar joint. Any anterior osteophytes or lateral osteochondral lesions can be addressed at this point. Often, scar tissue is encountered in the syndesmosis and should not be confused with an intact ligament. The distal tibiofibular joint is debrided from anterior to posterior using sharp and meticulous dissection. All interposed tissue must be excised to allow for anatomic reduction. Care is taken to avoid the peroneal artery and its branches, which can be injured with overzealous proximal debridement.

Excision of Synostosis (if Present)

If a bony synostosis is encountered, the entire synostosis must be excised to allow for medial translation of the fibula. Extensive dissection anterior and posterior to the fibula is required in this case to remove soft tissue attachments to the synostosis. An osteotome is taken along the lateral aspect of the tibia from anterior to posterior to remove the tibial attachment. An oscillating saw can be used; however, greater control is afforded with an osteotome, which may reduce the risk of violating that posterior neurovascular bundle. Once this is complete, an oscillating saw is then used along the posterior border of the fibula from lateral to medial to remove the fibular attachment. With care, the risk of neurovascular injury is low and the precision of a saw minimizes risk of iatrogenic fracture to the fibula. The synostosis can then be removed en bloc from the wound. If partial excision of the synostosis occurred, the

FIGURE 1. A cannulated drill is passed over a guidewire to create the tunnel for the graft from medial to lateral. Confirmation of guidewire placement is performed to ensure the correct position.

remaining portion should be excised in similar manner. The fibula should now be freely mobile.

Posterior Malleolus Osteotomy

The posterior malleolus may be addressed at this point if there is a malunion. The fibula can be anteriorly translated and temporarily fixed to tibia with a 0.062 Kirschner wire. Fluoroscopy is used to confirm the location of the malunion. An oscillating saw is taken from lateral to medial to osteotomize the posterior malleolus with a malleable retractor placed in the tibiotalar joint to prevent iatrogenic cartilage damage. The posterior malleolus is reduced, which typically requires inferior and medial translation. Temporary fixation

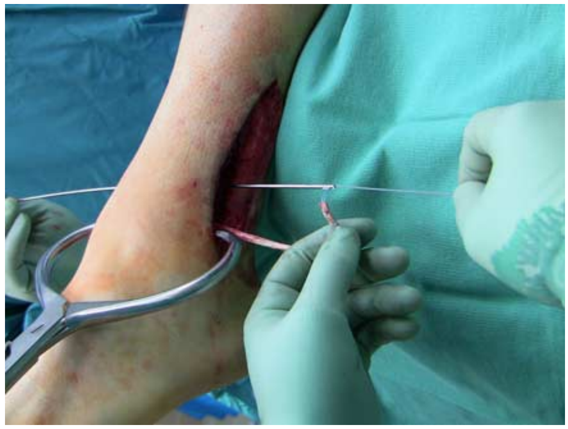

FIGURE 3. The graft is passed over the fibular bone bridge and taken medially with the aid of the beeth pin.

using 0.062 Kirschner wires is performed and adjustments are made until the reduction is near anatomic and verified on direct visualization and fluoroscopy. A one-third tubular plate is typically used for final fixation. Initial screw placement is proximal to the osteotomy to aid in compression of the fragment.

Ankle Arthrotomy

A medial ankle arthrotomy is then performed. An incision is made from 5 cm proximal to the tip of the medial malleolus extending inferior and distal along the course of the deltoid ligament to the navicular. Proximal extension can be made to adequately visualize the allograft tunnels. Care must be taken to protect the saphenous nerve in the anterior aspect of the wound. A medial malleolar malunion, if present, must be addressed as the talus cannot be adequately reduced in the setting of a laterally translated medial malleolus. Dissection is taken posteriorly and the posterior tibial tendon is identified and protected. The malunion is identified both visually and with fluoroscopy. The osteotomy is then performed with an oscillating saw through the malunion. The deltoid ligament is not violated. In the setting of a pure ligamentous injury, the deltoid ligament is transected from anterior to posterior from the medial malleolus leaving a 2 mm cuff of tissue for repair.

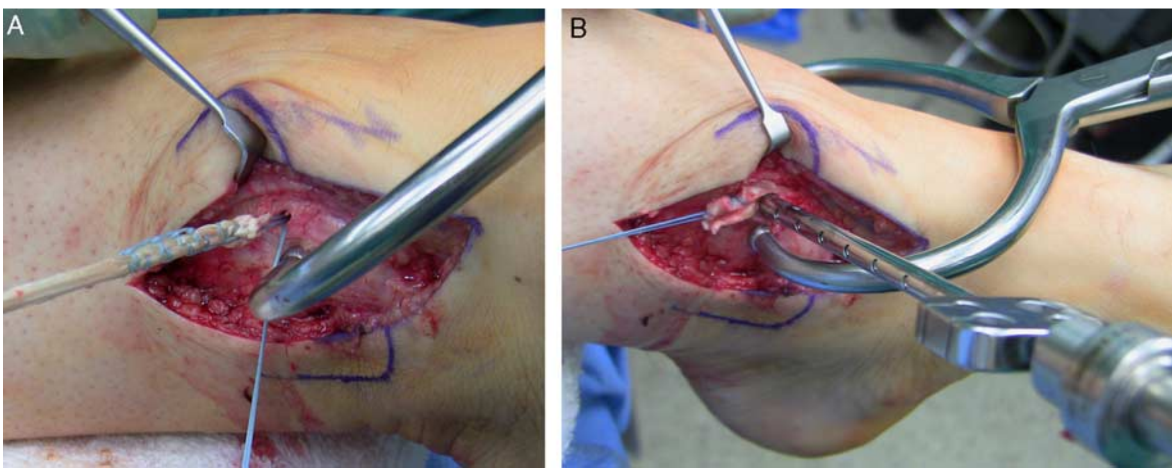

FIGURE 2. A, The allograft is passed from medial to lateral. B, With tension held on both ends of the graft, initial fixation is performed medially to secure the graft to the tibia.

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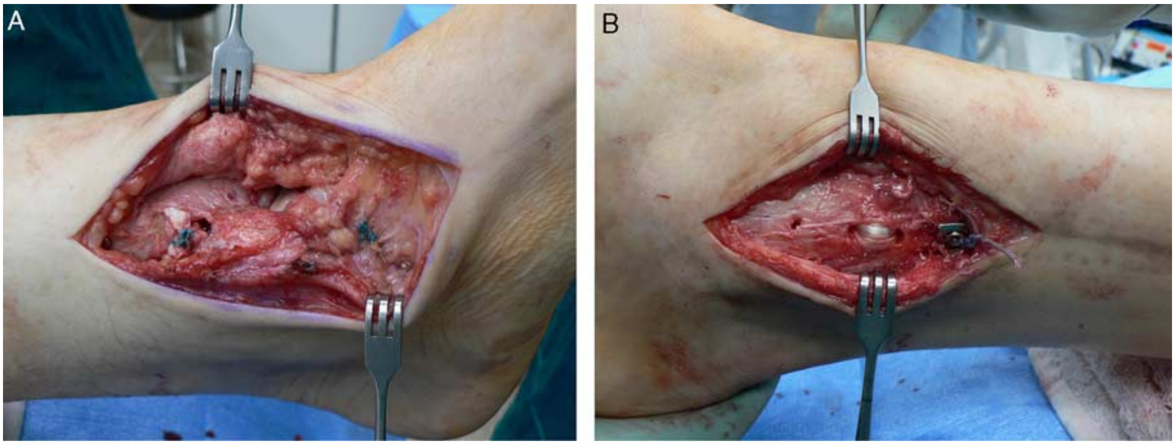

FIGURE 4. Final appearance of the graft medially (A) and laterally (B).

Dissection can be taken anteriorly across the tibiotalar joint to remove any osteophytes or treat a medial osteochondral lesion if present. Scar tissue is often abundant in the medial gutter and prevents reduction if not thoroughly debrided.

Reduction of the Syndesmosis

Once adequate debridement has been performed, reduction of the syndesmosis can be obtained. A large tong clamp is placed from the fibula to the anteromedial tibia at the level of the ankle joint and the syndesmosis is reduced. The reduction is judged both fluoroscopically and under direct visualization. Reduction must be obtained in both the coronal and sagittal plane. The talus will be translated medially into its anatomic position adjacent to the medial malleolus.

Fibular Osteotomy

If preoperative radiographs indicate a shortened fibula, or if an anatomic reduction cannot be obtained due to a fibular malunion, an osteotomy is required. Fibular osteotomy in this setting is complicated by the significant soft tissue stripping that has occurred along with the need to place a structural graft to lengthen the fibula. Thus, the recommended technique is an oblique osteotomy through the malunion of the fibula, preserving and maintaining continuity of the patient's fibula. The distal limb of the fibula is translated distally to achieve the required length. Fixation should be performed with a posterolateral plate and lag screw through the plate if possible. This will allow placement of the tendon graft directly apposing the fibula. If anatomic restrictions do not allow posterolateral plate application the graft will have to be placed superficial to the plate, which is less ideal. The surgeon must trim the graft to fit through the holes of the plate and the patient should not undergo hardware removal at a later date to prevent disruption of the reconstruction.

Graft Preparation

The allograft is then prepared and tensioned to 10 lbs of longitudinal pressure for 10 minutes to minimize graft creep and loss of reduction. The author typically uses semitendinosus allograft and recognizes that other options are available, including autograft. The length is always sufficient and the graft is ideally fashioned to a 4.5 mm diameter. Although tibialis anterior is another viable option, the diameter of the graft is slightly larger than the semitendinosus, requiring larger drill holes and a theoretically higher subsequent risk of fibula fracture.

Preliminary Syndesmotic Fixation

After the syndesmosis is adequately reduced, preliminary fixation is obtained with a suture-button device approximately 4 cm proximal to the distal tibia in patients without prior

FIGURE 5. A locking plate is utilized routinely to minimize the risk of fibular fracture. Fixation is difficult to perform given the multiple drill holes required for the graft and the suture-button. Placing the plate superficial to graft allows hardware removal at a later date without compromising the reconstruction.

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surgery. The suture-button reduces stress of the graft and thus theoretically decreases the rate of early failure. The suture-button has demonstrated the ability to maintain syndesmotic reduction and allow more physiological motion of the fibula relative to screw fixation.[32] In addition, it eliminates the need for hardware removal.

Graft Placement

In revision cases, before placing the suture-button, preexisting screw holes in the fibula are identified and 2 holes are marked for the graft. The suture-button should be placed 1 cm proximal to this level. The ideal location of the allograft is 1 and 2.5 cm proximal to the tibia; however, use of prior drill holes is vital to prevent fracture. With the clamp and suture-button in place, 2 guidewires are drilled at the chosen level for the allograft parallel to the tibiotalar joint at a 30-degree angle (posterior to anterior) from the fibula to the anteromedial tibia under fluoroscopy. Tunnels are drilled with a long 4.5 mm cannulated drill over the pins through both the tibia and the fibula (Fig. 1).

One limb of the allograft is passed from medial to lateral with a beeth pin and fixed medially with an absorbable 5.5 × 15 mm BioTenodesis screw (Fig. 2). The fixation strength is assessed by lifting the entire leg from the allograft suture ends. The graft is passed over the fibular bone bridge and then lateral to medial with the beeth pin (Fig. 3). Holding tension by the sutures ensuring the graft itself is also tensioned and not held up with the bone tunnel, a second 5.5 × 15 mm absorbable BioTenodesis screw is used to fix the second arm of the graft to the medial tibia. The remaining graft is sewn to itself over a medial tibial bone bridge and any excess graft is then excised. The reduction clamp is removed and the reconstruction is assessed for stability. The final appearance of the graft in situ is shown in Figure 4.

Deltoid Ligament Repair

The fibula should be stable to external rotation stress testing before deltoid ligament repair. Medially, the deltoid ligament is closed in a pants-over-vest manner imbricating the lengthened ligament. If a medial malleolar osteotomy was performed this should now be reduced and fixed. Typically, the site of the malunion is far distal, leaving little room for fixation. The use of a hook plate can aid in fixation of this small fragment.

Given the high stress placed upon the fibula from graft tensioning, a locking plate is now placed over the fibula spanning the graft and suture-button (Fig. 5). This is done to prevent early postoperative facture, which can occur compromising the reconstruction. In this setting, the fracture should be reduced and fixed promptly, as a malunion of such a fracture will compromise the achieved syndesmotic stability.

Closure

The wounds are copiously irrigated with sterile saline solution. The arthrotomy and deep tissues are closed with interrupted, 2-0 absorbable suture and the subcutaneous tissue is closed with interrupted, inverted 3-0 absorbable suture. The skin is then closed with alternating 3-0 nylon simple and vertical mattress stitches to relieve tension on skin edges. The lower extremity is then placed in a well-padded short-leg splint with the ankle in neutral position.

POSTOPERATIVE MANAGEMENT

Patients are initially placed in a short-leg splint for 2 weeks and transitioned to a non–weight-bearing cast at the first postoperative visit. They maintain non–weight-bearing for 4 more weeks in a cast and are then transitioned to weight-bearing as tolerated in a cast boot. They are encouraged to remove the boot to perform ankle range of motion home exercises as instructed by a physical therapist. After a total of

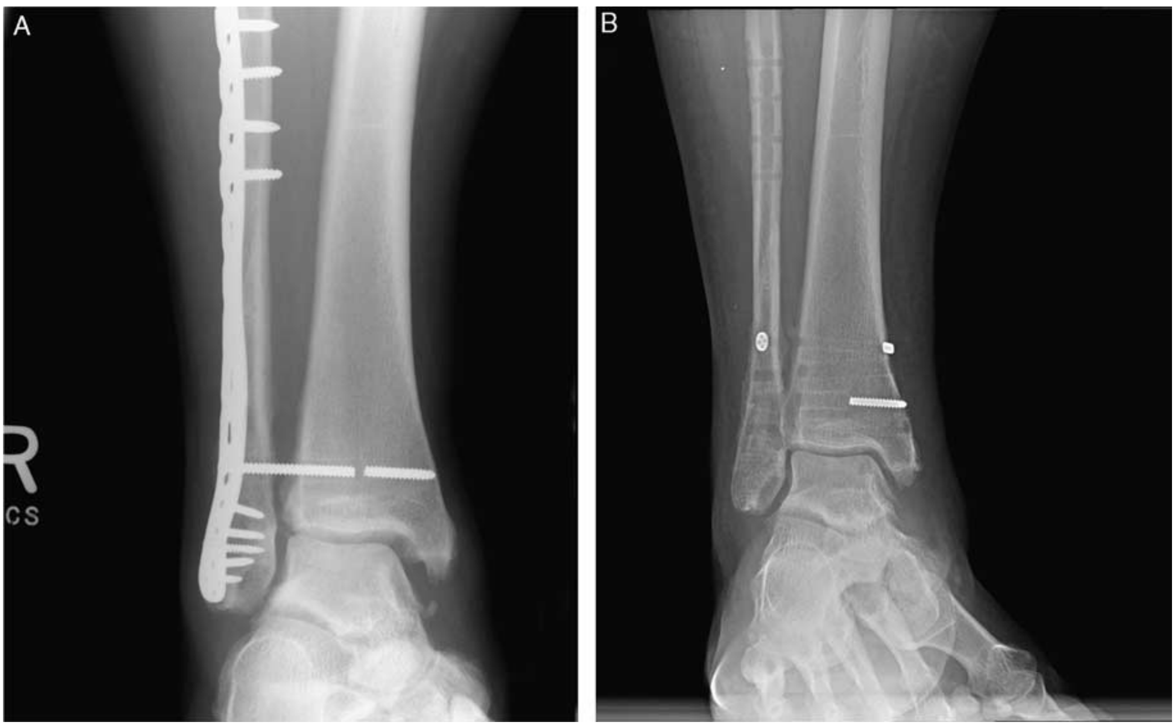

FIGURE 6. A, Preoperative mortise of a patient with failure of the syndesmotic fixation s/p open reduction and internal fixation. B, Six-month postoperative weight-bearing radiograph demonstrates stable reduction of the syndesmosis and medial clear space.

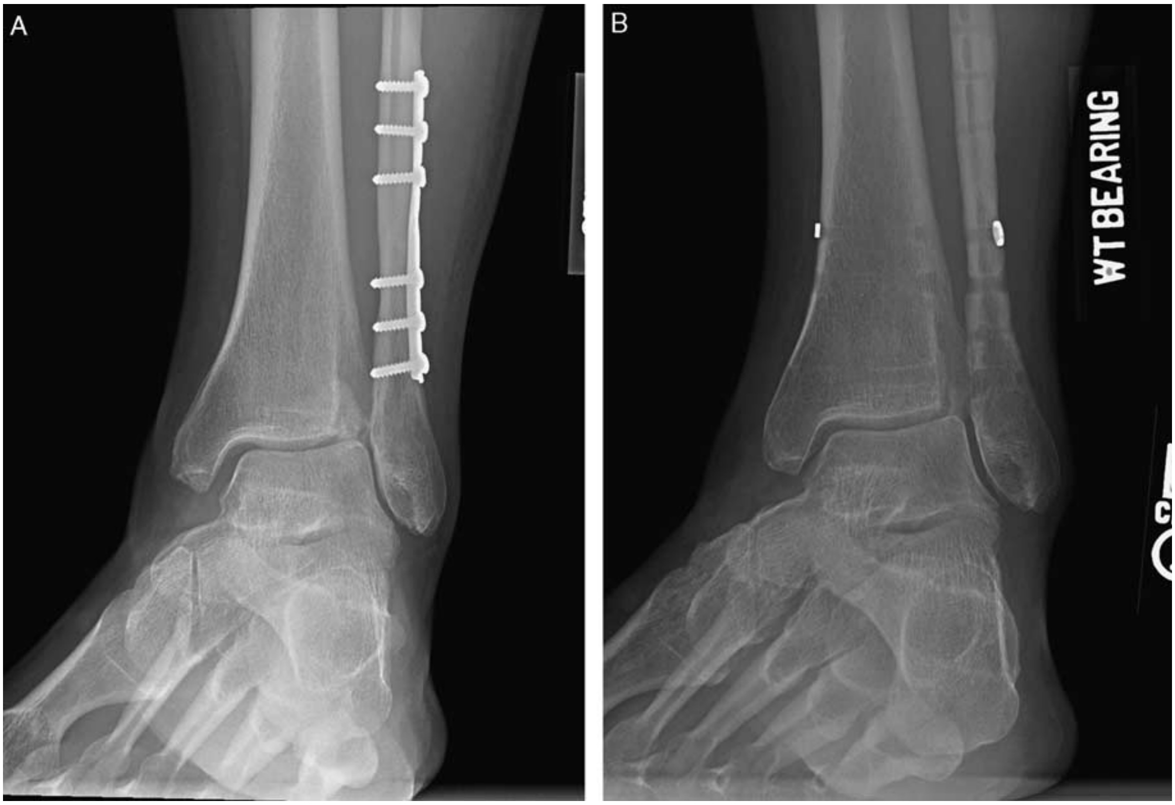

FIGURE 7. A, Preoperative mortise of a patient with an untreated syndesmotic injury. B, One-year postoperative weight-bearing radiograph demonstrates stable reduction of the syndesmosis and medial clear space.

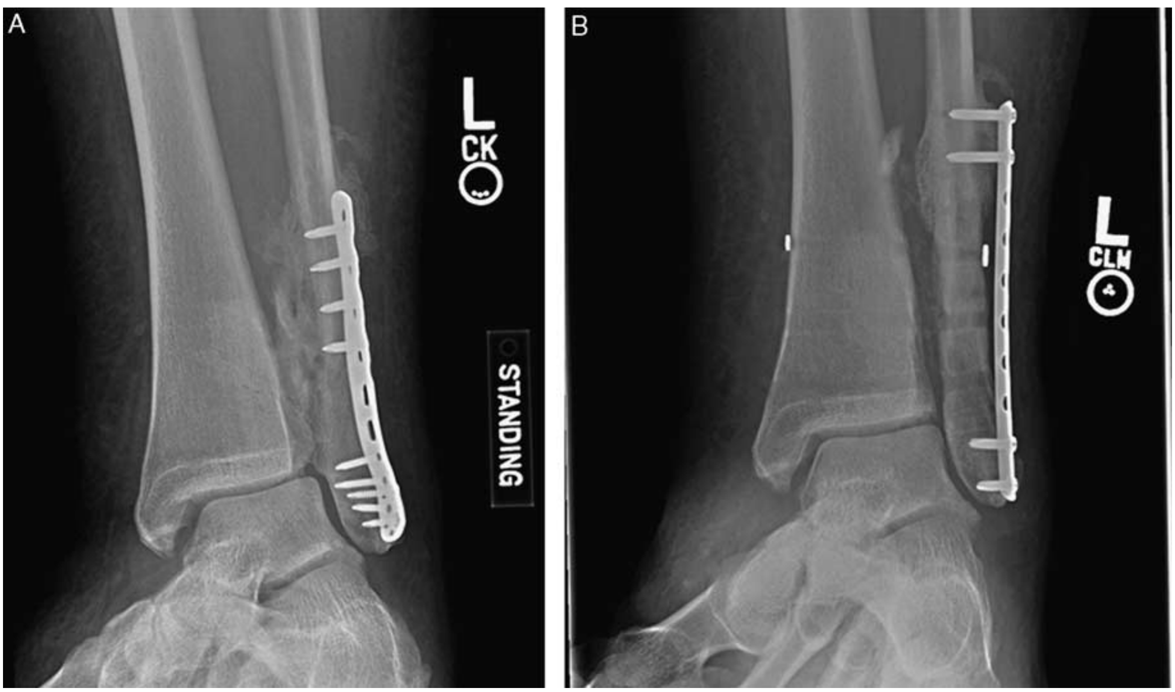

FIGURE 8. A, Preoperative mortise of a patient with an untreated syndesmotic injury who developed a significant synostosis. B, Three-month postoperative radiograph demonstrates excision of the synostosis with stable reduction of the syndesmosis and medial clear space.

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12 weeks of protection, patients are slowly allowed to transition out of the boot to a lace up ankle brace and standard shoe wear. At 6 months, they are allowed to return to full activity or transition back to sport-specific exercises. Postoperative radiographs are obtained at the first, 6 week, 12 week, 6 month, and 1 year visit to ensure stability of the reconstruction after full return of activity.

RESULTS

Moravek and colleagues reported excellent results after the successful treatment of 6 consecutive patients using this technique with a mean follow-up of 12 months (range, 5 to 17 mo). Of the 6 patients, 3 failed previous treatment, whereas 3 had a missed diagnosis. All had a minimum of 1 prior surgical procedure. The revision procedure occurred at a mean of 14 months (range, 8 to 25 mo) after initial injury. BMI averaged 36.6 (range, 24 to 46) and 4 patients were smokers who were required to stop before surgery. Mean postoperative plantar flexion was 35 degrees (range, 30 to 40 degrees), and dorsiflexion 5 degrees (range, 0 to 10 degrees). Overall, 5 patients were completely satisfied and 1 was satisfied with reservation with excellent correction of the radiographic deformity (Figs. 6–8). All patients reported a willingness to undergo the surgical intervention again. At most recent follow-up, no loss of reduction or increase in the medial clear space was seen.

COMPLICATIONS

Using this technique only 1 of 6 patients suffered an early postoperative fibula fracture requiring open reduction and internal fixation of the fibula and revision medial malleolar fixation. No other postoperative complications in this series were reported.[21] Specific complications associated with the use of allograft tendon include postoperative elongation, rupture or failure of incorporation. Also disease transmission and immunogenic host reaction to the allograft have been reported.

POSSIBLE CONCERNS, FUTURES ON THE TECHNIQUE

Currently, there are few studies reporting outcomes after double limb semitendinosus allograft reconstruction for treatment of chronic syndesmotic injuries. The greatest concern with the use of allograft is its ability to reconstitute the strength and anatomic function of the native syndesmosis. The technique presented in this article is an excellent option for reconstruction of the subtly unstable or completely disrupted syndesmosis. In more severe injuries, such as those with marked syndesmotic instability and talar shift, it is possible that likelihood of a symptom-free outcome is less given the frequency of associated injuries in this population. Further studies with long-term follow-up are needed to determine the stability of the reconstruction and the incidence of degenerative changes within the tibiotalar joint.

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