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Tips Quips, and Pearls

Technique for Utilization of an Interference Screw for Split Peroneus Brevis Tendon Transfer in Lateral Ankle Stabilization

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ABSTRACT

We present a technique for split peroneous brevis lateral ankle stabilization using an interference screw as the fixation device. The interference screw provided stable fixation by way of physiologic tension and restored lateral ankle instability while preserving the range of motion in the surrounding joints.

Ankle sprains secondary to chronic lateral ankle instability are 1 of the most common injuries of the lower extremity. The typical mechanism of injury involves forced inversion on a plantarflexed foot, causing hyperextension injuries to the anterior talofibular and calcaneofibular ligaments. Conservative and surgical interventions are both viable treatment options; however, residual functional instability after moderate-to-severe-ankle sprains has been linked to a recurrence rate as great as 80% with conservative treatment (1,2).

Historically, a variety of surgical procedures have been used to stabilize the lateral ankle. In 1934, Brostrom reported success with a technique of reappointing the ends of the impaired lateral ligaments (3). Reed (4) reported a modification of the procedure by Elmslie, who used a graft strip of fascia lata to reinforce the injured ligaments in an anatomic fashion. Karlsson et al (3) reported using an imbrication technique consisting of shortening and reinserting the ligaments and securing them with suture anchors. Others have described procedures involving soft tissue tendon transfers to reinforce the lateral ankle ligaments (5).

The use of an interference screw for repair of lateral ankle instability has been shown to be effective (6,7). Interference screws are fully threaded headless screws that allow for greater contact between a bone and its soft tissue interface (8).

Surgical Technique

The patient is placed on the operating table in the supine position, and a thigh tourniquet is applied. A bump is placed under the ipsilateral hip to provide adequate exposure to the lateral aspect of the foot and ankle. Intraoperative stress radiographs, including the talar tilt and the anterior drawer tests, are performed to verify ankle instability (Figs. 1 and 2).

A 12-cm incision, extending distally toward the base of the fifth metatarsal, is made at the level of the peroneal tendon and then deepened through the same plane using sharp and blunt dissection and avoiding all neurovascular structures. The tissues are incised down to the peroneal tendon sheath. The sheath is incised, and after the peroneal longus and brevis tendons have been identified, the split peroneal brevis procedure is performed, removing the anterior third of the peroneal brevis tendon. Once completed, a 4.0-mm drill is used to make a drill hole at the level of the ankle joint in the middle of the fibula from anteriorly to posteriorly. A whipstitch is applied to the free end of the brevis tendon, and the tendon is passed from anteriorly to posteriorly through the hole in the fibula (Fig. 3). A small incision is made through the soft tissues superior to the calcaneus to create an access point on the superior aspect of the calcaneus, 2 to 3 cm from the posterior aspect. The Stryker™ (Stryker Orthopaedics, Mahwah, NJ) guidewire femoral eyelet drill system is used to introduce the wire at the dorsocentral aspect of the calcaneus, and a through and through channel is created from the dorsal to plantar direction.

The central placement of the guidewire through the calcaneus is determined with intraoperative fluoroscopic guidance, using lateral

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Fig. 1. Preoperative ankle mortise stress radiograph demonstrating a positive talar tilt and instability of the lateral collateral ligaments.

Fig. 2. Preoperative ankle lateral stress radiograph demonstrating a positive anterior drawer sign.

and calcaneal axial views. The peroneus brevis tendon is passed superiorly to the remaining brevis and peroneus longus tendons to act as the retinaculum and is inserted into the calcaneus using the guidewire (Figs. 4 and 5). The ankle is placed into a neutral position at 90° to the leg, and the tendon is advanced into the calcaneal tunnel using the Stryker™ force fiber wire. Surgeon preference dictates the appropriate amount of physiologic tension to be placed on the tendon. To accomplish this step, the surgeon's assistant applies distal tension to the force fiber wire, which is extending through the plantar aspect of the foot. Next, a 1-mm guidewire is inserted into the calcaneus to act as a cannulated system for the interference screw. Using fluoroscopy to guide placement, a 7.0 × 2.5-mm absorbable interference screw is introduced into the calcaneus (Fig. 6). The assistant again applies plantar pressure against the calcaneus while pulling on the force fiber wire, and the exposed wire is cut. The deep and superficial layers are then closed according to surgeon preference. The patient is placed in a cast for 3 to 4 weeks and is then started in a physical therapy program.

Discussion

The most commonly injured structures in lateral ankle sprains are the anterior talofibular and calcaneal fibular ligaments (9). Numerous methods have been used to repair these structures (7,10,11). A number of investigators have demonstrated the effectiveness of interference fixation, which entails placement and fixation of a soft tissue graft into a cancellous bone tunnel with the use of a specialized screw that applies the amount of compression necessary to secure the tissue (10,11). This technique was originally developed for use in anterior cruciate ligament repair in the knee and was found to provide superior fixation strength compared with a number of other techniques (10).

Various factors have been determined to play a role in the strength and stability provided by interference screws. A longer screw length, which allows penetration of both the cortical and the cancellous regions of the bone, has been found to provide increased strength of fixation (12). In addition, placement of the screw as near to parallel as possible within the predrilled channel has been determined to promote the greatest amount of bony purchase, thereby allowing the

Fig. 3. Intraoperative photograph demonstrating application of a whipstitch.

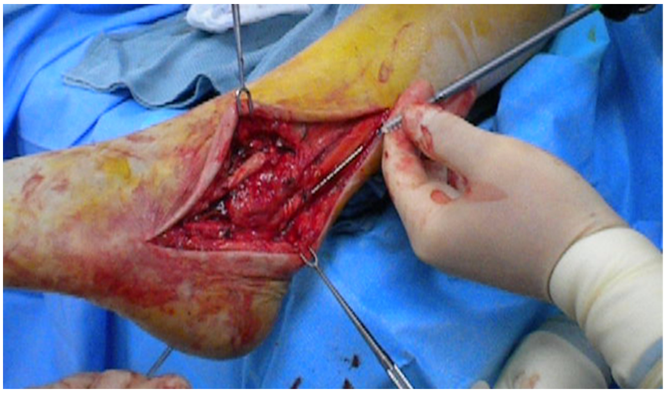

Fig. 4. Intraoperative photograph showing application of tension on the split peroneal brevis tendon over the remaining peroneal brevis and peroneal longus tendons.

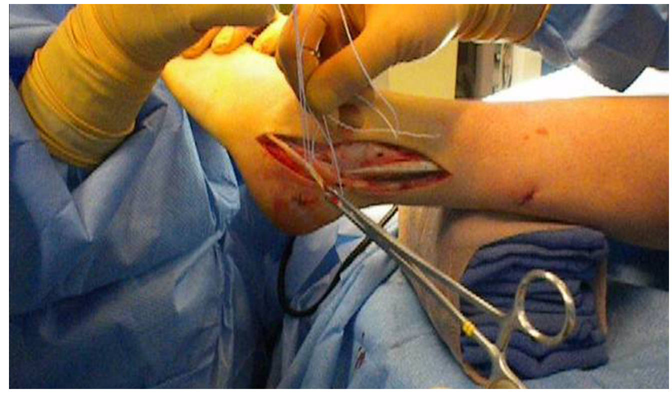

Fig. 6. Lateral radiograph demonstrating the interference screw well seated in the body of the calcaneous.

greatest amount of pullout strength (13). Furthermore, proper preparation of the tendon graft using Chinese finger-trap tubularization, the method described by Krackow and Cohn (13), will help to prevent compacting of the tendon when it is being passed into the predrilled canal. In the technique we have described, the whipstitch suture technique is used. Finally, some have theorized that the absorbable type of interference screw achieves optimal bone production at the bone–tendon interface owing to the slow increase in the amount of physiologic tensile forces placed on the tendon (11).

The potential disadvantages of this technique are those that can be encountered when using any bioabsorbable implant. These include host inflammatory response, decreased implant strength, decreased pullout strength, and greater cost (14). However, it has been proposed that the mechanical stability of the implant itself might decrease the rate of degradation, thereby helping to decrease the occurrence of a host inflammatory response secondary to degradation byproducts (15). Regarding the strength of the implant, it has been found that careful patient selection and a proper application technique will yield greater rates of success. Finally, the initial cost of the implant might be offset by the avoidance of additional operations for surgical removal of painful hardware (11,16).

The present report describes a technique for lateral ankle stabilization that involves using an interference screw for transfer of a split peroneus brevis tendon into the calcaneus. Similar techniques have been previously described by a number of investigators for other tendons within the foot and ankle region with positive results (11,12,17,18). By splitting the peroneus brevis muscle, only a portion is removed from the osseous insertion; therefore, functional eversion of the foot is maintained. Furthermore, this method allows for replication of both the anterior talofibular and the calcaneofibular ligaments, providing superlative correction of lateral ankle instability and preserving the motion within the surrounding joints.

Fig. 5. Intraoperative photograph inserting bioabsorbable screw into the cannulated system while applying physiologic tension plantarly on the split peroneal brevis tendon.

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