CHAPTER 36

CHRONIC LATERAL ANKLE INSTABILITY: REPAIR VERSUS RECONSTRUCTION

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Lateral ankle injuries are a common presentation in the emergency room, as well as, the physician's office. Most often these injuries can be treated with conservative and functional therapies. Regardless of the initial treatment, 20% of patients will develop persistent functional instability of the ankle.[1] Conversely, 80% of conservatively treated patients with a lateral ankle injury, will have no resultant functional instability. With this premise, the majority of acute lateral ankle injuries should be treated conservatively. Only certain circumstances require surgical intervention in the acute lateral ankle ligamentous injury.

Cain and Merrill recommend primary repair of the acutely injured ligaments in the active, athletic individual with high activity expectations.[2] Kalish, Ruch, and Boberg have similar recommendations for athletic individuals.[3] Trevino et al. offer as an indication for surgery in the acute ankle ligament injury the following: the high-level athlete, the acute severe sprain combined with a history of chronic instability which has undergone appropriate attempts at conservative functional treatment, and displaced osteochondral fracture of the talus or large avulsion fracture of the distal fibula.[4] The remaining patients with Grade I, II, and even Grade III lateral ankle injuries should be treated with conservative functional means. For those patients that may require delayed repair or reconstruction of the lateral ankle ligaments after conservative attempts, the results of the surgical treatment compare favorably with those of primary repair of acute injuries.[4]

Controversy remains on the preferred treatment of the functionally unstable ankle after previous lateral ankle injury. Two schools of thought have developed, those in favor of anatomic repair, and those advocating ligament reconstruction through the use of either autogenous structures, animal tendon, or synthetic materials. Many different procedures, and variations of those procedures, for augmented reconstruction of the lateral ankle, have been described in the literature. Each reconstructive procedure has attempted to provide stability of the lateral ankle in an anatomic configuration.

ANATOMY

The anatomy of the lateral ligamentous complex of the ankle joint consists of the anterior talofibular ligament (ATF), the calcaneofibular ligament (CF), and the posterior talofibular ligament (PTF). The lateral talocalcaneal ligament, while not a part of the ankle joint ligament complex, deserves attention due to its function in subtalar joint stability. It is not uncommon to see both ankle joint and subtalar joint lateral instability.

The peroneal tendons also are important structures of the lateral ankle. The peroneus brevis functions to assist in rearfoot eversion and stabilize the lateral column, thereby acting as a dynamic lateral ankle stabilizer.[5] The peroneus longus functions to evert the rearfoot in open kinetic chain, but may actually act to invert the subtalar joint in closed kinetic chain, secondary to retrograde plantar flexion of the first metatarsal.[6]

Burks and Morgan offered detailed descriptions, directions, and points of attachment of the lateral ankle ligaments in their cadaveric study of 39 ankles.[7] They found that the ATF ligament had an average width of 7.1 mm, and average length of 24.8 mm. The center of the fibular attachment averaged 10.1 mm from the proximal tip of the fibula. The center of the talar attachment averaged 18.1 mm superior to the subtalar joint. Their study revealed an average CF ligament width of 5.3 mm and average length of 35.8 mm. The center of this ligament began at the anterior edge of the fibula 8.5 mm from the distal

tip, and attached at the calcaneus 13 mm distal to the subtalar joint. The CF ligament was found to form a 133 degree angle from the bisection of the fibular, while the ankle was in a neutral position (Fig. 1).

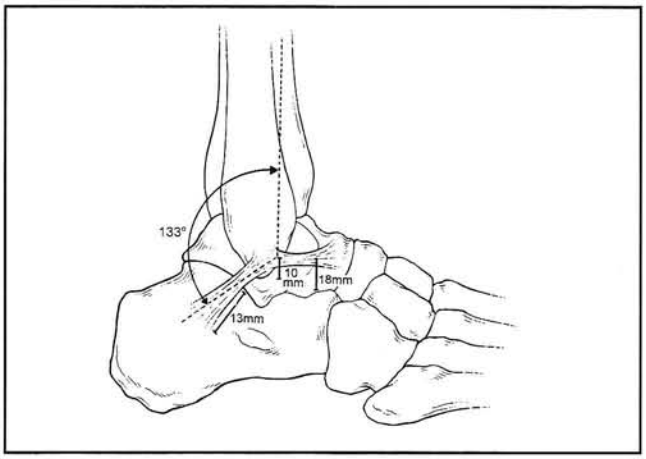

Figure 1. The anatomy of the lateral ligament complex as described by Burks and Morgan.

In an inversion injury of the ankle, with the foot in a plantar-flexed attitude, the anterior lateral capsule of the ankle joint is injured first. Injury of the ATF and CF ligaments, respectively, follow with increasing force. The PTF ligament is rarely injured. Colville et al. demonstrated that the ATF ligament and the CF ligament function synchronously to resist inversion of the ankle joint, in all angles of plantar flexion.[8] Cass and Settles used computer tomography in 19 cadaveric specimens to demonstrate that talar tilt occurred only when both the ATF and CF ligaments had been released.[9] These studies, as well as others, suggest that any procedure to repair or reconstruct the lateral ankle ligaments should include both the ATF and the CF ligaments whenever possible.

ANATOMIC REPAIR OF LATERAL ANKLE LIGAMENTS

Patients with ankle joint pain and swelling which interferes with either their daily, or competitive activities are candidates for lateral ankle repair or reconstruction.[5] These patients may give a history of a "weak ankle" or a "giving-out" of the ankle. In the authors' experience, the ruptured ends or the attenuated lateral ankle ligaments can be located intraoperatively, in the majority of cases of chronic ankle instability (Fig. 2). This is the reason that delayed primary repair of the ligaments is advocated, before an augmented or reconstructive procedure is attempted.

Brostrom described the classic primary anatomic repair as a mid-substance repair of the free ends of the ATF and CF ligaments.[10] Karlsson et al. described a shortening of the ligaments with re-attachment to the fibula through the use of drill holes.[11] Their experience demonstrated that the ligaments were stretched rather than ruptured in the majority of chronic ankle instability.

Sjolin et al. repaired the lateral ligaments, and reinforced the repair with periosteal flaps. They reported an 86% excellent, or good functional result with a median 24 month follow-up.[12] Gould and associates[13] coined what has now become the "modified Brostrom" procedure. This modification included repair of the lateral talocalcaneal ligament, if needed, and reinforcement of the ligamentous repair using the lateral extensor retinaculum (Fig. 3). Various authors have described minor modifications in the Brostrom repair utilizing different commercially-available soft tissue anchoring devices.[14-16] Kashuk and associates described repair of the ATF ligament through the ankle arthroscope, however, repair of the CF ligament could not be accomplished with this technique.[17]

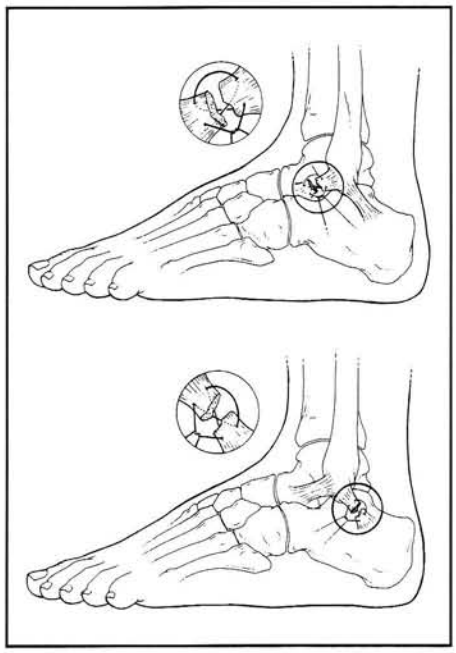

Figure 2. Anatomic repair of the anterior talofibular ligament and calcaneofibular ligament.

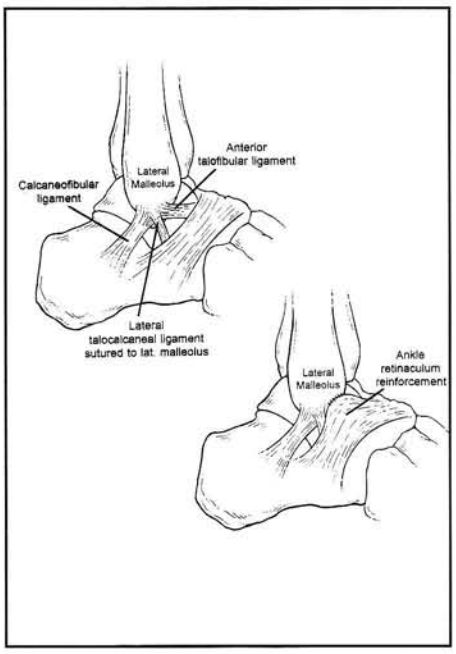

Figure 3. Gould modification of the Brostrom technique.

The advantages of a delayed primary repair of the chronic unstable lateral ankle ligaments include restoration of normal anatomy, restoration of normal joint mechanics, preservation of subtalar joint motion, a smaller incision, no donor site morbidity, and no weakening of any other muscle-tendon complex.[1]

Visser et al. feels that with repetitive injury, the lateral ligaments and other soft-tissue undergo a fibrous replacement and atrophy.[18] These structures are then inadequate to anatomically repair, and then act as a stabilizing force. Therefore, Visser et al. report that delayed primary repair is inferior to lateral ankle stabilization or reconstruction procedures.

Again, the authors' have not found evidence of this intraoperatively. If inadequate structures are present when a primary repair is being performed, a reconstructive procedure such as the Split Peroneal Brevis Lateral Ankle Stabilization (SPBLAS) can be undertaken. The patient with long-standing ankle instability, previous attempted anatomic repair, or generalized joint hypermobility should be consented for this possibility.

Results of this anatomic primary repair of the lateral ankle ligaments have been very satisfactory. Brostrom reported 85% success rate, or functional results with no symptomatic functional instability.[10] Karlsson reported good or excellent functional results in 86% of the patients in his study.[11] Hamilton et al. performed the Gould modification of the Brostrom procedure on 28 ankles, more than half of which were high-level professional ballet dancers.[19] They felt that this is the procedure of choice for athletes, especially dancers, who need a stable ankle with full range of plantar flexion and dorsiflexion, and normal peroneal function.

Postoperatively, patients undergoing this primary anatomic repair of the lateral ankle ligaments are placed in a non-weight-bearing compression cast for 10 to 14 days. This is followed by a weight-bearing below-knee cast for post-operative weeks two to four, and then in an air or gel stirrup ankle brace device for postoperative week four to six.[1,20] A gradual return to function can be expected over the next postoperative month.

RECONSTRUCTION OF LATERAL ANKLE LIGAMENTS

A procedure which attempts to reconstruct the lateral ankle ligaments is necessary where chronic injury has left the ligaments atrophic or absent.[3,21] Intraoperative findings of insufficient ligamentous tissue for primary repair is also an indication for augmented reconstructive techniques, such as the SPBLAS.[22] Karlsson states that the indications for an augmented lateral ankle ligament procedure are long-standing severe instability of greater than ten years, generalized hypermobility of joints, and a previously failed nonaugmented repair.[11] Since the majority of these reconstructive procedures secondarily limit the subtalar joint motion, by design, another indication might be where subtalar joint and ankle joint instability exist concurrently.

Many different structures have been used in reconstructive procedures to augment the lateral ankle ligaments. Most commonly, the peroneus brevis tendon, either in whole or in part, has been described. Evans used the peroneus brevis tendon in a tenodesis procedure to limit ankle inversion.[23]

The Watson-Jones tenodesis procedure is similar to the Evans, with the addition of reconstructing the ATF ligament by routing the peroneus brevis tendon through the talar neck.[24] The Chrisman-Snook procedure involves the use of a split peroneus brevis tendon to reconstruct the ATF and CF ligaments.[25]

The SPBLAS procedure, developed at Doctor's Hospital in Tucker, Georgia more than 20 years ago, is a modification of the Chrisman-Snook procedure. It is similar in its tendon routing to a procedure described by Winfield in 1953, in which all of the peroneus brevis tendon was used.[3,5] The SPBLAS procedure has been used successfully by many of the Podiatry Institute faculty (Fig. 4).

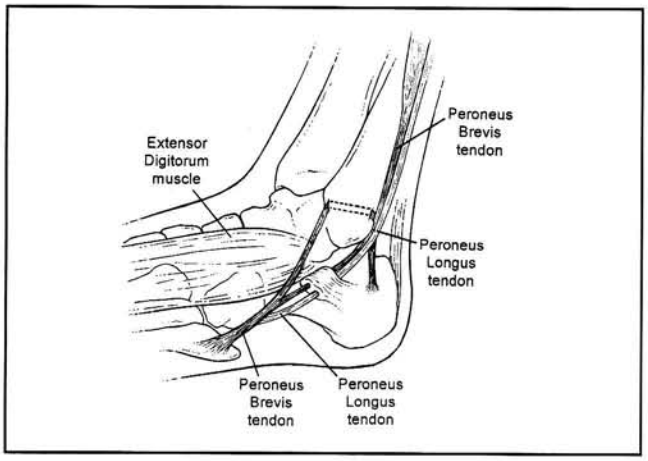

Figure 4. Split Peroneus Brevis Lateral Ankle Stabilization (SPBLAS) procedure.

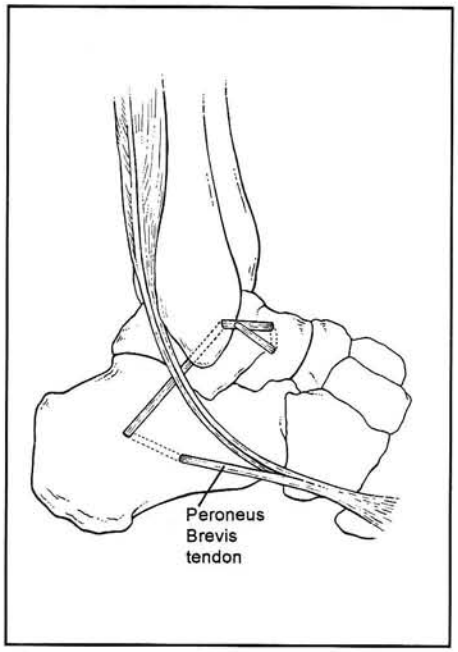

Figure 5. Modified SPBLAS as described by Colville and Grondel to prevent the limitation of subtalar joint motion. (Redrawn from Colville MR, Grondel RJ: Anatomic Reconstruction of the Lateral Ankle Ligaments Using a Split Peroneus Brevis Tendon Graft. *Am J Sports Med,* 23:212, 1995.)

The disadvantage to the procedures that utilize the peroneus brevis tendon is that the tendon-ligament crosses perpendicular to the subtalar joint axis, and can therefore, limit subtalar joint motion. Corville and Grondel have described a variation in the Chrisman-Snook procedure where the split portion of peroneus brevis tendon is routed first through an oblique osseous tunnel in the calcaneus, second through an oblique osseous tunnel in the distal fibula, and lastly, through a vertical osseous tunnel in the talar neck (Fig. 5). This orientation of the split peroneus brevis tendon closely duplicates the anatomic ATF and CF ligaments without restricting subtalar joint motion.[21]

Many other autogenous structures have been advocated in the reconstruction of the lateral ankle ligaments. Early on, Elmslie used the fascia lata as a free graft.[26] The peroneus longus,[6,27] the peroneus tertius,[28] and the plantaris[29,30] have all also been utilized with satisfactory results. Yu et al. believed that using a split peroneus longus tendon, (in a similar manner that the split peroneus brevis tendon is used in the SPBLAS procedure), partially inhibits forefoot inversion and allows the peroneus brevis to evert without compromise.[6] Xenografts have also been used with acceptable results in augmented reconstruction of the lateral ankle ligaments.[31]

There are few advantages of the augmented reconstructed lateral ankle ligament procedures. It is felt by some authors and investigators to be superior in strength. The disadvantages are numerous when compared to anatomic primary repair. The augmented reconstructed ligament repair requires a much larger incision, and often is more complicated and cumbersome to perform. The risk of wound complications, such as nerve entrapment and dehiscence, is proportional to the size of the incision. There is also a certain amount of morbidity associated with the use of an autogenous tendon with weakness in eversion of the rearfoot resulting.[1] Several of these procedures unwantingly limit subtalar joint motion.[32]

The majority of the studies of the augmented reconstructed lateral ligaments show favorable results. Snook and Chrisman's long term follow-up of their procedure revealed satisfactory stabilization in more than 90% of the patients at an average of ten years postoperatively.[33] Unfortunately, while stable, patients frequently complain of persistent pain postoperatively.[1,34]

CONCLUSION

A cadaveric study by Liu and Baker tested the static restraints of various surgical procedures including Chrisman-Snook, Watson-Jones, and modified Brostrom, versus intact and severed ATF and CF ligaments.[35] Their study demonstrated that the modified Brostrom procedure had less anterior talar dislocation and talar tilt than the cadavers which had the Chrisman-Snook or Watson-Jones procedures. While the anatomic repair of the lateral ankle ligaments produced greater static restraints then the peroneal brevis augmented reconstructed ligament procedure, neither type of procedure equaled the static restraints of the intact ligaments.

Zwipp, in a review of 347 lateral ankle surgeries and a follow-up study of 149 patients, found that both the primary ligament repairs and the tenodesis reconstructive ligament procedures produced good to excellent results in 90% of patients.[36] His final recommendation was that direct primary ligament repair be the first choice of procedures in chronic ankle instability. If only one ligament needs repair, an indirect ligament replacement with a periosteal flap should be the second choice. Lastly, the tenodesis procedures or ligament reconstructive procedures should be considered.

The average patient with a Grade I, II or III ankle sprain need not undergo surgical intervention. Conservative, yet functional treatment modalities should be undertaken. If the acute injury occurs in a competitive athlete with high physical expectations, or if the patient with an acute injury has a history of multiple lateral ankle injuries, then primary repair should be considered. For the 10% to 30% of patients treated conservatively who develop chronic ankle instability, the augmentation of ligament repair with tendon grafts or similar material is not necessary in most patients. The delayed primary repair of the lateral ankle ligaments, such as with the modified Brostrom procedure, has a high rate of success, preserves the motion of both the ankle and subtalar joints, and avoids the morbidity associated with the use of tendon grafts. The augmented reconstructive procedures should be kept in reserve, and implemented with an intraoperative decision when the ligaments cannot be repaired.

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