DELAYED PRIMARY REPAIR OF THE LATERAL ANKLE LIGAMENTS

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Chronic lateral ankle instability is a common condition that restricts activity in many otherwise healthy people. Many of these patients experience multiple episodes of their ankle "giving out", especially when the ankle is stressed or when the foot lands on uneven terrain. Chronic instability often leads to uneven mechanics and overloading of the ankle joint, which may result in osteoarthritis.[1] Many patients relate to having a "trick ankle" or an ankle that clicks upon active inversion.

Many surgical procedures have been described for the treatment of chronic lateral instability of the ankle. Tenodesis using one of the peroneus tendons, most often the peroneus brevis, is common. Examples are the Watson-Jones 1952, Evans 1953, and the Christman and Snook 1969 procedures. All of these techniques require that normal structures, such as the peroneal tendons, be used for reconstruction, and in none of these procedures is the normal anatomy completely restored.

This paper attempts to reintroduce the concept of delayed primary repair of the lateral ankle ligaments as was first described by Brostrom in 1966.[2] Brostrom reported on 60 patients who were treated by either reapproximating and suturing the torn ends of the anterior talofibular and calcaneofibular ligaments, or reattaching them to the lateral malleolus or talus (depending on the site of rupture). In a similar technique, members of the Podiatry Institute have been repairing the disrupted lateral ankle ligaments in chronically unstable ankles with good results.

LITERATURE REVIEW

It was previously thought that ruptured ends of the anterior talofibular and calcaneofibular ligaments atrophy, shorten, and reabsorb. However, Stener[3] demonstrated in his work on chronic ruptures of the ulnar collateral ligament of the metacarpophalangeal joint of the thumb, that the ligament ends were preserved and could be sutured years after the original injury. This led Brostrom to investigate the status of ruptured ligaments within the ankle joint. Brostrom[2] operated on sixty ankles and found an altered fascia cruris (deep fascia) in most cases. In 26 cases it was distinctly thickened and scarred, and in 18 cases it was thin and defective. Beneath the fascia, the peri-synovial tissue was in all cases greatly thickened and frequently highly vascularized. The capsular tissue was incised revealing the ligamentous pathology. Old tears of the anterior talofibular ligament were found in all cases, usually within the ligament substance. The ends of the ruptured ligaments were clearly separated, but as a rule were well preserved, with normal thickness and length. Histologic examination demonstrated in most cases normal ligamentous tissue without degenerative changes, but sometimes with fibrosis. However, in only two cases, insignificant remnants of ligament were found, and in four cases the freed end of the torn ligament seemed to be thinner and weaker than normal. Three cases showed partial ossification of the ligament substance.

According to Brostrom's study, 20 of the 60 patients demonstrated an avulsion from the lateral

malleolus, and one patient exhibited an avulsion from the talus. The avulsed bone fragments were all consistently rounded and covered with cartilage. They were fixed to the detached end of the anterior talofibular ligament.

The peroneal sheath was opened for inspection of the calcaneofibular ligament, and in about every fourth case, according to Brostrom, there was an area of scarring in the calcaneofibular ligament suggesting a healed rupture. In only two cases, the ligament was notably elongated and failed to tense on supination of the heel.

Brostrom obtained good results in 58 out of 60 patients by primarily repairing the ligamentous ends, or by anchoring the avulsed ligament to its corresponding bone after excising the avulsed fragment. In two cases, the remnants of ligamentous tissue were insufficient for suture, and the anterior talofibular ligament was reconstructed with a flap from the lateral talocalcaneal ligament.

Javors and Violet[4] reported good or excellent results in 13 of 15 patients who underwent delayed primary repair. In all cases, adequate ligamentous tissue was present for reconstruction. The torn ligaments were identified and either reapproximated or reattached to the lateral malleolus or talus, depending on the site of original rupture. In one of the cases the duration of symptoms was seventeen years old. Follow-up radiographs showed decreased talar tilt compared to the normal ankle in all but four patients, and those had no angle more than 3 degrees greater than that of the normal ankle.

Several authors advocate decorticating the anterolateral tip of the fibula where several drill holes are then made. The ligaments and joint capsule are then tightened with suture, while the foot is maintained in eversion and dorsiflexion. The procedure has been described variably by several European authors.[5,6,7] Their results are listed in Table 1. Their successful results imply that the remaining, healed lateral soft tissue structures are capable of supporting the lateral ankle, once these structures are surgically plicated or tightened at their insertion.

Ahlgren and Larrson[5] found that in patients with chronic lateral ankle instability, the ligaments are usually healed, but with lengthening and consequently functional insufficiency. A distal ligament advance was one of the procedures described by Milachowski and Wirth,[8] who found

Table 1

Results Of Lateral Ankle Stabilizations

NAME	YEAR	TECHNIQUE	# ANKLES	# GOOD/ EXCELLENT	%
Brostrom	'66	del. 1 rep.	60	58	97
Javors	'84	del. 1 rep.	15	13	87
Karlsson et al	'88	lig. advanc.	180/152 (reported)	132	87
Miachowski	'88	distal advanc.	21	-	80
Karlsson et al	'89	lig. advanc.	60	53	88
Ahlgren	'89	lig. advanc.	83/82 (reported)	53	95

that in longstanding ligament ruptures, the ligament was present although lengthened. Advancement of the ligament is achieved by preparing a site 3 mm distal to the original insertion, and utilizing a small screw and washer for fixation.

It appears that from the previously mentioned studies on delayed primary repair or imbrication (reinsertion) of the lateral ankle ligaments, that the resultant lateral ankle soft tissues have a maintained integrity, and can be used surgically to support the chronically unstable lateral ankle. Thus, plication of the lateral ankle ligaments should be considered in addressing the problem of the unstable ankle joint.

Kuwada[9] used a tendon graft, secured from the peroneus longus, to reinforce the primary repair of the lateral ligaments following acute rupture and chronic instability. No clinical evidence of ankle instability was noted after a three month postoperative period.

Immediate primary repair for acute ruptured lateral ankle ligaments has been described by Ruth[10] and Jaskulka.[11] Their studies have shown that early surgical treatment is recommended for recent instability. They reported no problems in identifying the acutely ruptured ligament ends and primarily suturing the ends together. They advocate primary repair as being simpler and more effective than late reconstruction, which uses the peroneus brevis tendon after failure of conservative therapy.

TECHNIQUE

The operative technique utilized by members of the Podiatry Institute faculty has been described in previous publications.[11, 12] The topographical

landmarks on the lateral aspect of the ankle dictate the crucial placement of the anterolateral incision line. The exact dimensions and orientation of the fibular malleolus are palpated and marked with a skin pen. The remnants of the anterior talofibular ligament courses from the distal 1.5 centimeters of the fibula malleolus, and extends distally onto the talar neck. The calcaneofibular ligament originates from the distal fibular malleolus and courses posteriorly and inferiorly to its insertion into the lateral body of the calcaneus.

The incision begins approximately 2 mm inferior to the tip of the fibular malleolus, coursing distally and superiorly over the superior aspect of the sinus tarsi, and then curves anteriorly to the lateral extent of the extensor tendons. (Figures 1-4) Care must be taken to locate the anterolateral fibular malleolus, in order to gain surgical access of the anterolateral ankle joint, rather than the anterior subtalar joint. The incisional approach is oriented differently from the previously-mentioned authors, who predominantly used a posterior L shaped incision around the fibular malleolus.

Care must be taken to avoid the intermediate dorsal cutaneous nerve at the anterior aspect of the incision, and the sural nerve at the posterior aspect of the incision. Dissection is carried through the subcutaneous tissue, and vessels which cross the incision line are clamped and coagulated as necessary. The next anatomic plane identified is the deep fascia. This layer is identified as a distinct fibrous layer that is specialized posteriorly as the peroneal retinaculum. In the chronically unstable ankle, this layer can either be thickened and fibrotic or thinned out with a defect present. This finding is in accordance with Brostrom's original findings. The deep fascia is incised in a curvilinear fashion which corresponds to the original skin incision.

The ankle joint capsule is the next layer encountered. Remembering that the anterior

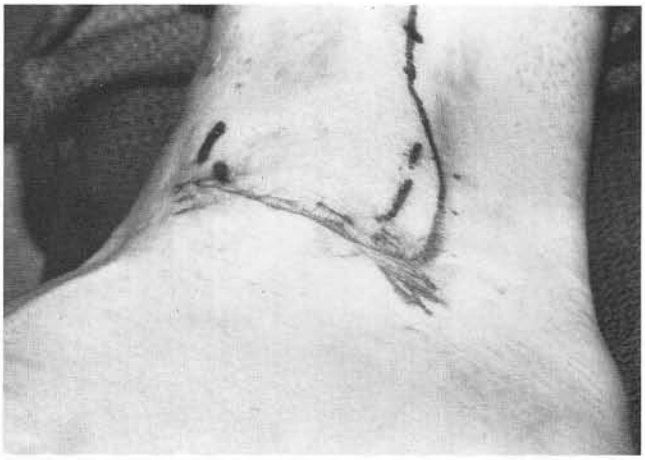

Figure 1. Incisional approach on a left foot, which closely approximates the anterolateral fibular malleolus.

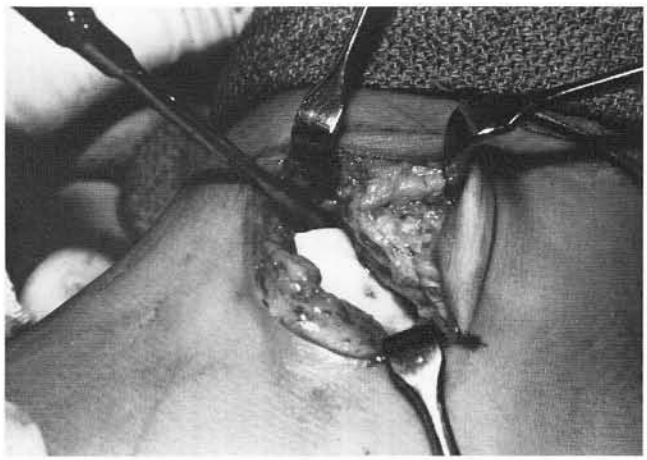

Figure 2. Identification of the ends of the ruptured anterior talofibular ligament.

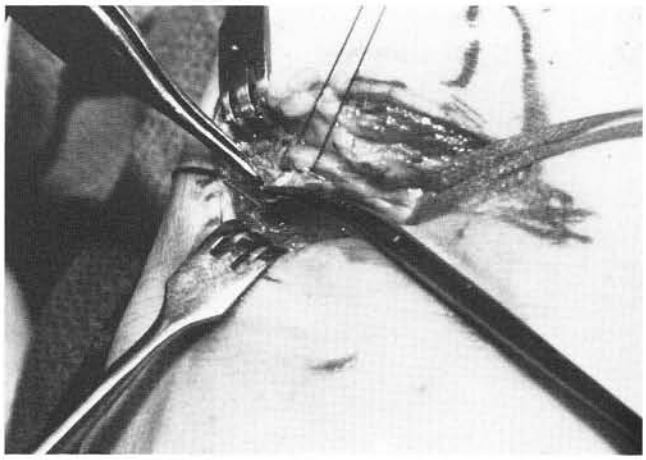

Figure 3. Plication of the ATF ligament.

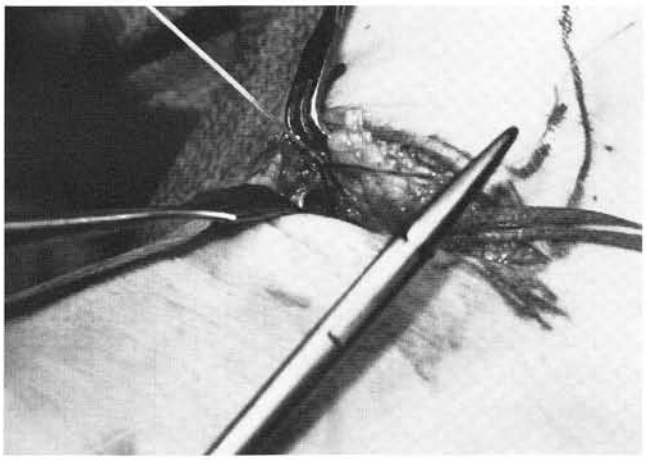

Figure 4. Primary repair of the revised ends of the ATF ligament.

talofibular ligament is an intracapsular ligament, the anterior aspect of the incision is where the remnants of the ligament will be located. Often the capsule has healed anteriorly within the substance of the ligament, producing a lax, scarred, elongated structure. This structure is then incised, the redundancy is sharply transected, and the ends are primarily sutured together with a heavy gauge absorbable or nonabsorbable suture, depending on the surgeon's choice. A simple over and over suture technique may be sufficient, however, a horizontally oriented over and over technique will enable the needle to cross the longitudinally directed fibers.

Another scenario is encountered when the capsule has undergone a certain degree of healing, and the fibers that comprise the anterior talofibular ligament are loose and frayed. In this setting, the ligament ends are trimmed and repaired as above, and the adjacent capsule is plicated tightly to reinforce the repair.

In cases where an avulsion has occurred from either the fibula or talus, an avulsion fracture fragment can be either anatomically repaired if large enough, or surgically resected if too small. The repair may be as simple as suturing the ligamentous structure back to the periosteal tissue of the corresponding bone, or the ligament can be reattached via trephine bone plugs, drill hole approximation, AO screw and polyacetal washer, or a newer device such as the Zimmer Statak.

The calcaneofibular ligament appears quite differently than the anterior talofibular ligament. Since the calcaneofibular ligament is not intracapsular, its remains are usually found below the level of the peroneal sheath, and below the posterior lateral ankle capsule. The ligament's ends are often long, sometimes frayed, and occasionally may invade the posterior facet of the subtalar joint. In certain circumstances where the ligament tear occurs close to its insertion on the calcaneus or the fibula, an appropriate fixation technique is required, as discussed earlier.

An important intraoperative consideration is examination of the osseous structures of the ankle. Under anterior drawer stress, the lateral dome of the talus is visually examined. (Figure 2) Transchondral defects or fractures are dealt with appropriately. The posterior talofibular ligament is then examined under inversion stress, and in the majority of cases is found to be intact.

Following a thorough lavage and precise anatomic restoration of the lateral ankle ligaments, the ankle capsule is repaired using 2.0 absorbable over and over sutures. (Figure 3) The repair is performed with the foot maintained in a slightly dorsiflexed and everted position to help to maintain lateral support. Redundant capsular tissue can be excised in an effort to tighten the lateral structures and reinforce the repair. This layer also serves to cover any nonabsorbable suture which may have been used for the ligament repair. The deep fascia is then repaired with 3.0 absorbable suture with attention to the peroneal retinaculum, which must be restored anatomically to prevent subluxation of the peroneal tendons. (Figure 4) Superficial fascia closure is performed utilizing a 4.0 absorbable running suture and skin is reapproximated with a 5.0 absorbable subcuticular closure. The incision line is supported with steri-strips and a Jones compression cast is applied for the first 48-72 hours. A dressing change is performed at that time, and a below the knee cast is applied for 3-4 weeks.

DISCUSSION

Chronic instability of the ankle may be a severe disability, especially in an active, athletic person accustomed to a mobile life style. The treatment of choice depends on the individual expectations and needs of the patient. Many surgical procedures to stabilize the lateral ankle have been described, but most of the reconstructive procedures compromise normal anatomic structures. Both the peroneus brevis and the peroneus longus tendons play an important role in eversion of the foot and also contribute to plantar flexion. The peroneus longus is also a dynamic stabilizer of the medial arch. Eversion of the foot is important in both athletics and many activities of daily life. It is beneficial to avoid the loss of stability and strength of eversion attributed to lateral tenodesing procedures. Furthermore, restriction of subtalar joint inversion is a widely accepted sequelae of lateral tenodesis, and may affect athletic performance. Other problems with tenodesing procedures include fracture of the fibular malleolus, entrapment of the sural nerve and osteoarthritis.

This paper serves as a prospective study of the results of delayed primary ankle ligament

repair. The literature cited, based upon Brostrom's original paper, clearly supports delayed repair as a successful surgical technique for stabilization of the chronically unstable ankle. The procedures which utilize the healed, elongated lateral structures, for plication are further testimony to the strength and viability of the lateral structures.

Ongoing experience has shown that it is possible to free and suture ruptured ends of ankle ligaments, even many years after the rupture. In the few cases where the available ligament is inadequate for primary repair, the ligament can be reconstructed with a tendon graft, or perhaps a tenodesis which mimics normal anatomy. The conclusions suggest that this surgical procedure is relatively simple, ankle joint stability is accomplished, the peroneal tendon function is maintained, and complications are few.

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