

LATERAL ANKLE STABILIZATION: The Williams Procedure

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INTRODUCTION

Lateral ankle ligament sprains are among the most common injuries of the lower extremity. They account for 20% of sports injuries and usually half of them require surgical management after repetitive recurrence (1). A severe injury of the lateral collateral ligaments may lead to ligamentous laxity and neuromuscular insufficiency resulting in chronic lateral ankle instability. Banks et al confirmed that the prevalence of sprains leading to chronic instability is as high as 30% (2). The ligamentous structures involved in these types of injuries are the anterior talofibular (ATF) ligament, calcaneofibular (CF) ligament, and the posterior talofibular (PTF) ligament (Figure 1). Of the three ligaments surrounding the lateral ankle, the ATF is the most commonly injured followed by the CF ligament. Symptoms consist of persistent ankle pain, swelling, stiffness, instability upon stance or ambulation, and restriction of daily activities. In order to perform proper treatment for this type of injury, an appreciation of and insight to the anatomy and biomechanics of the lateral ankle ligament complex are essential.

CHRONIC LATERAL ANKLE SPRAINS

There are two types of chronic instability, mechanical and functional (1, 3, 4). Mechanical instability results from laxity of the lateral collateral ligaments leading to potential elongation or complete ruptures. Factors such as degenerative changes, synovitis, pathologic laxity, and arthrokinematic changes may alter the mechanical stability therefore leading to hypermobility of the ankle. With mechanical instability, clinical examination and imaging studies are positive. In comparison, functional instability yields unremarkable radiographic examinations, yet the feeling of instability is the constant complaint (4, 5). Symptoms may result from proprioceptive and neuromuscular impairment, repetitive mechanical injury, and

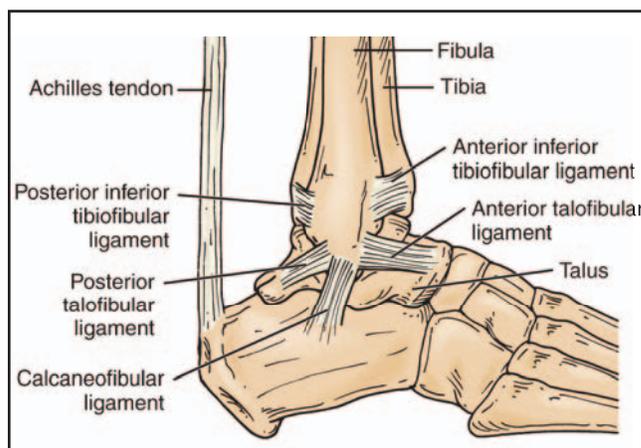


Figure 1. View of the three lateral collateral ligaments.

abnormal structural positioning of the lower extremity such as with a cavus foot (3). Approximately 40% of patients with recurrent ankle sprains complain of functional instability (5). Mechanical instability may lead to functional impairment secondary to injury of the mechanoreceptors of the ligaments or musculature. Therefore, chronic lateral ankle instability may be influenced by either mechanical instability, functional instability, or both. However, most surgical techniques were designed to correct the mechanical hypermobility and neglect the functional component.

DIAGNOSIS

Clinical evaluation and diagnosis of chronic sprains and instability involves bilateral radiographs including stress views, magnetic resonance imaging (MRI), or computed tomography scans as well as appropriate physical examination. Clinically, patients may complain of localized pain to the lateral ankle, edema, and instability of the ankle joint. The mechanism of action usually involves internal rotation or inversion. Patients may relate a popping sensation to the lateral aspect of the ankle joint. Some patients may also complain of difficulty with ambulation.

Objectively, the anterior drawer maneuver may elicit pain over the ATF. The examiner will note increased anterior translation of the talus and possibly a slight click in a positive drawer test. A suction sign may be identified over the anteriolateral ankle when there is a complete tear of the ATF. In addition, a CF ligament injury is measured by the inversion stress test, which may reveal excessive talar tilt and pain over the CF ligament.

Proprioceptive insufficiency may be tested by performing a Rhomberg test in functionally unstable patients (4). The modified Rhomberg test determines the function of the proprioceptive feedback, which helps quantify the functional stability. The test is performed with a single leg hop and one leg balancing on a wobble board. It is important to note that the test is assessed with the patient's eyes open and closed, and arms placed across the chest. A positive sign occurs if the patient falls within 30 seconds.

Radiographic evaluation may confirm increased talar tilt, bony avulsions or pathologic influence to lateral ankle instability. Performance of the inversion stress test is evaluated on an anterior-posterior (AP) ankle view and assesses the integrity of the CF ligament. On the AP view, measurement of the talar tilt is determined by drawing a line along the tibial plafond and the talar dome. Measurement of the angle will determine severity of the ligaments along with comparison to the contralateral ankle. Abnormality of the angle is usually >15 degrees. The lateral view of the ankle is utilized to assess the anterior drawer test. A value of >5 mm is concerning for an injury to the ATF ligament, which again should be compared to the contralateral limb. The imaging method of choice is an MRI, which may identify edema, partial or complete tears, bony abnormalities, or hemorrhaging (1). The MRI is also very important in the determination of treatment.

CONSERVATIVE TREATMENT

Typical conservative treatment consists of rest, ice, compression, elevation, bracing, limitation of physical activity, physical therapy for lateral muscle group strengthening, and proprioceptive training. Proprioceptive training is essential to restore the disrupted proprioception of the injured joint capsule and lateral collateral ligaments. Training may prevent reinjury of these ligaments and contribute to articular stability (6, 7).

If conservative treatment has exceeded 6 months and continual instability is noted, surgical management should be considered. Surgical criteria for lateral ankle stabilization

are chronic functional instability that has been present for 6 or more months, positive Romberg sign, excessive talar tilt, and failure of conservative treatment (2).

SURGICAL TREATMENT

Multiple surgical procedures have been described for addressing chronic lateral ankle instability. These procedures either involve autologous tenodesis of the lateral ligaments, delayed primary repair, or single/double ligament repair with the use of autogenic or allogenic grafts to reinforce the impaired lateral structures. Such procedures attempt to achieve functional as well as anatomic placement of the ATF and CF ligaments. However, these procedures are somewhat undesirable in that they often tend to require large incisions and involve complex and intricate transfer of adjacent tendinous structures or graft materials. Involvement and augmentation of the lateral adjacent tendons also impairs their principle function, varus stability, which also greatly affects the dynamic component during ambulation. Post-operative complications noted with these procedures include nerve complications, stiffness, recurrent instability, degenerative joint disease, and osteophyte proliferation (8).

Plication of the anterolateral capsule of the ankle, also known as the William's procedure, is an alternative surgical intervention for chronic lateral ankle instability. The William's procedure omits the need to reconstruct the lax lateral collateral ligaments with augmentation of other ligaments or tendons, thus providing adequate functional stability and mobility without joint stiffness and impairment. The procedure involves plicating the anterior capsule-ligamentous complex with approximation and reefing of the extensor digitorum brevis (EDB) muscle belly (3). Among all other lateral stabilization procedures, this technique does not reconstruct the lateral collateral ligaments, which is an advantage allowing functional stabilization of the ankle joint without the hindrance of biomechanics. In fact, it reconstructs and improves the mechanical instability by tensioning the lateral ankle capsule (1, 3). The proximal end of the EDB is translocated proximally by folding it and securing with sutures, also known as reefing. Langstaff and Handley reported that transfer of the EDB restores the proprioceptive effect of the injured capsule and/or the lateral collateral ligaments (9). Utilizing the EDB muscle for reefing also improves the functional stability and proprioception of the ankle as compared to the other mentioned procedures, which only attend to the mechanical instability (1).



Figure 2A. Incision placement over the sinus tarsi, perpendicular to the anterior talofibular ligament.



Figure 2B. The capsuloligamentous complex is exposed and open vertical to the skin incision.



Figure 2C. Over the base of the extensor digitorum brevis muscle, another 2 parallel incisions are placed approximately 2 cm apart exposing the fascia of the extensor digitorum brevis.

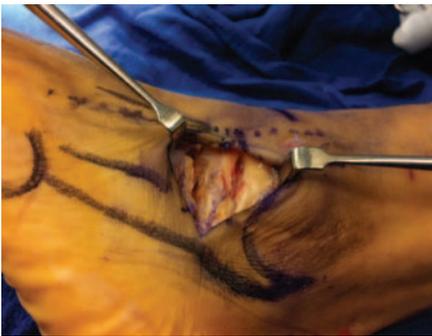


Figure 2D. A bridge is constructed from the parallel incisions over the sinus tarsi.

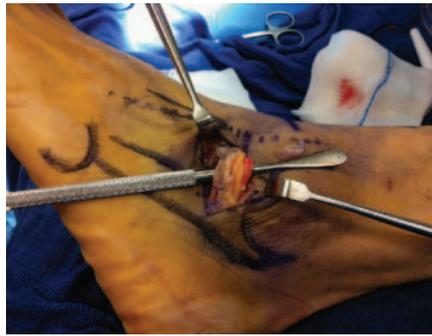


Figure 2E. Freer is placed under the created capsular bridge.



Figure 2F. Grabbing the distal aspect of capsule with #2 fiber wire passing under the bridge and grabbing the proximal end of the capsule.

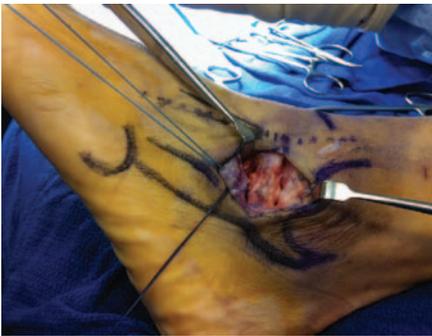


Figure 2G. #2 fiber wire a 0-0 vicryl is placed in the tissue anterior to the fibula then passed under the bridge of the soft tissue into the fascia of the extensor digitorum brevis and backwards again under the bridge to the tissue anterior to the fibula in an alternate fashion.



Figure 2H. Close view of the passed suture.



Figure 2I: Completion of passed fiber wire and vicryl under bridge.



Figure 2J. While knotting and tightening the extensor digitorum brevis fascia proximally, the foot is held in an everted and dorsiflexed position.



Figure 2K. Reefing of the constructed bridge is reapproximated proximally over the deep fascia with 2-0 vicryl.



Figure 2L. Subcutaneous closure is performed with 3-0 vicryl and cutaneous closure is performed with a 3-0 prolene.

OPERATIVE TECHNIQUE OF WILLIAMS PROCEDURE

Under general anesthesia, a well-padded thigh tourniquet is applied to the patient and placed in the lateral dicubitus position. Attention is brought to the lateral ankle just beneath the fibula. Approximately 1 cm distal to the tip of the fibula a 3-4 cm oblique incision is made along the relaxed skin tension lines. The incision will lay over the sinus tarsi and perpendicular to the ATF ligament. The capsuloligamentous complex is exposed and opened vertical to the skin incision. Two parallel incisions approximately 1 cm apart are created with the first at the proximal aspect of the EDB and the other over the ATF or lateral capsule just distal to the fibula. A bridge of capsular tissue is elevated between the parallel incisions over the sinus tarsi.

Alternating vertical mattress sutures of #2 braided polyethylene and 0-0 vicryl are placed in the capsular tissue anterior to the fibula, then passed under the bridge of soft tissue into the fascia of the EDB and backwards again under the bridge into the capsule anterior to the fibula. All sutures are placed before tying the knots while the foot is held in an everted and dorsiflexed position. Reefing of the soft tissue bridge is then performed proximally and distally over the deep fascia with 2-0 vicryl, while still everting the foot. At this time, an anterior drawer test and talar tilt testing are performed to confirm stabilization. Subcutaneous closure is performed with 3-0 vicryl and cutaneous closure is performed with 4-0 prolene horizontal mattress sutures or 4-0 monocril subcutaneously. Once closure of incision is achieved, a nonadherent dry-sterile dressing is applied with a well-padded posterior and sugar tong splint in slight dorsiflexion and eversion (Figure 2).

POSTOPERATIVE MANAGEMENT

Patients are maintained non-weightbearing for 2 weeks in a splint, followed by another 2 weeks in a cast. Afterwards, the transition to weight bearing in a CAM walker with physical therapy for an additional 2 to 4 weeks. At 6-8 weeks following surgery, gradual ambulation without assistance is allowed with adjunctive physical therapy.

CONCLUSION

Reapproximation of the EDB proximally is the critical step in this surgical procedure because it acts as a dynamic sling and promotes early firing and a greater proprioceptive response (3). Postoperatively, full range of motion and excellent functional stability of the ankle joint are achieved. The techniques utilized in this procedure are simple, which avoids compromise of anatomic structures while still addressing both the mechanical and functional components of chronic lateral ankle instability.

REFERENCES

1. Mann G, Elishoov O, Chaimsky G, et al. Recurrent ankle sprain: experience with modification of William's reefing technique. *J Orthop Surg Tech* 1993;8:3.
2. Banks AS, Downey MS, Miller SJ, et al. *McGlamry's Comprehensive Textbook of Foot and Ankle Surgery*. Baltimore: Williams & Wilkins; 2001. p. 1115-24.
3. Williams JG. Plication of the anterolateral capsule of the ankle with extensor digitorum brevis transfer for chronic lateral ligament instability. *Br J Accident Surg* 1998;19:2.
4. Tropp H, Odenick P, Gillquist J. Stabliometry recordings in functional and mechanical instability of the ankle joint. *Int J Sports Med* 1985;6:180-2.
5. Richie D. Functional instability of the ankle and the role of neuromuscular control: a comprehensive review. *J Foot Ankle Surg* 2001;40:4.
6. Vammen S, Peterson LG, Kaalund S, et al. The effect of musculus extensor digitorum brevis transfer for chronic lateral ankle instability. *Foot Ankle Int* 1998;9:563-5.
7. Aydin T, Yildiz Y, Uildiz C, Atesalp S, Kalyon TA. Proprioception of the ankle: a comparison between female teenage gymnasts and controls. *Foot Ankle Int* 2002;23:123-9.
8. Bauer G. New method for reconstruction in lateral ankle instability. *J Am Podiatric Med Assoc* 1996;85:9.
9. Lanstaff R, Handley C. Functional ankle instability in members of the armed forces, the results of the extensor digitorum brevis transfer operation. *Br J Accident Surg* 1991; 22:105-7.
10. Karlsson J, Bergsten T, Lanisinger O, et al. Surgical treatment of chronic lateral instability of the ankle joint. *Am J Sports Med* 1989;27:2.
11. Denegar CR, Miller SJ. Can chronic ankle instability be prevented? Rethinking management of lateral ankle sprains. *J Athletic Training* 2002;37:430-5.
12. Hertel J. Functional anatomy, pathomechanics, and pathophysiology of lateral ankle instability. *J Athletic Training* 2002;37:364-75.