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Review Article

Surgical Technique Update: Slater Modification of Minimally Invasive Brostrom Reconstruction

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Abstract

Chronic instability arising from lateral ligamentous injury despite surgical intervention presents a common problem among athletes. This can be attributed to multiple factors including non-anatomic repair and disruption of ankle biomechanics, untreated intraarticular pathology and delayed or suboptimal rehabilitation. Building on Slater., *et al*'s previous articles showing the effectiveness of the rapid rehabilitation protocol and arthroscopic diagnosis prior to repair, this article provides an outline of the modified Brostrom direct anatomical repair of the lateral ligamentous complex.

Keywords: *Chronic Ankle Instability; Lateral Ankle Ligament; Brostrom; Arthroscopy; Minimally Invasive; Rapid Rehabilitation*

Introduction

Ankle sprains are the most common injury among athletes, with lateral ligament sprains often being implicated [1,2]. These injuries typically involve damage to the lateral ligamentous complex after planar flexion-inversion injury [3] and although most people recover, as many as 20% go on to have chronic instability [4-8]. Success with conservative treatment with functional rehabilitation focuses on muscle strengthening and proprioceptive feedback [9] however, some patients fail these measures and surgical intervention is indicated. If left untreated, there may be a progression to chronic ankle instability, synovitis and chondral damage leading to osteoarthritis [10-12]. Chronic ankle instability of the lateral ligamentous complex can be repaired either anatomically or non-anatomically, with the former being considered as the superior reconstructive technique due to the preservation of hindfoot biomechanics, less pain and better cosmetic results [13-17]. Despite a reduction in undesirable post-operative complications with this method, literature still suggests that 15 - 35% of patients have ongoing symptoms as results of unaddressed ankle pathology [6,18]. The utilisation of arthroscopic assessment prior to reconstructive repair has proven to be effective analysis of the extent of injury and ligamentous integrity, as well as detecting undiagnosed pathology. Clinical studies have shown arthroscopy is effective in confirming pre-operative MRI diagnosis in the majority of patients and is able to detect intraarticular lesions when there has been no radiological evidence [6,18,19].

The challenge for minimally invasive surgery is to increase the strength of the procedure to allow immediate weight-bearing [1,10,20]. With key-hole incisions the patient is able to weight bear as the chance of wound breakdown is minimised [21,22]. The benefits of early weight bearing are evident in both decreasing the chance of DVT and also in reducing muscle wastage from non-weight-bearing. Muscle wastage after surgery is a significant problem in the professional sporting community [23,24].

We have recently published our rapid rehabilitation programme for Brostrom reconstruction [25]. This series follows earlier work reporting on the outcomes in 250 reconstructions.

Surgical technique

As we have previously mentioned that there is no need to explore the peroneal tendons in the absence of symptoms and MRI findings. We do not explore the tendons unless there is symptomatic pathology in the tendons [17]. If exploration is required, we prefer a targeted incision rather than one long incision. As a matter of surgical principle in the foot, we prefer multiple small incisions rather than long incisions with lots of undermining.

Ankle arthroscopy

Patients are positioned supine with non-invasive distraction of the ankle used in the majority of cases. Using a thigh holder and ankle distractor, the thigh is positioned at 60 degrees of flexion with 4 to 5 mm of ankle distraction.

Antero-medial and anterolateral portals are used.

The anteromedial portal is best placed close to tibialis anterior tendon, taking care to avoid injury to the saphenous nerve. An incision is made adjacent to tibialis anterior tendon and blunt dissected down to the joint capsule. Blunt trochar is inserted in dorsiflexion to avoid damage to the talar dome.

The anterolateral portal is made under visualisation using the anteromedial portal. The lateral border of peroneus tertius is used as a landmark. Care is taken to avoid injury to the superficial peroneal nerve; this structure can be marked prior to portal placement if necessary. After a needle is inserted and confirmed arthroscopically, the lateral skin incision and blunt dissection can be made. The blunt trochar is inserted in dorsiflexion as previously [26].

We use a standard template for recording the ankle arthroscopy findings.

Arthroscopy template

Medial Gutter

MCL

Talus

Tibia

Lateral Gutter

Lateral Ligament

Talus

Tibia

Central Joint

Talus

Tibia

Trifurcation Zones

Tib-Fib Joint

Anterior Bony ankle impingement

Figure 1: *Incision placement.*

~3 cm incision over the anterior border of the fibula followed by blunt dissection down to the lateral capsule.

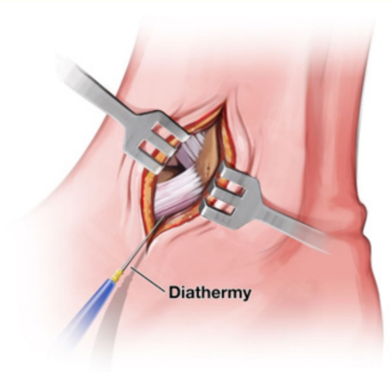

Figure 2: *Haemostasis and exposure by sharp dissection.*

Once haemostasis is achieved by diathermy of the bleeding points, the lateral capsule is divided with sharp dissection. The fibula wall exposed and the anchor insertion points identified. A flap of tissue is mobilised over the fibula.

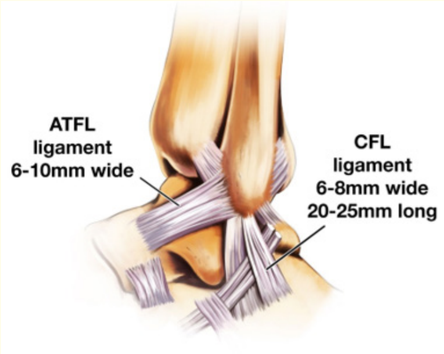

Figure 3: *Identification of lateral ligamentous complex.*

The lateral ligaments are not dissected as distinct anatomical structures. Rather the lateral wall is mobilised as a cuff.

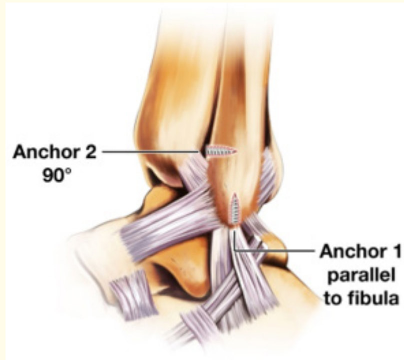

Figure 4: *Insertion of 3.5 mm anchors.*

The anchors are inserted into the fibula. Integrant 3.5 mm anchors are used. A blue bone sparing reamer is used and drilled the depth of the anchor. The anchors have a course thread and are self-drilling in most bone. However, if they are inadequately reamed, they may not be able to advance and become too prominent.

One anchor is placed parallel to the fibula at the tip of the styloid at the inferior end of the incision. The other is placed at a 90 degree angle as close to the joint line as possible. The reamer is used to make the pull-to hole and they are checked with image intensifier.

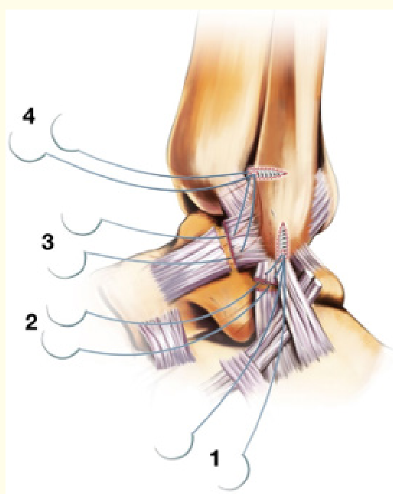

Figure 5: *Suture placement.*

A needle is cut from each of the sutures. This facilitates removal of the sutures and is safer for tying which is done by hand. The anchors are tested for purchase by pulling on the threads. It should be possible to lift the weight of the leg on a single suture.

Suture 2 is placed first. This allows delivery of the distal cuff to be delivered into the incision. Its aim is to purchase part of the ATFL and CF ligament.

As large a portion of the cuff is purchased by retraction on the anterior incision. The needles have been designed to be not only strong but also very sharp to allow this.

Suture 1 purchases the CF ligament.

Suture 2 purchases primarily CF and anterior capsule.

Suture 3 Majority of the ATFL ligament.

Suture 4 purchases the anterior portion of the ATFL and capsule and part of the extensor retinaculum.

The sutures are then tied with the ankle in eversion from 1 - 4.

Number 4 is cut at this point; the posterior cuff is then advanced over the previous imbrication with careful attention to cover the knots.

Closure

3-0 undyed Vicryl is crucial to cover the knots.

2 vertical mattress 3-nylon sutures.

Local anaesthetic is injected with adrenaline.

A compression bandage is applied and the patient is immediately mobilised in a cam boot.

Conclusion

Our preferred modification of the Brostrom technique, which utilises arthroscopic examination prior to minimally invasive and delayed lateral ligament reconstruction has been highly successful. Over the past 20+ years, we have shown that it provides optimal patient outcomes as demonstrated by Slater et al in the largest single surgeon study to date. We have also demonstrated that its effectiveness combined with a rapid rehabilitation protocol that athletes can return to sport in as much as half the time compared to traditional rehabilitation. It is clear that a combination of the preservation of ankle biomechanics, treatment of unresolved intraarticular pathology and early rehabilitation provides the framework for recovery in athletes where a fast return to sport is paramount.

Disclosure

Dr Gordon Slater is a senior design consultant to Integrant Pty Ltd.

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