Technical note

Anatomical reconstruction of the anterior talofibular and calcaneofibular ligaments with an all-arthroscopic surgical technique

S. Guillo\textsuperscript{a}, G. Cordier\textsuperscript{a}, B. Sonnery-Cottet\textsuperscript{b}, T. Bauer\textsuperscript{c,}\textsuperscript{a}  
\textsuperscript{a} Clinique du sport, Bordeaux-Mérignac, France  
\textsuperscript{b} Centre orthopédique Santy, hôpital privé Jean-Mermoz, Lyon, France  
\textsuperscript{c} Service de chirurgie orthopédique et traumatologique, hôpital universitaire Ambroise-Paré, (AP–HP), hôpitaux universitaires Paris–Île-de-France Ouest, Boulogne-Billancourt, France

\textbf{A R T I C L E  I N F O}

Article history:  
Received 30 July 2014  
Accepted 17 September 2014

Keywords:  
Ankle instability  
Sprain  
Arthroscopy  
Ligament reconstruction

\textbf{A B S T R A C T}

Arthroscopy is becoming an essential tool for the treatment of chronic lateral ankle instability. It allows the surgeon to determine which ligaments are injured and choose the most appropriate surgical repair technique, and also to assess and treat any associated injuries. Several arthroscopic techniques for lateral ankle ligament repair have recently been developed. As a consequence, it may be possible to carry out complete lateral ligament reconstruction with an all-arthroscopic procedure. Such an arthroscopic lateral ankle ligament reconstruction technique is described in this article.

© 2014 Elsevier Masson SAS. All rights reserved.

1. Introduction

Ankle arthroscopy is increasingly being used to treat chronic lateral ankle instability since it provides a good view of the ligaments to determine which ligament repair technique is most suitable, along with an opportunity to assess and treat any associated injuries [1]. Several teams have recently published the results of arthroscopic Bröstrom–Gould type capsule–ligament repair, which confirms the fundamental role of arthroscopy in treating chronic lateral ankle instability [2–9]. Although the Bröstrom–Gould technique is the gold standard for most cases, the repair cannot be performed in some cases, thus a reconstruction with tendon grafts is needed. Non-anatomical reconstruction leads to altered biomechanics and stresses—mainly in the subtalar joint—with early onset of osteoarthritis [10,11]. The goal of using arthroscopy in these situations is to perform anatomical ligament reconstruction with more accurate positioning of the graft and reduced iatrogenesis [12,13]. This article describes a novel technique for all-arthroscopic anatomical reconstruction of the anterior talofibular ligament (ATFL) and the calcaneofibular ligament (CFL).

2. Surgical technique

Patients are placed on their side, with a support under the lower leg that allows the ankle to be positioned either laterally or vertically by rotating the leg (Fig. 1). This set-up makes it possible to perform anterior and lateral ankle arthroscopy during the same procedure. A tourniquet cuff is placed at the base of the thigh. The entire leg is prepared for surgery, up to the cuff. The ipsilateral gracilis tendon is harvested. The tendon graft must be at least 10 cm long; it is prepared into two strands, one strand being at least 3.5 cm long for the ATFL and the other at least 4.5 cm long for the CFL. The malleolar part of the graft is sutured to a ToggleLoc\textsuperscript{TM} (Biomet, Warsaw, Indiana).

2.1. Step 1

The first part of the procedure consists of standard anterior arthroscopy of the ankle with the foot vertical and dorsiflexed. A 4.5 mm scope is introduced through the standard anteromedial portal (portal 1). After evaluating the joint to look for associated injuries, a standard anterolateral portal (portal 2) is made at the anterolateral groove using the scope’s transillumination feature and direct needle control. A shaver is inserted into portal 2 to start debridement of the lateral groove. Any scar and inflamed tissue located in the distal part of the inferior bundle of the anterior tibiofibular ligament is resected, from the tibia to the lateral malleolus, until the ATFL’s fibular insertion is visible. The scarred ATFL is
then resected from its malleolar insertion to its talar insertion, so as to expose its attachments. (Fig. 2).

2.2. Step 2

The scope is then transferred to portal 2. An instrument portal (portal 3) is made at the sinus tarsi. The landmarks for this portal are the posterior edge of the extensor retinaculum and the superior edge of the peroneus brevis tendon. The portal is placed where these two lines intersect. A shaver is introduced by this portal to finish preparing the malleolar attachment of the ATFL and CFL. A K-wire is then inserted in an upward direction into the lateral malleolus at the ATFL and CFL insertions through portal 3. A 6-mm diameter bone tunnel is drilled into the lateral malleolus. (Fig. 3).

2.3. Step 3

The ankle is turned laterally so that tendinoscopy of the peroneal tendons can be performed. A retromalleolar portal 1 cm above the tip of the lateral malleolus (portal 4) is needed. After performing the skin incision, the superior peroneal retinaculum is exposed then incised before introducing the scope into the peroneal tendon sheath. The septum between the two tendons is located; this marks the start of the proper tunnel and where the sinus tarsi and CFL will be dissected. The scope is placed in front of the peroneus brevis, with the light aimed towards the subtalar joint space. A shaver is introduced into portal 3 and used to prepare the area just proximal from the beginning of the peroneal tendon tunnels; this will expose the subtalar joint space distally to proximally since it is crossed by the CFL. This step is used to locate and release the CFL while checking the integrity of the peroneal tendons. (Fig. 4).

2.4. Step 4

The ankle is returned to a vertical position and the scope is introduced into portal 3. A shaver is inserted into portal 2 to finish
debridement of the ATFL's talar attachment. A blind tunnel is made at the ATFL's talar attachment using a K-wire to insert a 6-mm drill bit to a depth of 20 mm. The tunnel is directed towards the middle of the talar dome. A 1.4 mm JuggerKnot™ anchor (Biomet, Warsaw, Indiana) is then placed inside this tunnel to serve as a pulley when the graft will be inserted later on. (Fig. 5).

2.5. Step 5

The scope is placed into portal 2 and the shaver in portal 3 to prepare the CFL's calcaneal attachment. A calcaneal tunnel is made with a 6-mm diameter drill bit placed on a K-wire that is introduced in portal 3. This is a full-thickness tunnel that is oriented downwards, inwards and backwards. (Fig. 6).

2.6. Step 6

This step corresponds to the positioning of the talofibular graft (Fig. 7A). The scope is placed in portal 2. One of the JuggerKnot™ suture strands is externalized by portal 3 and then sutured to the talar end of the graft (Fig. 7A). The ToggleLoc™, inserted by portal 3, is then inserted into the peroneal tunnel and pinned against the posterior cortex of the malleolus so the malleolar part of the graft can be placed in the malleolar tunnel (Fig. 7B). The ATFL graft is inserted through the talar tunnel by pulling on one of the JuggerKnot™ strands (pulley effect) (Fig. 7C). The graft's final tension is set by applying traction to the ToggleLoc™ in the malleolus. The ATFL graft's final fixation is ensured by an interference screw in the talar tunnel.

2.7. Step 7

The scope remains in portal 2. The calcaneal graft is inserted into the calcaneal tunnel through portal 3. The graft is tensioned with the ankle in neutral position by pulling on the calcaneal graft suture. Its final fixation is ensured by an interference screw in the calcaneal tunnel (Fig. 8).
3. Discussion

Arthroscopy has a primary role in the treatment of chronic lateral ankle instability as it allows for simultaneous:

- assessment and treatment of commonly associated injuries that impact the prognosis after ligament repair [14];
- assessment of ligament integrity (ATFL, CFL), thus helping the surgeon decide which repair technique is most appropriate for a given case [15];
- treatment of chronic lateral instability using either the Bröström–Gould type ligament repair procedure [2–9] or ligament reconstruction and repair as described in this article [10,11].

Lateral ankle arthroscopy using a sinus tarsi approach and peroneal tendinoscopy are used to view the entire lateral ankle and rear foot structures (subtalar joint, peroneal tendons, ATFL, CFL). This is an extra-articular endoscopy that requires a learning period and rigorous technique to be able to easily identify the anatomical landmarks, safely create a working space and reproducibly perform the procedures. Through deep subcutaneous dissection of the capsule–ligament layer, lateral ankle endoscopy provides a complete view of the structures that need to be identified (unlike percutaneous techniques) and limits the risk of damaging nearby nerve structures, namely to the cutaneous branches of the superficial peroneal nerve [16].

With experience, this endoscopic technique makes it possible to carry out anatomical reconstruction of the ATFL and CFL with greater accuracy of the tunnel positioning. Cadaver studies are being performed to confirm the feasibility and reproducibility of such arthroscopic anatomical reconstruction techniques and to standardize the procedural steps and fixation methods. Medium and long-term studies will be essential to confirming the benefits of these techniques in terms of the recovery time and osteoarthritis progression.

Disclosure of interest

SG is a consultant for Biomet.
BSC and TB are consultants for Arthrex.

References