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Ligamentoplasty of the Ankle Periosteum Known as Roy-Camille/Saillant at the Orthopedic Traumatology Department of the Pau Hospital Center (France)

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Abstract

Introduction: Chronic ankle instability comprises two main entities, often associated with mechanical instability due to ligament and/or bone trauma, and functional instability due to a postural or proprioceptive defect. Periosteal ankle ligamentoplasty is a widely used technique in France. The aim of our study was to evaluate the functional result after a ligamentoplasty technique on the periosteum known as Roy-Camille/Saillant. **Methods**: A retrospective study of 264 months which involved 21 patients including 3 women and 18 men with a sex ratio of 6 with a mean age of 38.71 (25 - 58) years. Patients were included who benefited from a Roy-Camille/Saillant periosteal ligamentoplasty for chronic ankle instability and had accepted for the completion of an evaluation form. Fourteen were reviewed clinically and radiologically. We have an assessment sheet taking into account pain, function and alignment. The rearfoot AOFAS score indicates excellent (90 - 100), good (80 - 89), fair (70 - 79), and poor (<69). **Results**: A minimum follow-up of 8 months and an average follow-up of 7 years (8 months to 18 years). 93% had a painless and stable ankle, and 86% returned to sport. The mean postoperative AOFAS score was 97 (87 - 100), (86%) patients believed their ankle was more stable after surgery, (14%) did not feel any difference. 11 patients were very satisfied, 3 satisfied. Among the 11 satisfied with the operation, two (2) people complained of a sensitivity disorder. One patient presented with hypoaesthesia in the superficial peroneal nerve territory. Nine of them felt no difference between their right and left ankle. **Conclusion**: The satisfaction rate was 93%, and the results obtained in our study are in agreement with other techniques and previous publications on similar procedures.

Keywords

Instability, Ankle, Ligamentoplasty, Periosteum

1. Introduction

Chronic ankle instability includes two main entities, often associated with mechanical instability due to ligamentous and/or bone trauma, and functional instability due to a postural or proprioceptive defect [1] [2]. Both have intrinsic risk factors, essentially morphological or postural, and extrinsic (environmental) factors, essentially linked to sport or occupation, which are modifiable. Lateral capsulo-ligamentous lesions (anterior tibiofibular ligament or calcaneofibular ligament) induce lateral laxity, a determining and predominant factor in chronic mechanical instability. The mechanism is usually varus and equinus (anterior tibiofibular ligaments), or sometimes varus and dorsiflexion (calcaneofibular and talocalcaneal interosseous ligaments). In forced rotation trauma, there may be ligamentous injuries associated with the ankle complex (medial and tibiofibular syndesmosis). These injuries largely depend on the specific mechanism and intensity and lead to a concept of complex ankle laxity beyond simple lateral laxity [3] [4]. Risk factors for chronic instability, such as varus or congenital proprioceptive deficit, as well as osteochondral lesions of the talar dome related to laxity, dislocation of the peroneal tendons and/or anterior or posterior fissure or impingement, should be treated at the same time as lateral laxity.

The present study aimed to evaluate the functional result after a periosteal ligamentoplasty technique known as Roy-Camille/Saillant.

2. Material and Method

A retrospective study included 21 patients (3 women, 18 men, average age: 38.71 years) treated by periosteal ligamentoplasty known as Roy-Camille/Saillant, performed by a single surgeon in the Orthopedics department of the Pau Hospital center.

Data were obtained from patient files and a pre-established survey form for each patient. All patients were examined by the surgeon; The diagnosis was made by clinical examination and frontal profile and Telos ankle radiographs.

All patients received and treated in the department for chronic ankle instability, confirmed by LCL lesions intraoperatively, were included in our study. The average follow-up was five months (3 - 18). The patients were all men with a mean age of 38.71 years (25 - 58)).

Operating technique Facility: Entry checklist. Supine position, single tray. General anesthesia. Intraoperative cefazolin. Mitek DePuy equipment: Mitek intraosseous anchors (G2 and mini). Skin preparation according to current protocol. Esmach band, pneumatic thigh tourniquet (100 min - 300 mmHg).

Disinfection, champage.

Intervention:

1) Ligament and joint approach and assessment:

Lateral vertical skin incision, facing the fibula, curved horizontally forward, up to the external orifice of the sinus tarsi. Hemostasis.

The skin flaps are tilted, allowing good exposure to the entire external malleolus and the anterior capsule with the LCL.

Vertical pre-malleolar arthrotomy, assessment: lesion with the disappearance of the cartilage at the anterior end of the dorso-lateral angle of the dome, over 3 cm, up to the osteochondral limit. Normal-appearing capsule. TAFA is thick, but disinserted from the malleolus.

2) Preparation of the flap:

We mark the periosteal flap with a cold scalpel, which will be taken on the lateral aspect and on the anterior edge, 10 cm distal to the fibular shaft.

The flap is then split vertically over its entire length, the anterior half intended for the repair of the anterior talofibular ligament (TAFA) and the posterior half for the repair of the calcaneofibular bundle (**Figure 1**).

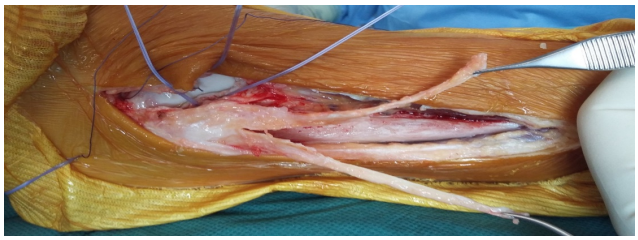

Figure 1. Preparation of the double bundle flap.

3) TAFA plasty:

Identification of the distal insertion of the TAFA at the talar level and placement of an intraosseous talar anchor (Mitek G2). Sharpening the anterior edge of the fibular malleolus with a gouge, and placement of two G2 intraosseous anchors. The periosteal flap is fixed at the level of the talar intraosseous anchor, then it is long enough to be folded backward and fixed on the proximal G2 anchor, then folded forward again, and fixed on the talar anchor (in total we tripled the plastic surgery). The points are tightened ankle at 90˚ maintained throughout the rest of the intervention (**Figure 2**).

Figure 2. Location of the distal insertion of the TAFA bundle.

Calcaneofibular ligament reconstruction:

Preparation of the calcaneal insertion: 1.5 cm skin incision. Deperiostealing of the calcaneus, creation of a small bone sharpening trench. The lower periosteal flap is then passed to the deep surface of the fibularies. Placement of a G2 intraosseous anchor, then fixation of the periosteal flap by suture in the calcaneal trench (Figure 3).

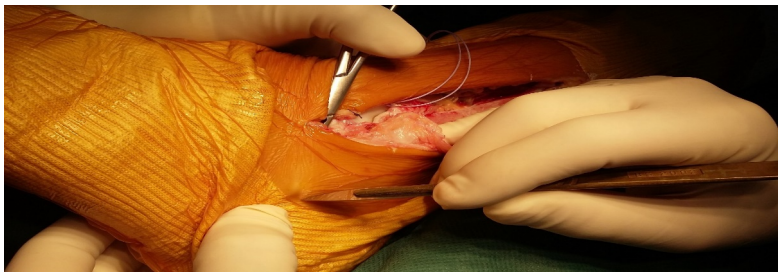

Figure 3. Preparation of the calcaneal insertion.

4) Capsular retention and closure:

To complete the assembly: three X-shaped points fix the capsular flap to the anterior edge of the malleolus, relying on the three intraosseous anchors. Additional suturing with X-shaped stitches. Washing, closure in two layers, separate stitches on the skin (Figure 4).

Figure 4. Capsular retention.

5) Restraint:

Making a jambo-pedal resin holding the ankle at a right angle, windowed.

Release of the tourniquet and immediate revascularization of the toes.

Aftermath of surgery: (Exit checklist)

Anticoagulant, removal of J12 wires, immediate resumption of weight bearing. Release of the ankle (rehabilitation) on day 45.

Intervention time: 1 hour 35 minutes.

Fourteen patients were evaluated clinically and radiologically (frontal and lateral views). We have established an assessment sheet that takes pain, function and alignment into consideration. Functional outcomes were graded, using the AOFAS rearfoot score [5], excellent (90 - 100), good (80 - 89), fair (70 - 79), and poor (<69). The satisfaction reported by patients with the objective analysis of radiographic

images of the clinical stability of the ankle.

3. Results

Out of 21 patients, 66.7% patients responded to the final assessment in 2018 of which 78.6% were men, and 64.3% were right ankle. The average age of the 14 patients was 38.71 (25 - 58) years at the time of the intervention.

The 14 patients present at the final evaluation had a minimum follow-up of eight months and an average follow-up of 7 years (8 months to 18 years). 93% had a painless and perfectly stable ankle without any apprehension, and 86% of those operated on were able to return to sport. We observed an absence of laxity of the tibiotalar and subtalar, good stability with absence of osteoarthritis and absence of secondary displacement of the harpoons in all patients on radiography**.**

The average postoperative AOFAS score was 97 (range: 87 - 100). 12 (86%) patients believed their ankle was more stable after surgery and had no pain, while two (14%) felt no difference, with occasional pain. We had (78.6%) patients who were very satisfied, (21.4%) satisfied. One of our satisfied patients complained of occasional peri-malleolar pain at rest on the surgical scar. Among the 11 (78.6%) patients satisfied with the operation, two (2) people complained of impaired sensitivity and discomfort at the scar with transient paresthesia at the superficial peroneal nerve. One patient presented with hypoesthesia in the area of the superficial peroneal nerve which subsequently improved significantly. It was interesting to note that even very satisfied patients sometimes complained of minor discomfort, such as numbness. Nine of them felt no difference between the right and left ankle in the perception of their postoperative ankle.

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The minimum follow-up was 1 year month. Surgery was systematically associated (six weeks postoperative with support were prescribed), with circular immobilization in molded resin with the ankle held at 90˚, followed after 6 weeks by active and passive rehabilitation including muscle strengthening and training, detecting joint position.

4. Discussion

The quality of functional results in our series with a simple technique and prolonged follow-up was comparable to that of other studies.

Undoubtedly, some of these procedures show excellent results in the initial period, but in the long term they may also show cases of persistent instability, abnormal kinematics, stiffness, and low eversion. The large incision required for the procedure [6]-[8] theoretically increases the risk of wound infection, dehiscence, and nerve damage to the superficial peroneal nerve; we report no infections and only one permanent irritation of the superficial peroneal nerve.

93% of our patients found their ankle painless and perfectly stable without any apprehension; 86% of those who had surgery were able to return to sport.

In 1985, Chrisman-Snook *et al.* published their results of 48 patients operated with their technique using half of the peroneus brevis tendon [1]. The results showed 38 patients (79%) had excellent results, 7 (15%) had a good result with some symptoms, and 2 patients (4%) were considered sufficient because they had no regain of functionality in total. Among the 36 patients reviewed, inversion was identical to the uninjured side, but limited in 50% of patients to the range of (5 - 20). 39% of patients had hypoesthesia of the ankle, which persisted. In 11% of cases associated with sensitivity disorders, a neuroma and recurrent instability were also observed. In our series we do not find this stiffness, despite an identical duration of immobilization.

With the Evans technique, in 1988, Karlsson *et al.* [9] analyzed the long-term results of the original technique and found only 50% satisfaction among patients. Kitaoka *et al.* [10] in 1998 published the results of the Evans technique in 18 patients and found instability walking on uneven ground, frequent and sporadic pain, and limitation of physical activities as a common problem. However, 94% of these patients were satisfied with the operation. The modified Evans procedure and its results have been studied by some authors [11] [12] in a series of 25 - 85 patients and a follow-up period of 7 to 20 years. Studies have shown 35 - 55% excellent results but have shown limited inversion and flexion/extension movements and sometimes need for surgical revision for graft loosening and long-term degenerative changes. No patient in our series had to be taken again. The instability on irregular terrain reported by the authors seems to suggest that subtalar laxity is not taken into account in the instability.

C. Mabit *et al.* [13] made a comparative study of peroneus brevis tenodesis with periosteal ligamentoplasty. These results showed a better functional outcome of the periosteal procedure (91% success rate) compared to the peroneus brevis procedure (54% success rate). The functional results were statistically correlated with an improvement in stability assessed during a radiological resistance test. For these authors, the discrepancies in clinical results can be explained by a biomechanical approach: the anatomical reconstruction procedure of the anterior talofibular ligament is a better technique for preserving the adaptive function of the talar joint. Our results confirm their conclusions, with a very similar satisfaction

rate for the same procedure.

Castaing ligamentoplasty, a very popular technique in France, uses the distal part of the peroneus brevis. Jarde *et al.* [7] published a series of 46 patients operated with this technique with a follow-up of 5.5 years. With the Kitaoka score, they obtained 43% very good results, 39% good results, 11% good results and 7% poor results. Early complications included delayed scar healing, abscesses, neuromas, and algoneurodystrophy. Mild pain after prolonged exercise, recurrence of ankle sprain, edema, unsightly scarring, and limited leisure activities were observed. A major physical obstacle that has been observed includes decreased inversion amplitude between 50 and 70% compared to the healthy side, inconvenience, inability to squat, and inability to stand on one leg. This is why we have never used this technique in the service.

Matteo *et al.* [14] in their arthroscopic studies reported an overall complication rate almost twice that of complications from conventional surgery. It should be noted that this high rate of complications has no significant impact on the patient's postoperative clinical and functional results, as assessed at the end of follow-up (average AOFAS score: 92.48 for arthroscopy and 90.34 for open procedures). Arthroscopic techniques have higher costs due to the surgical equipment and higher surgical skills required, reserving these procedures for surgeons experienced in ankle arthroscopy. The duration of intervention and the duration of post-operative immobilization are unchanged compared to conventional techniques, to the extent that there are no fewer complications. The contribution of this technique seems limited to us.

The main limitation of our study is that the sample of patients is small and has a retrospective nature. However, it represents the first series studied in our center.

5. Conclusion

With a satisfaction rate of 93%, the results obtained in our study are in agreement with other techniques and previous publications on similar procedures. The main advantages of our method are effective stabilization of the two (2) levels (tibiotalar and subtalar) of the ankle and preservation of joint mobility of the ankle, with a very small number of complications. Chronic ankle laxity, especially when it is lateral, is now the main cause of ankle osteoarthritis, which argues in favor of early surgical repair of the lateral ligamentous structures.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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