The Journal of Foot & Ankle Surgery 56 (2017) 744–747

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

A 24-Month Follow-Up of a Custom-Made Suture-Button Assembly for Syndesmotic Injuries of the Ankle

Mohamed A. Imam, MD, PhD, FRCS(Tr & Orth) [1], Ahmed Matthana, MD, PhD [1], Ji Wan Kim, MD, PhD [2], Mohamed Nabil, MD, PhD [1]

[1] *Senior Lecturer and Consultant Orthopaedic Surgeon, Department of Orthopaedic Surgery, Faculty of Medicine, Suez Canal University, Ismailia, Egypt*
[2] *Associate Professor, Department of Orthopaedic Surgery, Haeundae Paik Hospital, Inje University, Busan, South Korea*

ARTICLE INFO

Level of Clinical Evidence: 4

Keywords:
ankle
diastasis
suture-button fixation
talus
tibiofibular syndesmosis

ABSTRACT

In the present retrospective analysis, we introduce a custom suture-button fixation device for acute ankle syndesmotic injuries that allows for early weightbearing without another planned operation for hardware removal. We evaluated 87 consecutive ankles in 87 patients (49 males [56.32%] and 38 females [43.68%]). Of the 87 patients, 15 (17.24%) withdrew or were lost to follow-up, leaving 72 patients (82.76%) in the present study. Their mean age was 35.2 (range 17 to 67) years. Nineteen patients (26.39%) presented with a pure syndesmotic disruption, and 53 (73.61%) had associated malleolar fractures. The American Orthopaedic Foot and Ankle Society scale score improved significantly from 31.2 ± 4.2 preoperatively to 88.5 ± 5.3 at an average of 24 months postoperatively ($p < .0043$). Revision was undertaken because of implant failure in 4 ankles (5.56%). Two revisions (2.78%) were performed in 2 ankles because of early weightbearing in the first 2 weeks after surgery. The third patient (1.39%) underwent revision at 5 weeks postoperatively. This syndesmotic reduction failure was attributed to failure of the threads, which was noted at the second surgery. The fourth patient (1.39%), a 66-year-old male, underwent revision at 5 months postoperatively because of persistent infection. An 18-month postoperative radiograph was available for all patients. The medial clear space had significantly decreased, from 8.2 ± 3.1 mm preoperatively to 3.5 ± 2.2 mm at 18 months postoperatively ($p < .0344$). Likewise, the tibiofibular clear space had decreased significantly, from a mean of 8.8 ± 3.7 mm preoperatively to a mean of 3.7 ± 2.2 mm at 18 months postoperatively ($p < .0322$). In conclusion, suture-button fixation described in the present report delivered satisfactory functional outcomes and anatomic reduction at minimum of 18 months after surgery.

The distal tibiofibular syndesmosis is essential for weightbearing activities. The suture-button (SB) technique has increased in popularity for the management of syndesmotic injuries because it allows for physiologic movement of the distal tibiofibular joint (1–5). Nevertheless, in developing countries, the increased expenses of the commercial construct have been a burden on already limited funds.

Syndesmotic injuries account for 10% of fractures around the ankle and ≤20% of fractures requiring operative intervention (6). Various methods of fixation have been described for management of syndesmotic injuries, including the SB technique. The SB allows for more flexibility, resulting in physiologic movement of the distal tibiofibular joint (1,7). However, because of cost issues, it is difficult to use the commercially available options routinely in our institution. Consequently, the need to design an alternative similar construct was substantial.

In the present retrospective study, we introduce, describe, and evaluate a custom-made SB construct for acute ankle syndesmotic injuries that allows for early weightbearing without another operation for hardware removal.

Patients and Methods

Three of us (M.I., A.M., and M.N.) retrospectively evaluated the first 87 consecutive ankles with syndesmosis injury in 87 patients (49 males [56.32%] and 38 females [43.68%]), with a mean age of 35.2 (range 17 to 67) years in whom the described SB technique was used. These patients were treated from January 2010 to January 2014. All the patients were followed up radiologically for a minimum of 18 months after surgery and clinically for ≤2 years postoperatively. Of the 87 patients, 2 (2.30%) died in the first year after surgery; 1 (1.15) within the first 6 months of severe acute respiratory syndrome attributed to multiple injuries, and 1 of other irrelevant medical comorbidities. Neither death was related to the ankle fixation, and both ankles were stable in situ at the time of death. Another 13 patients (15 total [17.24%]) either withdrew from the study or were lost to follow-up, leaving 72 patients (82.76%) for the final analysis. These

Financial Disclosure: None reported.
Conflict of Interest: None reported.

Address correspondence to: Mohamed A. Imam, MD, PhD, FRCS(Tr & Orth), Department of Orthopaedic Surgery, Faculty of Medicine, Suez Canal University, Circular Road, Ismailia, Egypt.

E-mail address: Mohamed.imam@aol.com (M.A. Imam).

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http://dx.doi.org/10.1053/j.jfas.2017.02.010

72 patients (42 right ankle [58.33%] and 30 left ankle [41.67%]) were successfully evaluated for ≤24 months. The study was performed at our trauma tertiary center, which serves a population of >5 million people. The present study was a 3-surgeon (A.M., M.N., and M.I.), single-center study, and the same technique was used in all recruited patients. The local institutional review board approved our study protocol.

All patients had syndesmotic diastasis injuries evidenced by a tibiofibular clear space of >6.0 mm on the anteroposterior or mortise radiographs, a medial clear space greater than the superior clear space or 5.0 mm on the anteroposterior radiographs, and/or tibiofibular overlap of <6.0 mm on the anteroposterior radiograph or <1.0 mm on the mortise radiograph (8).

Surgical Technique

With the patient under spinal anesthesia, the patient was positioned supine on the operative table. Initially, a tourniquet was applied at a pressure of 300 mm Hg. The construct is an assembly of different components (Table). After reducing the syndesmosis into position, an incision of 3 to 4 cm was made on the lateral aspect of the fibula, about 2 to 4 cm proximal to the plafond level.

Next, the 4 cortices were drilled in the transmalleolar plane (30° anterior to the coronal plane) using the 4-mm drill bit. Then, a slotted straight needle was loaded with a Vicryl® (polyglactin 910®; Ethicon, Inc., a Division of Johnson & Johnson, Somerville, NJ) guiding suture and passed through until retrieved percutaneously at the medial aspect of the tibia.

By pulling 1 of the 2 arms of the suture, a 2-hole minim plate was directed through the tunnel until it came out on the medial aspect. Pulling the other arm of the suture secured the plate transversely, anchoring it on the medial tibial cortex (Figs. 1 and 2). Finally, the polyester threads were passed through the second 2-hole mini-nonlocking plate on the fibular side (2 suture arms through each hole) and were knotted tightly together on the plate (Fig. 3). Postoperative ankle radiographs were performed routinely to check the syndesmotic reduction (Fig. 4).

Preoperative antibiotics and antibiotic regimens were the same for all patients and were in accordance with the local trauma protocol. Intravenous ceftriaxone 1 g was given within 60 minutes before the incision and was continued for 24 hours after surgery.

The postoperative rehabilitation regimens were the same for all the patients. The patients were immobilized in a short leg plaster cast for the first 4 weeks. All patients were fully weightbearing comfortably and had started ankle motion exercises at 4 weeks postoperatively.

All patients were invited to complete an American Orthopaedic Foot and Ankle Society ankle scale before and at 6, 18, and 24 months postoperatively. After testing for a normal distribution using the Kolmogorov-Smirnov and Shapiro-Wilk tests, the paired *t* test or Wilcoxon signed rank test was performed. Statistical analyses were performed using PASW Statistics, version 18.0 (IBM Corp., Armonk, NY). For all statistical tests, significance was defined as $p < .05$.

Results

The mechanism of injury was a fall, road traffic accident, and sports injury in 33 (45.83%), 28 (38.89%), and 11 (15.28%) patients, respectively. Of the 72 patients, 19 (26.39%) presented with a pure syndesmotic disruption and 53 (73.61%) had associated malleolar fractures. The American Orthopaedic Foot and Ankle Society scale score had improved significantly from 31.2 ± 4.2 preoperatively to 88.5 ± 5.3 at an average of 24 months postoperatively ($p < .0043$). A total of 4 superficial wound infections (5.56%) were documented postoperatively and were treated successfully with antibiotics. In addition, 3 patients (4.17%) required treatment of deep venous thrombosis and 2 (2.78%) for pulmonary embolism.

Revision was undertaken as a result of implant failure in 4 ankles (5.56%). Two revisions (2.78%) were required in 2 ankles because of early weightbearing in the first 2 weeks after surgery. The early weightbearing resulted in subsidence and pull through of the small plate into the bone and was attributed to the osteoporotic nature of the patient. Additionally, this was 1 of the earliest cases we performed, and the failure could have been attributed to probable inadequacy in the technique. Both revisions were performed using the same construct to achieve anatomic reduction, and both healed completely, with no other surgery required. The third patient (1.39%) underwent revision at 5 weeks postoperatively. This syndesmotic reduction failure was attributed to failure of the threads noted at the second surgery. The revision included repair of the soft tissue envelope (including the deltoid ligament), hardware removal, and fixation with a syndesmotic screw. The fourth patient (1.39%), a 66-year-old male, underwent revision at 5 months because of persistent infection. Pain was persistent over the anterior ankle. At exploration, the construct was found to be loose, with evidence of infection, which was proved by culture and sensitivity. The symptoms resolved after removal of the construct, and further revision was not required.

Postoperative 18-month ankle radiographs were available for all patients. The medial clear space had decreased significantly, from 8.2 ± 3.1 mm preoperatively to 3.5 ± 2.2 mm postoperatively ($p < .0344$). Likewise, the tibiofibular clear space had decreased significantly, from a mean of 8.8 ± 2.7 mm preoperatively to mean of 3.7 ± 2.2 mm at 18 months postoperatively ($p < .0322$).

Table
List of consumables needed for suture-button construct

Suture Button Construct Structure
Polyester braided Ethibond Excel® (size 5; Ethicon, Inc.)
Two mini plates (size 2 mm) with 2 holes
Polyglactin 910 sutures (size no. 2; Vicryl®; Ethicon, Inc.)
Drill bit, 4 mm
Suture needle, 15 cm long with slotted end

Fig. 1. Application of the assembly.

Discussion

We have described a custom-made SB construct for treatment of acute syndesmotic injuries either isolated or associated with fractures. We observed excellent survivorship of 72 constructs for acute

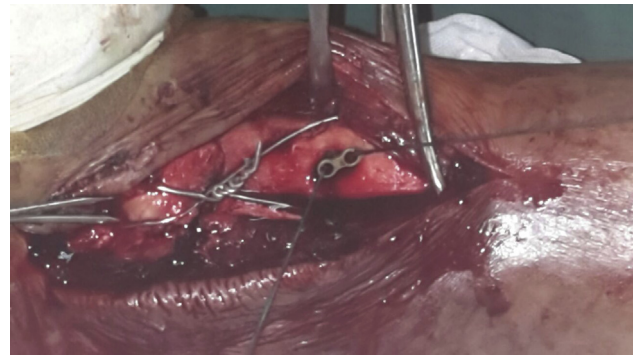

Fig. 2. Pulling of the 2 threads securing the plate on the medial tibial surface.