Syndesmotic Screw Fixation Versus Button-Suture Fixation for Patients with Ankle Fracture: Mini Review

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Abstract

Background:
Ankle fractures are among the most common injuries of the human skeleton treated by orthopedic surgeons with an increasing incidence in the elderly. Different treatment modalities are now available.

Aim of the study:
The purpose of this study was to compare the clinical and radiological outcome of syndesmotic screw fixation versus button-suture fixation in patients with ankle fractures.

Conclusion:
Suture-button fixation can provide stability similar to that provided by screw fixation in patients with ankle fractures.

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Introduction:

Reducing the syndesmosis is the initial step in the surgical therapy of syndesmosis ligament damage. It can be done in an arthroscopic, closed, or open manner. The fibula is frequently externally rotated and laterally translated in isolated ligamentous injuries without fibula fracture. Internal rotation is applied using a bone clamp on the distal fibula, and a second two-point reduction clamp is applied from the anteromedial tibia to the posterolateral fibula 3 cm in front of the ceiling (1, 2).

Fluorescence should be used to confirm reduction. Recent research suggests that the operating surgeon may have been mistaken about the efficacy of earlier syndesmotic reduction techniques. The techniques listed below can then be used to establish definitive fixation. It is crucial to restore the fibula's length, internal rotation, and medial translation when a Maisonneuve pattern, proximal fibula fracture, and syndesmosis injury are present. Anatomic reduction and stable fixation of the malleolar fractures should be achieved prior to reducing the syndesmosis as indicated above when a distal fibula fracture coexists with syndesmotic instability (3).

Fixation using Syndesmotic Screws

A popular treatment for stabilising the syndesmosis is syndesmotic screw fixation (SSF). This approach has been used for decades and has a history of producing good to exceptional results (4).

SSF offers rapid stability, enabling healing at a minimal initial cost, and because surgeons are experienced with the procedure and the equipment, they may be confident using it. The trans-syndesmosis screws are drilled lateral to medial at roughly 2 to 5 cm proximal and parallel to the joint line with the syndesmosis decreased and the ankle in a neutral position.

The screw(s) should have an angle of 25 to 30 degrees from posterior to anterior. There is a wealth of literature examining various variables including size, quantity, cortices involved, placement, and requirement for screw removal. 3.5 mm or 4.5 mm screws are frequently used, although there is no evidence to support the use of larger screws, even though using 4.5 mm screws could make removal easier and make them less likely to break (5).

When compared to small screws on removal, larger screws pose the risk of potentiating a stress riser. If any screws need to be pulled out, do so after the wound has healed unless the hardware is damaged (6, 7).

Additionally, SSF has been linked to a high rate of mal-reduction, which has been identified as the most powerful independent predictor of unfavorable clinical outcomes (lower The American Orthopaedic Foot & Ankle Society [AOFAS] scores, decreased range of motion). It must be underlined that the screws themselves do not lead to mal-reduction; rather, they only keep the fixation in place. In a fixed SSF, the reduction prior to fixation is crucial. It has been demonstrated that removal of the screw enables in-situ reduction and the restoration of syndesmosis motion in cases of surgical mal-reduction. (8-10).

Hardware removal may seem straightforward, but it could expose the patient to unneeded risks and expenses. The removal of the syndesmosis hardware, according to Lalli et al. (11)'s analysis, imposes a significant financial burden on both the patients and the healthcare system as a whole.

Button-suture Fixation

Instead of using syndesmotic screws, suture-button fixation (SBF) of the distal tibiofibular joint has become increasingly popular. Despite the fact that both of these methods produce comparable results, the SBF has mechanical and anatomical advantages. The fibula is reduced within the incisura, and then a guidewire is inserted in the same location as a conventional screw, 2 cm from the joint line and roughly 25 to 30 posterior-anterior. Fluoroscopy is used to confirm the position of the guidewire before a cannulated drill is used to guarantee that all four cortices have been pierced. The surgeon must verify knowledge with the chosen device because there are numerous manufacturers of SBF devices.

Typically, an oblong button device is placed on the medial cortex of the tibia via a passing guidewire, and it is subsequently flipped across the tunnel to provide cortical fixation. The lateral button, also known as the fibular buttress plate, is sequentially tightened. SBF has some drawbacks; osteolysis of the bone next to the implant and subsequent sinking of the device have both been reported. (12).

However, more recent devices offer knotless suture fixation, which has helped to lessen these consequences. Earlier devices needed numerous knots to achieve fixation, which frequently left patients with palpable painful suture stacks and reports of abscess formation leading to osteomyelitis (13, 14).

SBF does have a greater initial cost, however the costs are substantially lower when compared to routine SSF hardware removal. A research by Neary et al. (15) compared the cost-effectiveness of these two surgical approaches and found that SBF patients' care was less expensive than that of SSF patients. They continue by saying that SSF only started to pay for itself when the screw removal rate dropped below 10%. In a cadaveric research, the SBF mechanically prevents mal-reduction even with ineffective clamp placement (16).

This was also examined by a randomised controlled trial, which discovered that there might be a similar incidence of intraoperative mal-reduction. However, due to the dynamic nature of SBF fixation, there were significantly more incidences of mal-reduction in the SSF group at the 2-year follow-up, as seen by CT (17).

Due to the original fibula's ability to externally rotate three times during dorsiflexion, SBF also permits micro fibular motion. SBF does not need to be removed because to the more anatomic motion it is given, eliminating the requirement for hardware removal and any worries about broken hardware (18).

The results of SBF are positive; several published meta-analyses show higher AOFAS scores, reduced rates of postoperative complications, and an even quicker time to full weight-bearing when compared to SSF (5, 19).

In a randomised experiment contrasting SBF with SSF, Anderson et al. (20) found that SBF had higher AOFAS, Olerud-Molander Ankle, and VAS ratings as well as less widening at the minimum 2-year follow-up than did SSF.

Studies have revealed that one suture button has equivalent results to SSF and that introducing a second suture button may not significantly increase stability, which has raised issues about the usage of one versus two suture buttons (21, 22).

Anterior-inferior tibiofibular ligament augmentation along with suture-button fixation. In light of SBF's well-documented accomplishments, some writers have legitimate worries that the permitted micromotion may result in insufficient stability (23-25); nonetheless, functional clinical investigations are required to define stability. It has been suggested that suture button fixation with additional suture tape augmentation of the AITFL may restore stability while preserving motion based on the observation of lateral ankle ligament augmentation with suture tape for lateral ankle instability. This surgical procedure was initially explained by Teramoto et al in 2017. (26).

Shoji et al. (27) went on to do a biomechanical analysis of this procedure in comparison to suture-button fixation alone and screw fixation using cadaveric models. They discovered that screw fixation was too rigid and that suture-button fixation alone did not offer stability to the syndesmosis. They achieved dynamic stability that was comparable to intact models using suture-button fixation and further AITFL augmentation. There are no long-term studies analysing the results of this approach yet. When compared to SSF, AITFL anatomic repair and augmentation had equal outcomes, reduction, earlier rehabilitation, and less complications, according to a study done on syndesmotic instability with posterior malleolus involvement (28).

This method was discovered to be helpful for patients with a shallow tibial incisura (25–40%) (29, 30). owing to the innate instability and propensity for mal-reduction (31).

The two main issues with all approaches are over compression and improper reduction. Concerns about SBF's impact on medial neurovascular systems have emerged recently. The most clinically important syndesmosis treatment consequence, mal-reduction, has been found to result in noticeably inferior outcomes (32).

Incorrect clamp tine location and incisura shape are two causes of mal-reduction. The placement of the tines is crucial when employing reduction forceps to reduce syndesmosis. In the lateral view, the medial clamp tine should be on the anterior third of the tibial line and the lateral clamp tine on the fibular ridge (2, 4).

When Cherney et al. (31) examined the incisura's morphology, they discovered that various mal-reduction patterns are connected to certain morphologies. They discovered that deep syndesmoses tended to posterior sagittal plane and rotational malalignment, whereas shallow incisura linked with anterior fibular mal-reduction and was less likely to be rotated.

It is possible to reduce mal-reduction by placing the clamps correctly (4, 32) and avoiding over compression. Over compression is defined by Haynes et al. (33) as fibular medialization greater than 1.0 mm in comparison to non-injured extremities. In their investigation, they discovered that those with a mean clamp force of 130 N had appropriate compression of the syndesmosis while those with a mean clamp force of 163 N were over compressed. According to their description, the necessary force would be equivalent to what is required to imprint a 12-ounce beverage can. Additionally, we use direct arthroscopy and fluoroscopy to confirm the decrease. visualization as described by Lui et al. (34) and Miller et al. (35).

Regarding at-risk structures in SBF, it has been identified that the saphenous nerve and vein are in close proximity, leading to entrapment of these structures. Cadaveric studies of SBF have shown that nerve entrapment occurs 10% to 20% of the time and saphenous vein entrapment occurs 10% to 37% of the time, regardless of how proximal the SBF was placed, leading these authors to suggest medial incisions to ensure entrapment is avoided (36-38).

We have also transitioned to newer SBF techniques which help flip the button, potentially reducing the saphenous nerve complications that have been described. A newer knotless device is also available which has demonstrated good clinical results with the possibility of reducing entrapment and skin irritation seen in previous devices (13).

Conclusion:

Suture-button fixation can provide stability similar to that provided by screw fixation in patients with ankle fractures.

Conflict of interest

Authors declare no conflict of interest.

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