Many methods to treat a syndesmosis injury – are any of them superior?

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Syndesmosis rupture is common in operatively treated ankle fractures, and needs to be transfixed if found to be unstable after malleolar fixation. The aim is to prevent instability and late posttraumatic osteoarthritis subsequently affecting the upper ankle joint. The recommended way to transfix the distal tibiofibular joint is the placement of a 3,5mm tricortical syndesmosis screw approximately 2 cm above the tibial plafond. Many other methods of fixation have been described but the latest suture-button device (TightRope) stands out as having the advantage of being flexible and allowing physiological movement in the tibiofibular joint. In biomechanical studies the suture-button has proved to be as strong as screw fixation. Clinical studies also yield outcomes comparable to syndesmosis screw(s). However there are no randomised controlled studies to date. The suture-button is a promising development for syndesmosis transfixation, but more high quality studies are needed to illustrate its superiority over screw fixation.

Syndesmosis rupture is a ligamentous injury between the tibia and fibula. The syndesmosis consists of an interosseus ligament, membrane and inferior tibiofibular (anterior and posterior) ligaments. It is often injured in conjunction with ankle fractures, but rupture may rarely occur in isolation (1).

Ankle fractures are one of the most common fractures to be treated operatively. Approximately 10% of all ankle fractures and 20% of operatively treated fractures include a significant syndesmosis injury, but it is still unclear when they need to be transfixed (2–4). However, if a syndesmosis injury is noted, it is recommended to transfix it to avoid late instability in the upper ankle joint, post-traumatic arthritis, pain and stiffness (5–7).

There are many methods of transfixing the tibiofibular joint. Along with traditional screw fixation there are the options of using bioabsorbable screws, K-wires, syndesmosis hooks, suture-button fixation and even a direct repair of the ligaments (8).

When is syndesmosis transfixation needed?

Significant syndesmosis injury is traditionally linked to pronation-external rotation injuries (PER, Lauge-Hansen classification i.e. Weber C) but has also been shown to be present in some of the supination-external rotation injuries (SER or Weber B) (3,9,10).

According to the classic cadaveric study by Boden and his colleagues only those syndesmosis injuries in which rigid medial side fixation is not possible and the fibular fracture is at least 45 mm from the plafond, should be transfixed (11). Importantly, if the medial side can be stabilized (rigid medial malleolus fixation and deep deltoid ligament intact), no syndesmosis transfixation is needed.

Other clinical studies also support the findings of Boden and his colleagues (7,12), although some authors suggest testing the stability of the syndesmosis intraoperatively and transfixation if noted unstable (13).

An ideal fixation method

An ideal syndesmosis implant would include stable fixation, which would maintain reduction of the syndesmosis regardless of early full weight-bearing. It should also allow physiological movement in the tibiofibular joint and should not require removal after recovery.

Screw transfixation

Metal screw fixation is considered the 'treatment of choice' in transfixing the syndesmosis and all other methods should be compared to it (14). However there are variations in how screw fixation can be performed.

Two screws have been shown to form a stronger construct to fix the syndesmosis compared to one in cadaveric studies. Some authors advocate using two screws in high fibula fractures (Maisonneuve or Dupuytren's fracture) (15,16), neuropathic feet in diabetics and if the patient is obese (17). In Northern-America it is just as common to use one screw as it is two, whilst in the UK two screws are preferred (18). There are no good studies comparing fixation with one versus two screws, but with one screw good clinical results have been achieved, and can be considered a strong enough fixation excluding the above-mentioned exceptions.

A 4,5 mm screw provides a marginally stronger fixation compared to a 3,5mm screw, but does not have a significant biomechanical advantage (19,20).

A tricortical screw has been shown to provide enough stability to the syndesmosis compared to four-cortex screw biomechanical stability (21). Instead, a four-cortex screw is associated with a longer recovery period, however no significant clinical difference can be seen one year following fixation (22).

According to a cadaveric study if the syndesmosis screw is placed approximately 2 cm above the plafond it provides the strongest transfixation. However there is no evidence that the location of the screw affects clinical or radiological outcome in the long run (23,24).

There is no evidence that a titanium screw has any advantage over a stainless steel one, and good clinical results have also been reported with bioabsorbable screws (25,26,27,28).

Numerous problems have been linked to syndesmosis transfixation with screws. Screw fixation is suggested to be too rigid and rates of malreduction in the tibiofibular joint vary between 16% – 52 % (29,30). There is some evidence that malreduction may be corrected following screw removal (31). However, according to Weening and Bhandari post-operative malreduction has been specifically shown to be a risk factor for poor outcome (29).

Other problems with screw fixation include the fact they may break, irritate local tissues, skin and lead to upper ankle joint stiffness (32,33).

Some authors advocate removing syndesmosis screws routinely and even before allowing the patient to fully weight-bear (34). However there is no evidence that a better clinical outcome can be achieved by routinely removing the screws and this is no longer recommended (16).

Suture-button as a method to fix the syndesmosis

Syndesmosis transfixation can also be performed by using a strong but dynamic suture-button device. This is not a new idea, and has become more popular after a suture-button kit was introduced a few years ago (TightRope, syndesmotic repair kit; Arthrex, Inc., Naples, FL). Fourteen per cent of trauma surgeons in North America reported using a suture-button device routinely (18). No data is available from Finland, the UK or the rest of Europe.

The TightRope device consists of two metal /buttons and two strong No 5 braided polyester sutures. One of the metal buttons is passed through the predrilled holes in the tibia and fibula. The tibiofibular joint is reduced and the TightRope is tightened and tied. In an ideal situation the TightRope provides strong and stable fixation, whilst allowing physiological movement in the tibiofibular joint.

In biomechanical cadaveric studies the suture-button has been shown to be at least as strong as screw fixation (35–39). There is only one cadaveric study in which the suture-button provided weaker fixation compared to screw fixation (40).

In clinical series the suture-button has also been shown to achieve as good long-term results as screw fixation (41–45).

According to a recent systematic review the mean AOFAS score of 133 patients treated with a suture-button was 89,1 with the mean follow up time being 19 months. The corresponding score was 86,3 for the group of 253 patients treated with screw fixation, but

follow up was also longer (42 months). Suture-button fixation was also associated with a faster return to work and less need for device removal (10% vs 52%) (8).

It is not clear how many suture-button devices are needed to transfix the syndesmosis. One device has been used in biomechanical studies but this has varied between 1 to 3 suture-buttons in clinical studies (41,44).

There are currently three ongoing randomised clinical trials looking at suture-button versus screw fixation in syndesmosis injuries. One of the studies is running in Oulu University Hospital and it is the only study in which all patients have been collected in series (Identifier number: NCT01742650).

There are 44 patients with Weber C type ankle fractures in our series. The syndesmosis was fixed with a TightRope in half of the patients and for the other half we used one tricortical 3,5 mm screw fixation. All patients underwent intraoperative CT scanning after syndesmosis fixation. A below knee cast was applied for 6 weeks with partial weight-bearing protocol for all patients. Two years follow up will be complete in a year.

In our series, 75 % of patients who had a high fibula fracture (<10 cm above the plafond) and syndesmosis fixation performed with a TightRope, had a malreduction of the tibiofibular joint demonstrated on intraoperative CT. The corresponding number was only 11 % in more distal fractures. However, after applying the below-knee cast a satisfactory reduction was achieved in almost all patients, highlighting the importance of ligamentotaxis to reduce the syndesmosis if a dynamic device is used (Figure 1).

Postoperative reduction

The syndesmosis reduction cannot be assessed accurately based on plain post-operative radiographs (30). It is recommended to check the congruency of the tibiofibular joint with CT either intra- or postoperatively and to follow current published recommendations (46).

Conclusion

Syndesmosis rupture is a common injury and is recommended to be transfixed if noted unstable after malleolar fixation. The current "treatment of choice standard" of transfixing the distal tibiofibular joint is one 3,5mm tricortical syndesmosis screw approximately 2 cm above the plafond, where 2 screws has been recommended in high fibula fractures, diabetics or obese patients. The suture-button appears to be a promising alternative, with the advantage of allowing for physiological movement, a faster recovery and less need for device removal. Further quality studies are needed.

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