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Original article

The management of syndesmotic screw in ankle fractures

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Summary. *Background and aim:* There is a wide debate about the number, diameter and length of the syndesmotic screw and necessity and timing for its removal. The aim of this study is to determine whether functional and radiological outcomes differ in patients operated for Weber type B and C ankle fractures who had syndesmotic screws removed (group 1) compared to those who did not (group 2). Furthermore, authors want to define if it is really necessary to remove this device and its correct timing. *Materials and Methods:* 90 patients were eligible for the study. The functional outcomes were analyzed 1 year after surgery using OMAS and AOFAS scores. Radiographic evaluation assessed the tibiofibular distance immediately and 12 months after surgery and fracture's healing. *Results:* Clinical and x-rays results were similar in both groups at follow-up. *Discussion:* Fractures with interruption of syndesmosis are lesions that, if not well treated, are complicated by joint stiffness, residual pain and post-traumatic osteoarthritis. Syndesmotic screw removal is not routinely performed, thus accepting the risk of rupture but avoiding a new surgery. *Conclusions:* Results observed suggest that syndesmotic screw removal is not necessary. If surgeon decide to remove this device correct timing is mandatory in order to obtain satisfactory long-term results. (www.actabiomedica.it)

Key words: ankle, fracture, syndesmosis, screw, fixation

Introduction

Ankle fractures occur with an incidence of 107-148 per 100,000 in the adult population (1, 2). The mechanism of injury is mainly a traumatic event in external rotation with the foot supinated (SER) or pronated (PER), as described by Lauge Hansen (3). The consequence is often a Denis-Weber Type B or C lesion associated to syndesmotic injury occurring in up to 40% of all Type B injuries, and up to 80% of all Type C (4). Anatomical restoration and stabilization of the disrupted distal tibiofibular syndesmosis is essential in order to prevent changes in contact load and posttraumatic osteoarthritis, and to improve functional outcomes (5-8).

Characteristic of syndesmotic fixation is a font of wide debate among orthopedic surgeons. There is no consensus regarding the number, diameter and length of the syndesmotic screw and necessity and timing for its removal (9-12). This study has the aim to determine whether functional and radiological outcomes differ in patients operated for Weber type B and C ankle fractures who had these screws removed compared to those who did not. Furthermore, authors want to define if it is really necessary to remove this device and its correct timing.

Materials and methods

This study was conducted in accordance with the principles of Declaration of Helsinki. All patients signed informed consent about the treatment they were subjected and the processing of their personal data.

Adult patients affected by Weber B and C closed fractures and synthesized with plate and screws (ORIF) associated to syndesmotic fixation between

January 2010 and July 2017 were included. Each case was identified from a patient information database at the University Hospital of Parma. Patients with their charts or radiographs unavailable or incomplete were excluded. Exclusion criteria were also the development of postoperative infection and hardware failure and the need of additional surgery due to complications. Age and gender, mechanism of injury and characteristics of fractures (affected side and fracture type) were extracted from the database and analyzed. All subjects had syndesmotic fixation with 1 or 2 3.5mm screws with a tricortical placement. Patients were divided in 2 groups: group 1 included subjects who removed the syndesmotic screw and group 2 those who did not.

Postoperatively, all patients were immobilized for 4 weeks without weightbearing. After this period rehabilitation started and progressive loading was allowed.

The choice to retain or remove the syndesmotic screw was based on consultant preference.

A functional evaluation was performed 1 year after surgery through 2 validated scoring systems: OMAS and AOFAS (13-15).

A radiological assessment immediately and 1 year after surgery was done using anteroposterior, lateral and mortise views. Tibiofibular clear space (the horizontal distance between the lateral margin of the posterior tibial malleolus and the medial border of the fibula) (figure 1) was recorded in patients of both groups as well as fracture's consolidation.

All data extracted from the database and collected during the final outpatient clinic examination were introduced into a database (Microsoft Excel). Non-parametric Mann-Whitney U test was used to compare AOFAS and OMAS results. Statistical analysis was performed using SPSS for Windows (version 20.0). Statistical significance was defined as p value of <0.05.

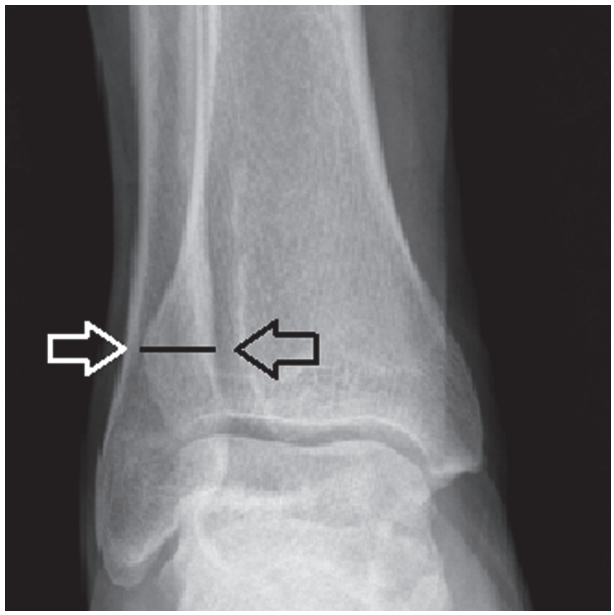

Figure 1. Tibiofibular clear space (line between arrows)

Results

A total of 90 patients were included in the study [54 (66%) were females and 36 (34%) males]. Mean age at the time of injury was 49 years (range 19-71). Fractures occurred more frequently on the left side (54.0%). SER injuries were seen in 15 subjects (14%) and PER injuries in 75 (86%). Thirty-nine patients (43.3%) sustained Denis-Weber B type fractures; the remaining (56.7%) had type C injuries. Based on the state of the syndesmosis screw, group 1 comprised 65 patients (72%) and group 2 25 (28%). In the second group, 8 subjects broke the device but results were similar to others (figure 2). All patients of group 1 removed the screw after a mean period of 7 weeks from surgery (range 6-8) (12). Overall, clinical outcomes for OMAS and AOFAS scores are described in table 1. There were no statistically significant differences in these results between the two groups ($p<0.05$).

Radiological assessment is summarized in table 2. The tibiofibular clear space (normal 0-5 mm), measured immediately after surgery and 1 year later, was similar in group 1 and 2 ($p<0.05$). All fractures healed after a mean period of 3.5 months (range 3-5).

Discussion

This retrospective trial focused on the comparison between two groups of patients. The first group retained the syndesmotic screw, while the second removed it.

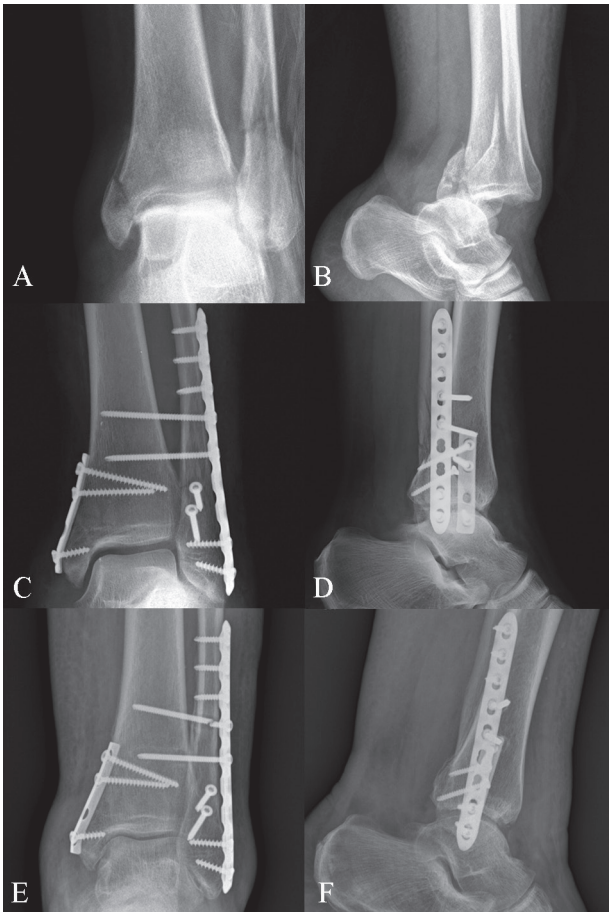

Figure 2. Preoperative x-ray of left ankle fracture (A and B); postoperative views (C and D); radiographs 4 months after surgery with syndesmotic screw rupture (E and F)

Table 1. Clinical outcomes at follow-up

	AOFAS	OMAS
Group 1	94	95
Group 2	99	92.5
Test U Mann Withney	p = 0.056	p = 0.081

Table 2. Radiological outcomes

Tibiofibular clear space (mm)		
	Postoperative x-ray	x-ray at 1 year of follow-up
Group 1	5.0	5.0
Group 2	4.5	5.0
Test U Mann Withney	p = 0.685	p = 0.175

There are no clear indications in literature on the real need for removal of this screw. In a recent literature review, in which seven clinical studies were analyzed, there were no differences in outcomes of patients who maintained or removed this device (16). Its rupture occurs in 29% of cases (16), but numerous studies do not report significant differences in outcomes of patients with intact, broken or removed screw (17-20). Indeed, more recent studies showed that patients with rupture of the screw report a better outcome than the group of patients with intact one (18, 21).

Another report demonstrated that the functional evaluation in patients with retained (intact or broken) or removed screw was not statistically different, although the group of patients with intact screw had a worse ankle function (17). Authors hypothesized that the cause was the decrease of the physiological movement of the fibula in relation to the tibia, which limited ankle's movement (22).

To confirm this, surgeons who are usual to remove the screw state that its removal guarantees a recovery of the biomechanical physiology of the ankle (22-24) with better long-term outcomes (17).

Opponents instead stress that an increased risk of distal tibiofibular diastasis exist after removal (25), as well as an increased risk of infections (18).

Clinical results observed in this report are similar to those described in the literature. In fact, data registered 1 year after surgery were not statistically different between group 1 and 2. Furthermore, rupture did not influence the final outcomes. One of the main problems after ankle ORIF is the management of the postoperative period in which an aggressive rehabilitation and an early weight bearing may induce the rupture of the syndesmotic screw and an early removal may favor distal tibiofibular diastasis. In many cases, the patient struggles to accept the idea of being able to load on the ankle with retained screw, which is essential to avoid the evolution towards a rigid joint. Likewise, the patient does not accept the idea of maintaining a screw that has broken although this does not entail any risk (18, 21). In any case, authors believe that, whatever the treatment performed, the postoperative management has to be the same with an initial period of cast immobilization for at least 4 weeks, thus facilitating the healing of the disrupted soft-tissues structures.

The maintenance of tibiofibular clear space at 1 years follow-up confirms this assumption. Finally, authors wants to stress the importance of removal's timing of the screw which has to be performed not earlier than 7 weeks following ORIF, thus preventing a possible abnormal enlargement of tibiofibular distal joint.

Conclusions

Results observed suggest that syndesmotic screw removal is not necessary. Rupture of the screw does not influence 1-year follow-up outcomes. Removal's timing of the device must guarantee the complete healing of the injured syndesmotic soft tissues.

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