TECHNIQUE OF SYNDESMOTIC SCREW INSERTION IN WEBER TYPE C ANKLE FRACTURES

SAJID EJAZ RAO, SOHAIL MUZAMMIL, ABDUL HAFEEZ KHAN

ABSTRACT

Objective *To find out impact of the position of the ankle during tightening of the syndesmotic screw used to fix syndesmotic disruption in bimalleolar Weber type C ankle fracture.*

Study design *A randomised controlled clinical trial.*

Place & Duration of study *Orthopaedic Department at Combined Military Hospital Malir Karachi, from October 2002 to December 2005.*

Patients and Methods *We hypothesized that syndesmotic screw tightening with ankle in plantigrade position rather than 20^0 dorsiflexion would result in reduced range of dorsiflexion of the ankle joint postoperatively. Twenty-one consecutive young active patients with Weber type C bimalleolar ankle fractures having syndesmotic injuries treated with open reduction and internal fixation were randomly allocated to two groups. In group I (n = 10) syndesmotic screw was inserted with ankle in 20^0 dorsiflexion and in group II (n = 11) syndesmotic screw was inserted with ankle in plantigrade position. Patients were followed up for 12 months. Study end point was healing of the fracture. Subjective and objective assessment with Olerud-Molander Ankle (OMA) scores and bi-planar radiography was done. The range of ankle dorsiflexion postoperatively, hardware failure and need to remove the screw were the outcome measures.*

Results *Comparing two groups using paired sample t-test, we did not find a statistically significant difference in postoperative range of ankle dorsiflexion between the two groups (p values > 0.05). Differences between the two groups as regard the OMA scores, hardware failure and need to remove the screws were not significant either.*

Conclusion *Syndesmotic screw can be tightened with ankle in plantigrade or dorsiflexed positions without resulting in reduced range of ankle dorsiflexion postoperatively.*

Key words *Ankle Fractures, Syndesmotic injuries, Syndesmotic screw.*

INTRODUCTION:

Syndesmosis disruption is most commonly associated with Weber type C ankle fractures. Syndesmosis instability may lead to talar displacement and deranged ankle mechanics.[1,2]

Correspondence
Dr Sajid Ejaz Rao
Department of Orthopaedics
Combined Military Hospital Bannu Cantt
Email: sajidhfh@yahoo.co.uk

The diagnosis of unstable syndesmosis injuries is based on preoperative radiographs, intraoperative stability testing, and sometimes on intraoperative fluoroscopy.[3] MRI and CT scanning have been reported as an adjunct to evaluating syndesmosis injury.[4,5]

Controversies exist about syndesmotic fixation.[6] Many surgeons and orthopaedic references recommend that fixation of a disrupted distal tibiofibular syndesmosis be performed with the ankle in dorsiflexion to avoid overtightening and subsequent restriction of ankle dorsiflexion. This recommendation is based in large part on one cadaver study without clinical correlation.[7] On the contrary, Tornetta proved in a cadaver model that maximal dorsiflexion of the ankle during syndesmotic fixation is not required to avoid loss of dorsiflexion.[8] To our knowledge all those studies addressing the issue have been performed in cadaver models. The evidence regarding the desired ankle position during syndesmotic screw fixation is lacking in real patients. We hypothesized that syndesmotic screw fixation in plantigrade ankle position rather than 20^0 dorsiflexion would result in reduced postoperative range of ankle dorsiflexion. A prospective randomised controlled trial was conducted to prove or disprove this hypothesis.

PATIENTS AND METHODS:

A randomised controlled clinical trial was conducted at Combined Military Hospital Malir Karachi from October 2002 to December 2005. Written informed consent was obtained from all the patients. The study was approved by the medical ethics and scientific committee of the hospital.

Twenty-one young males, involved in competitive physical activities, having bimalleolar Weber type C ankle fractures with syndesmotic disruption were included in the study. Those patients in whom preoperative radiographs and intraoperative clinical testing could not establish syndesmotic disruption were excluded. All patients were admitted on the day of injury. The age ranged from 21 to 34 years (mean 28 years). In five patients injury was open and 16 had closed injury (table I). Syndesmotic injury was diagnosed on the basis of plain radiographs preoperatively and confirmed intraoperative by cotton or hook test.[9] More than 5mm clear space (the distance from the medial fibular border to the posterolateral border of the tibia measured 1cm above the joint) was taken as a radiological evidence of syndesmotic injury on a preoperative anteroposterior radiograph. Syndesmotic injury was also diagnosed if the tibiofibular overlap (the distance from the medial fibular border to the anterolateral border of the tibia as measured 1cm above the joint) was less than 6mm or approximately 40% of the fibular width.[10] This was confirmed intra-operatively using the conventional hook test done by grasping the stabilized fibula through the lateral incision with a hook or clamp and pulling it in the coronal or sagittal planes. If more than 3 or 4 mm of lateral displacement in coronal or more than 10-12 in sagittal planes occurred, syndesmotic disruption was confirmed.[11,12] Those patients in whom intra-operative testing could not confirm syndesmotic disruption were excluded from the study.

Patients were randomly divided into two groups using randomisation sequence generated by random table. All patients in both the groups underwent open reduction and internal fixation with a 3.5mm Dynamic Compression Plate with 3.5mm cortical screws on the lateral side and two 4mm screws for the medial malleolus fracture. Quadricortical fixation with a single fully threaded AO cortical screw in position mode, inserted from the lateral side, was done for each syndesmotic injury in both the groups.[13,14] The syndesmosis was anatomically reduced and held with provisional Kirschner wires or a reduction clamp before the syndesmotic screws were inserted. The screws were positioned 2 to 3 cm proximal to the tibial plafond, directed parallel to the joint surface, and angled 30 degrees anteriorly so that they were perpendicular to the tibiofibular joint.[15] In group I (n = 10) the syndesmotic screw was tightened with ankle in plantigrade position and in group II (n = 11) the syndesmotic screw tightening was done with ankle in 20^0 dorsiflexion.

Postoperatively all patients were treated with non weight bearing for 10 weeks and gradual weight bearing allowed initially on crutches and in another two weeks time full weight bearing without crutches was started. All patients were discharged from the hospital after removal of the sutures on 12th postoperative day. The syndesmotic screws was left in place indefinitely, in both the groups. Hardware removal was to be done only after healing of the fracture, for definite indications of screw loosening leading to reduced range of motion of the ankle joint or if the screw broke and was causing pain to the patient. Follow up was done on monthly basis for 12 months. All patients were seen at 6, 10, and 16 weeks and then at 6, 9 and 12 months postoperatively in the outpatient department. Study end point was healing of the fracture. Measurement of range of ankle dorsiflexion, loosening or breakage of the screw and need to remove the screw were the outcome measures. At every follow up visit, patients were assessed subjectively and objectively with OMA scores,[1] range of ankle dorsiflexion assessment and two views (anteroposterior and lateral) on x ray. Radiological evidence of fracture healing was noted. Loosening of the screw was diagnosed according to predefined criteria of osteolysis around the two third length of the syndesmotic screw seen on an anteroposterior radiograph.[16]

SPSS version 12.0 was used for data analysis. Statistical analysis was done using paired sample t-test and p-value was considered significant at the level of <0.05.

RESULTS:

There were 10 patients in group I, in whom syndesmotic screw was tightened with ankle in plantigrade position (Table II). All were young active males of age range 20-29 years. Two patients had an open injury and eight had a closed fracture. All fractures healed over 14-18

Table: I. Details About Patients

Details	Group I	Group II
Number of patients	10	11
Age range	20 -29 Years	19-34 Years
Open injury	2	3
Closed injury	8	8

Table: II. Postoperative Outcome

Outcome Measures	Group I	Group II
Reduction in range of ankle dorsiflexion	7^o (Mean)	6^o (Mean)
OMA score	79 (Mean)	83 (Mean)
Fracture healing (On x ray)	10	11
Screw loosening	7	6
Screw breakage	1	1
Hardware removed	8	7
Improvement in dorsiflexion after removal of loose screw	6^0 (Mean)	5.5^0 (Mean)

weeks time and loss of reduction was not noted. Screw loosening was seen in seven and screw breakage found in one out of 10 patients in this group. Mean OMA score was 79 and reduced postoperative range of ankle dorsiflexion was found in seven out of 10 patients in group I.

There were 11 patients in group II, in whom syndesmotic screw was tightened with ankle in 20^0 dorsiflexion (Table II). All were young active males of age range 19-34 years. Time for fracture healing ranged from 14-18 weeks and loss of reduction was not noted. Screw loosening was found in eight and screw breakage in one out of 11 patients in this group. Mean OMA score was 83 and range of ankle dorsiflexion was reduced postoperatively in six out of 11 patients.

The broken screws were removed because of pain in two patients (one each in both the groups). Loose screws were removed from seven ankles in group I and six ankles in group II. Range of motion improved in group I by 5-8 (mean 6) degrees and in group II by average 4-7 (mean 5.5) degrees when loose or broken screws were removed after radiological healing of the fracture.

On plain radiography all patients in both the groups showed complete healing in 14-18 weeks time. On statistical analysis no significant difference was found between the two groups as regards the postoperative range of ankle dorsiflexion (p = >0.05) and OMA score (p-value >0.05). Difference in screw loosening and breakage were also not significant (p values > 0.05).

DISCUSSION:

Syndesmotic screws are a subject of controversy.[6] Indications of syndesmotic screw fixation, techniques of fixation, types of implants and the need for hardware removal are all controversial matters.[6,17-21] Technique of screw placement, tricortical or quadricortical fixation and whether or not the screws should be removed remain controversial subjects too.[13,14,22,23] Trans-syndesmotic or supra-syndesmotic insertion, tricortical or quadricortical placement, fixation in position or lag mode and best position of the ankle while tightening the screw have been controversial subjects also.[24] Whether to remove the screw before weight bearing or leave it in place indefinitely and let it either become loose or break have been suggested by different studies.[25]

Our protocol was to use suprasyndesmotic (2-3cm above the tibial plafond) insertion, in quadricortical, position mode and leave the screws in place indefinitely. Hardware was removed for predefined indications, which include loose screw if it was causing reduced range of ankle dorsiflexion, and in case of a broken screw if it was painful. Hardware was to be removed only after radiological healing of the fracture was seen. In our study this ranged from 14-18 weeks. We removed seven loose and one broken screw from group I and six loose and one broken screw from group II. Range of motion improved in all those patients with loose screws by 5-8 degrees in group I and in group II by 4-7 degrees.

It is recommended that syndesmotic screws should be tightened in maximal or 20^0 dorsiflexion.[7] The rationale behind this teaching is that the anterior half of the superior articular surface of talus is wider than the posterior half. Narrower posterior part of the talar dome is in contact with the distal tibial articular surface. Tightening the syndesmosis in this position would prevent the wider anterior half of the talar dome to come in contact with tibial articular surface. This would result in postoperative stiffness and reduction in the range of ankle dorsiflexion.

Syndesmotic screw compression in different ankle positions has been studied in various studies. Recommendations range from maximal dorsiflexion to plantigrade positions of the ankle.[8] However, to our knowledge all these studies have been done on cadavers. We studied this issue on real patients by designing a randomised controlled clinical trial on 21 patients. Our results do not endorse the recommendation of placing the foot in full dorsal flexion during screw placement. It is likely that the most important aspect of syndesmotic fixation is anatomic reduction of the syndesmosis and that the degree of ankle dorsiflexion during fixation is not important.

CONCLUSION:

We conclude that the syndesmotic screws can be tightened with ankle in plantigrade or 20^0 dorsiflexion of the ankle without a bearing on the postoperative range of motion.

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