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Comparison of screw fixation with elastic fixation methods in the treatment of syndesmosis injuries in ankle fractures

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ABSTRACT

17 patients with ankle syndesmosic injury were treated with a 4.5 mm single cortical screw fixation (passage of screw 4 cortices) and 15 patients were treated with single-level elastic fixation material. All patients were evaluated according to the AOFAS ankle and posterior foot scale at the third, sixth and twelfth months after the fixation. The ankle range of movement was recorded together with the healthy side. The Student's *t* test was used for statistical comparisons. No statistical significant difference was observed between the AOFAS scores ($p > 0.05$). The range of dorsiflexion and plantar flexion motion of the elastic fixation group at the 6th and 12th months were significantly better compared to the screw fixation group ($p < 0.01$).

Elastic fixation is as functional as screw fixation in the treatment of ankle syndesmosis injuries. The unnecessary need of a second surgical intervention for removal of the fixation material is another advantageous aspect of this method of fixation.

Introduction

Ankle fracture sand their associated sequelae constitute a common injury in the workload of orthopaedic trauma surgeons [1–4]. Syndesmosis injury coexists in some of the ankle fractures. The outcomes of ankle fracture treatments accompanied by syndesmosis injuries yield worse results compared to that of isolated fractures [5]. Syndesmosis tear is observed in Weber C fractures occurring due to the pronation-external rotation mechanism, and in Maisonneuve injuries in which proximal fibula fracture and medial ankle injuries coexist. Furthermore, the syndesmosis is injured in some Weber B fractures, although not noticed in the radiography results [6–8]. In this type of fractures, the stability of the syndesmosis may be checked and a possible injury may be detected by the stress test, which is performed by external rotation and eversion enforcement under fluoroscopic control, following the completion of lateral malleolus fixation [9–14].

The screw fixation method is the conventional treatment in syndesmosis repair. Rigid fixation is performed via the passage of a cortical screw through the fibula at a level of 2 cm superior to the tibiotalar joint and parallel to the joint, into the tibia and 30° anteriorly [15]. Sometimes the passage of a second screw may be needed superior to the first one. According to the studies in the literature, no significant difference has been observed between the passage of the syndesmosis screws along 3 or 4 cortices, while 4.5 mm screws were found to be biomechanically advantageous compared to the 3.5 mm screws [15–17].

The syndesmosis screw should be removed 3 months after the procedure at the latest. If the screw is not removed and remains unbroken, local symptoms may be developed [6,18]. Removal of the screw is usually undertaken thus exposing the patient to the disadvantage for a second surgical intervention.

Recently, elastic fixation materials have been used, which are alternatives to screws. Despite the doubts concerning their biomechanical adequacy, they have some advantages over the rigid fixation method as the need for removal of the implant is less,

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and they possess a more dynamic and physiological property compare to screw fixation [19–24].

The aim of this study was to compare the functional results of ankle joints fixed either using the 4.5 mm single cortical screws or elastic materials, and to determine if the elastic fixation is advantageous over the 4.5 mm cortical screw fixation.

Materials & method

The records of 110 patients with ankle fractures who had undergone surgical treatment in our clinics between January 2007 and June 2011 were retrospectively investigated. Among these, 37 with syndesmosis fractures underwent evaluation. One patient over 60 years of age, 2 diabetic patients, one patient with open fracture and politrauma and one patient with insufficient follow-up were excluded from the study. A total of 32 consecutive patients with syndesmosis injury including 17 patients who had undergone treatment with 4 cortex 4.5 mm single cortical screw fixation and 15 patients who had been treated with single level elastic fixation material Tightrope® (Arthrex Inc, Naples, FL, USA), were retrospectively evaluated. The mean age was 32.5 years (range 19–60), and the mean follow-up period was 14.6 months (12–50). The demographic distribution of the patients and their the fracture types sustained are shown in Tables 1–5.

Surgical technique

All of the surgeries were performed in the same hospital and by the same surgeon (MS) under general or regional anaesthesia. The syndesmosis fixation was performed following completion of the lateral malleolus osteosynthesis with fluoroscopic control. Primarily, the distal tibiofibular junction was maintained anatomically reduced by the help of a reduction clamp in both the screw and elastic fixations (Figs. 1 and 2). Fixation was performed in the transmalleolar plain passing through the most protruding points of the lateral and medial malleoli, and at the level of 2 cm superior to the tibiotalar joint and parallel to the joint, into the tibia with an inclination of 30° degrees anteriorly. A 4.5 mm cortical screw was used and was advanced through 4 cortices (Fig. 3). Elastic fixation was performed with the guidance of a Kirschner wire using the same direction of the screw, by tightening and knotting of the needle-tip suture-button set after passage through the channel opened by the cannulated drill. The buttons are completely placed onto the bone cortex without leaving any soft tissue in between (Fig. 4).

Follow-up

The same protocol was used for the patients in both groups. Plaster-splints were applied for all the patients following surgery. After surgery, all patients mobilised with a walker or double crutches without weight-bearing on the operated side. Two weeks later, the splints were removed and pressure-socks were applied with the foot kept in the neutral position. After the 6th week, partial weight bearing was initiated on the operated side using double crutches. At the end of the 3rd month, the screws in patients with screw fixation were removed and complete weight-bearing was permitted on the operated side. The screw removal operations were all performed in the surgery room. 8 patients were operated under general anaesthesia and 7 patients were operated under sedation and local anaesthesia. Straight running was begun for the sportsmen in the 4th month. They were allowed to return back to sports at the 6th month.

The patients were clinically and radiologically evaluated at the post-operative 1st, 2nd, 3rd, 6th and 12th months, and then once every year. Three-sided (anteroposterior, lateral and mortis) radiographs were obtained. The patients were evaluated according to AOFAS ankle and posterior foot scale at the 3rd, 6th and 12th months [21]. The third month AOFAS evaluations of these patients were made prior to screw removal.

Statistical analysis

The Statistical Package for Social Sciences (SPSS) for Windows 15.0 program was used for the statistical analysis of the data obtained in this study. The normal distribution of parameters was assessed using the Kolmogorov–Smirnov test, and the values were determined to be normally distributed. The Student's t test was used for comparison of the two groups of parameters. A p value of <0.05 was defined as statistically significant.

Results

No important complications such as infection, loss of fixation, screw breakage, delayed union or non-union were observed in any of the groups. Implant discomfort caused by the syndesmosis screw was observed in 4 patients until removal of the screw at the third month. In the elastic fixation group, 2 patients encountered discomfort due to the sense of the knot under the skin by the application of local pressure. Removal of the elastic fixation material was carried out in one patient at the 8th month follow up and for the other patient after 12 months. After removal of the material both patients reported elimination of their discomfort. At a later stage another 4 patients underwent removal of the elastic fixation material due to soft tissue irritation.

The mean duration of return of the screw fixation group patients to their previous condition after the screw removal was 5 days (range 3–12 days).

No statistically significant difference was observed between the pain scores of the screw and the elastic fixation groups at the 3rd, 6th and 12th months ($p > 0.05$).

Table 1
Gender and age distribution of patients undergoing screw or elastic fixation.

	Screw ($n=17$)	Elastic fixation ($n=15$)
Male	14	13
Female	3	2
Age (years)	32.0	33.2

Table 2
The distribution of the patients according to the Weber classification.

	Number of cases	Syndesmosis injury	Screw fixation	Elastic fixation
Weber A	12	–	–	–
Weber B	73	7	4	3
Weber C	25	25	13	12
Total	110	32	17	15

Table 3
The distribution of the fracture accompanying syndesmosis injuries.

	Lateral malleolus fracture and syndesmosis injury				
	MM	D: Deltoid tear	MM + PM	PM + D	SY
Screw	4	5	5	2	1
Elastic fixation	3	4	6	2	

MM, medial malleolus fracture; PM, posterior malleolus fracture; LM, lateral malleolus fracture; D, deltoid ligament injury; SY, syndesmosis injury.