

# To retain or remove the syndesmotic screw: a review of literature

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## Abstract

**Introduction** Syndesmotic positioning screws are frequently placed in unstable ankle fractures. Many facets of adequate placement techniques have been the subject of various studies. Whether or not the syndesmosis screw should be removed prior to weight-bearing is still debated. In this study, the recent literature is reviewed concerning the need for removal of the syndesmotic screw.

**Materials and methods** A comprehensive literature search was conducted in the electronic databases of the Cochrane Library, Pubmed Medline and EMBASE from January 2000 to October 2010.

**Results** A total of seven studies were identified in the literature. Most studies found no difference in outcome between retained or removed screws. Patients with screws that were broken, or showed loosening, had similar or improved outcome compared to patients with removed screws. Removal of the syndesmotic screws, when deemed necessary, is usually not performed before 8–12 weeks.

**Conclusion** There is paucity in randomized controlled trials on the absolute need for removal of the syndesmotic screw. However, current literature suggests that it might be reserved for intact screws that cause hardware irritation or reduced range of motion after 4–6 months.

**Keywords** Unstable ankle fracture · Syndesmosis · Syndesmotic screw · Transsyndesmotic

## Introduction

Approximately one in seven ankle fractures is accompanied by a distal tibiofibular syndesmotic disruption [1]. When, after stable fixation of the fractured malleoli, persistent instability of the distal tibiofibular joint is identified perioperatively, additional stabilization is indicated. In most cases the syndesmotic ligaments are left untouched and a so-called ‘syndesmotic positioning screw’ is placed to restore and maintain a congruent mortise.

The theoretical and technical aspects of syndesmotic screw placement have been subject to numerous clinical and biomechanical investigations, in an attempt to solve some of the controversies concerning syndesmotic screw usage. There appears to be no difference in stainless steel versus titanium screws [2]. A 4.5-mm screw apparently provides greater resistance to shear stress than a 3.5-mm screw [3]; however, this does not implicate a biomechanical advantage [4]. The level of placement probably does not affect outcome [5]. Two syndesmotic screws provide more stability than one [6], which seems beneficial in more proximal fibular (Dupuytren and Maisonneuve) fractures and neuropathic fracture dislocation in the diabetic patient [7]. Bioabsorbable screws are biomechanically and clinically equivalent to stainless steel syndesmotic screws [8–12]. Three-cortical versus four-cortical screw placement does not affect biomechanical stability [13, 14], or influence outcome [4, 15–18]. The use of a suture device seems to provide equal [19] or improved [20] outcome compared to a four-cortical syndesmotic screw. The position of the foot during insertion of the syndesmotic screw does not influence the range of motion or outcome [21–24]. Finally, based on CT scanning, 16–52% of syndesmoses are not reduced anatomically [25, 26], which will most likely negatively affect outcome [27–32].

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Whether or not the syndesmotic screw has to be removed prior to weight-bearing is still subject to debate. Proponents of this policy state that tibiofibular movement is affected by leaving the screw in place and dorsiflexion is hampered [33, 34]. This is accompanied by the possibility of breakage of the screw when left in place [35]. Prominent reference books [36, 37] in the field of fracture care still advocate removal of the syndesmotic screw prior to weight-bearing at 6–8 weeks, which to date, influence current practice [38, 39]. However, this statement has been disputed since the late 1950s and early 1960s [33, 40–44]. In 1985, De Souza et al. [45] showed that in a group of 30 patients with a syndesmotic screw, of which 12 were left in place, no difference in outcome, pain and motion between retained and removed screws could be detected after an average of 36 months. In addition, leaving the screw in place saves the patient from one extra surgical procedure, including its possible complications.

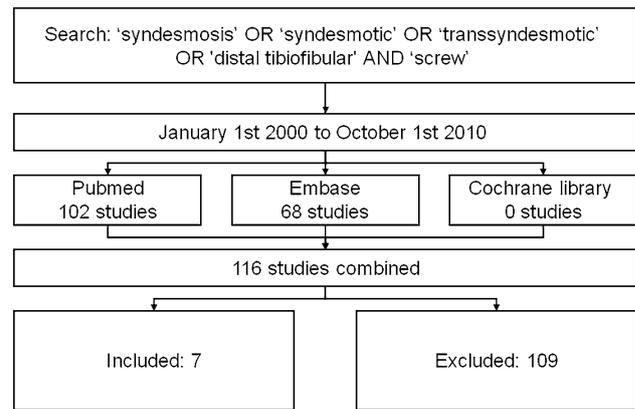
The current review study challenges the need for routine removal of the syndesmotic screw, despite that removal is currently considered best practice.

## Materials and methods

A literature search was conducted to identify studies in which syndesmotic screws were retained or not routinely removed. The electronic databases between 1 January 2000 and 1 October 2010 of the Cochrane Library, Pubmed Medline and EMBase were explored using the following search terms and Boolean operators: 'syndesmosis' OR 'syndesmotic' OR 'transsyndesmotic' OR 'distal tibiofibular' AND 'screw'. The restriction in publication date was applied to obtain insight into more current practice. Manuscript language was restricted to English, German, and Dutch literature. Publications were requested at the university medical (Internet) library and reviewed. In addition, a comprehensive search of reference lists of all identified articles was conducted to find additional studies. An article was found eligible when it concerned: (1) the surgical treatment for unstable ankle fractures; (2) usage of one or more syndesmotic screws, whether or not compared to an alternative procedure (e.g., suture wire or absorbable screws); and (3) studies included that mentioned the outcome of patients with positioning screws retained and removed. Studies were excluded when they were review, case report or biomechanical studies.

## Results

Figure 1 shows the strategy of the literature search. A total of seven studies mentioning both the outcome of removed



**Fig. 1** Flowchart showing literature search

or retained syndesmotic screw were identified in the literature (Table 1). Six studies found no difference in outcome between retained or removed screws [17, 28, 32, 46–48]. In the study by Hamid et al. [47], patients with a broken screw had the highest outcome scores. Manjoo et al. [49] showed a less favorable outcome in retained screws that were intact, but screws that were broken or showed loosening had similar outcome as removed screws. In these seven studies, the time of removal was 3 months on average [17, 28, 32, 46–49]. Manjoo et al. [49] recommended screw removal only when still intact after 6 months.

## Discussion

Recent literature in general does not support routine removal of the syndesmotic screw and outcome appears to be similar both in retained and removed screws [17, 28, 32, 46–48]. However, one study showed lower outcome scores in intact retained screws [49]. In the included studies, broken screws did not result in an adverse effect on outcome, as broken screws had similar or improved outcome over intact screws [47, 49]. This might be considered a plea for omitting the routine removal of syndesmotic screws. This is reflected in three surveys on syndesmotic screw usage showing increased numbers of retained screws, from 8% in 2004, 14% in 2008 to 35% in 2010 [38, 39, 50].

The primary limitation of this review study was that most included studies had a retrospective study design (Table 1). The two studies with the highest level of evidence, comparing three- versus four-cortical screws [17, 48], presented indirect evidence, as these studies were not powered to compare outcome in screws removed or retained. Secondly, it cannot be ruled out that despite a thorough literature search not all related studies were identified. How this would affect the overall conclusion of the current review study is unknown.

**Table 1** Literature overview on after-treatment of syndesmotic screws

Study	LOE	Patients	Screws retained	Follow-up (months)	Major findings
Hoiness [48]	1 (RCT)	64	32	12	Routine removal of quadricortical screws; no removal of tricortical screws. Tricortical, at 3 months significantly better on OMAS; after 1 year no difference in outcome
Bell [46]	4 (retrospective cohort)	30	7 (2 broken)	15	No significant difference in Baird–Jackson ankle score
Weening [32]	4 (retrospective cohort)	51	21	18	No significant difference in OMAS and SMFA for removed and retained screws
Moore [17]	2 (quasi-RCT)	120	113 (9 broken)	5	No apparent difference in outcome between retained and removed screws
Hamid [47]	4 (retrospective cohort)	52	25 (10 broken)	30	No significant difference in AOFAS and VAS for intact and removed screws. Broken screws, best outcome
Manjoo [49]	4 (retrospective cohort)	76	64 (44 broken or loose)	23	No significant difference in the lower extremity measure and OMAS for broken/loose and removed screws. Intact screws, significantly lower outcome
Egol [28]	4 (retrospective cohort)	79	68 (15 broken)	12	No statistical difference in pain, function or range of ankle motion between removed/broken screws and retained screws

LOE level of evidence; FAOS Foot and Ankle Outcome Score; OMAS Olerud–Molander Ankle Score; AOFAS American Orthopedic Foot Ankle Society hindfoot score; SMFA Short Musculoskeletal Function Assessment Questionnaire

On average, the included studies showed removal of the syndesmotic screws after approximately 3–4 months, usually when intact screws caused hardware irritation or reduced dorsiflexion [34, 49]. Unprotected weight-bearing in these studies started on average at 6–8 weeks [17, 28, 46–49]. Screw removal prior to 8 weeks has been related to loss of reduction at the tibiofibular joint [51, 52]. One study that did not meet the inclusion criteria showed an increase in outcome and range of motion on standard removal of the syndesmotic screw at approximately 4 months [34]. However, follow-up was short and there was no control group.

A previous review recommended removal of four-cortical screws after 6–8 weeks, and removal on indication in three-cortical screws [53]. The outcome and stability are similar in tri- and quadricortically placed screws [16–18, 48], and hardware failure is identical in both groups [17, 49]. Depending on the duration of follow-up, 7–29% of syndesmotic screws left in place break, with no apparent difference between tricortical and quadricortical screws [17, 19, 35, 46]. However, synostosis might occur more frequently in quadricortical screws [16]. In a study by Heim et al., syndesmotic screws were placed tricortically and showed loosening in 91% of the patients. They therefore stated that early removal of syndesmotic screws was only appropriate when no loosening occurred or limitations in dorsiflexion existed [54]. Hoiness et al. [48] routinely removed quadricortically placed syndesmotic screws, but tricortical screws were removed only in case of hardware complaints. In about 93% of cases with two tricortical screws, no hardware removal was required in this study

[48]. Thus, metallic syndesmotic screws are probably best placed tricortically, as this prevents secondary surgery to remove hardware in over 90% of the patients. Removal of hardware might be completely abolished with the use of absorbable screws or suture device [9–12, 19, 20].

In conclusion, the fear of less favorable outcome, if syndesmotic screws are left in situ, is seemingly unfounded. Recent literature shows similar or better results when screws are retained. Screw removal, when intact after 4–6 months, might be justified if the positioning screw gives rise to physical complaints, e.g., when dorsiflexion is hampered or outcome appears to be affected. When one or two syndesmotic screws are placed tricortically, the need for hardware removal is <10%. The results of these studies need to be verified in randomized controlled trials.

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