DOI: 10.7860/JCDR/2025/79248.21520

Original Article

Orthopaedics Section

Comparison of Tightrope versus Syndesmotic Screw Fixation for Functional and Radiological Outcomes in Patients with Ankle Syndesmosis Injuries: A Prospective Interventional Study Form Southern India

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ABSTRACT

Introduction: Ankle syndesmosis injuries often occur due to high-energy trauma or distal fibular fractures, disrupting the stabilising ligament complex. Conventional screw fixation, while effective, requires implant removal and may be associated with complications. Tightrope fixation offers dynamic stabilisation, allowing early mobilisation with potentially fewer complications

Aim: To evaluate and compare clinical and radiological outcomes of Tightrope fixation and syndesmotic screw fixation in patients with ankle syndesmosis injuries.

Materials and Methods: The present prospective interventional study conducted in the Department of Orthopaedics at SRM Medical College Hospital and Research Centre, Tamil Nadu, India over a period of 18 months (September 2023 - February 2025). A total of 60 patients with ankle syndesmosis injuries were enrolled and allocated into two groups based on clinical judgment: group A (Tightrope fixation, n=30) and group B (syndesmotic screw fixation, n=30). All patients underwent open reduction and internal fixation of the ankle fracture followed by either Tightrope or syndesmotic screw fixation for stabilization of the syndesmosis, depending on group allocation. Functional outcomes were assessed using the Olerud-Molander Ankle Score (OMAS) and the Foot and Ankle Outcome Score (FAOS). Pain was evaluated using the Visual Analog Scale (VAS). Radiological parameters included tibiofibular clear space, tibiofibular overlap, and medial clear space. Postoperative follow-up was conducted at three weeks, six weeks, three months, and six months, with a total follow-up duration of six months. Complications were also recorded. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 29, with a p-value <0.05 considered significant.

Results: Mean age of participants in groups A and B were 43.2±18.3 years and 42.8±16.2 years, respectively. Gender distribution was also comparable across both groups (p=0.793). Regarding co-morbidities, Diabetes Mellitus (DM) was present in 8 (13.3%) of participants overall and Hypertension (HTN) was seen in 11 (18.3%), with similar distribution across groups. Smoking habits were nearly evenly distributed, with 40 (66.7%) of participants being non-smokers. OMAS and FAOS scores were significantly higher in the Tightrope group across all follow-up intervals (p<0.001). At six months, the mean VAS score was significantly lower in group A compared to group B (1.6±0.9 vs. 3.3±1.6; p<0.001). Radiological outcomes, including tibiofibular clear space and overlap, also significantly favoured group A (p<0.001). The rate of infection was lower in the Tightrope group (3.3% vs. 20%), and there were no cases of malreduction, compared to 6.7% in the screw fixation group.

Conclusion: The present study demonstrates that Tightrope fixation offers superior functional recovery, pain relief, and radiological outcomes compared to syndesmotic screw fixation in ankle syndesmosis injuries treatment. Additionally, it results in fewer postoperative complications, allowing it a more feasible and efficient surgical choice for treating such injuries.

Keywords: Ankle injuries, Ankle surgery, Orthopaedic procedures, Prospective studies, Suture anchors, Treatment outcome

INTRODUCTION

A fibrous joint is a syndesmosis where strong ligaments or a membrane connect two adjacent bones. This structure is exemplified in distal tibiofibular syndesmosis, which is composed of two bones and four stabilising ligaments [1]. The two bones are convex distal aspect of fibula and concave lateral aspect of distal tibia. The four ligamentss are "Anterior-Inferior Tibiofibular Ligament (AITFL), Interosseous Ligament (IOL), Posterior-Inferior Tibiofibular Ligament (PITFL), and Inferior Transverse Ligament (ITL)". Traumatic injuries to this joint, frequently known as ankle syndesmotic injuries, typically takes place due to high-energy trauma such as rotational forces during sports activities or accidents. These injuries may present as isolated ligamentous disruptions or in association with ankle fractures [2]. Globally, ankle fractures constitute around 18% of all fractures, with an overall frequency of about 75 per 100,000 individuals [3-5]. The incidence is particularly high in Weber B and C-type fractures, ranging from 55% to 100%, with instability rates elevated at 70% in Weber C-type fractures [6]. Type B fractures occur at the syndesmosis level. Type C fractures have been located above syndesmosis, which is commonly disrupted in these instances, leading to instability. Even the slightest malreduction can reduce the joint's contact area by up to 42%, leading to chronic instability, pain, and early degenerative arthritis if left untreated [7,8].

The management of ankle syndesmotic injuries includes both conservative and surgical options, based on severity of disruption. For unstable injuries, surgical fixation remains the standard of care, with the ultimate goal being the restoration of anatomical alignment and a safe, rapid return to full activities [9,10]. Historically, for fixation, syndesmotic screws were considered gold standard. However, their use is surrounded by several challenges, including optimal screw size, number, level of placement, and post-operative protocols [11]. Complications for example stiffness, screw loosening, breakage, requirement for a second surgery, and possibilities of late diastasis after early removal further complicate their utility [12].

In contrast, the Tightrope fixation system, a relatively newer technique utilises non-absorbable FiberWire. Enables early weight bearing and a quicker return to everyday activities by allowing the physiological motion of syndesmosis while retaining reduction, this removes the need for routine implant removal [13]. Despite its advantages, complications for example soft wound breakdown, syndesmotic widening, tissue irritation, as well as the rare risk of synostosis have been reported [12,14].

Despite the availability of both sydesomtic screws and Tightrope systems, the choice between these techniques remains contentious, especially in the Indian context, where limited data exists comparing their functional and radiological outcomes [15-17]. While the drawbacks of screws are well-documented, the promising yet underexplored potential of Tightrope systems highlights a critical research gap.

To attempt to close this gap, this prospective interventional study compares functional as well as radiological results of screw fixation versus Tightrope fixation in treatment of ankle syndesmotic injuries.

MATERIALS AND METHODS

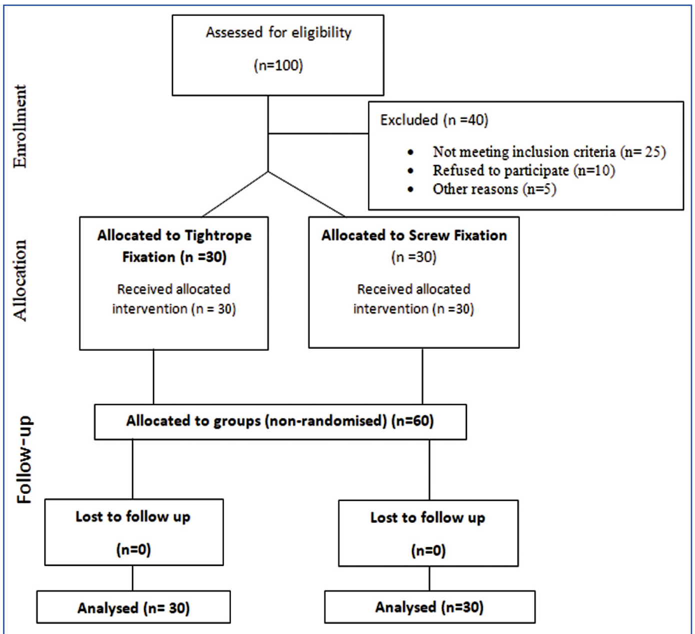
This prospective interventional study was conducted in the "Department of Orthopaedics at SRM Medical College Hospital and Research Centre" (SRM MCHRC) in Tamil Nadu, India from September 2023 to February 2025 after acquiring Institutional Ethical Clearance from study Institute (Reg. No: EC/NEW/INST/2022/2933 and Ethics Clearance Number: SRMIEC-ST0823-1416). Throughout the course of research, all participants received assurance of confidentiality and their informed agreement was acquired.

Inclusion and Exclusion criteria: The study included skeletally mature patients aged over 18 years who presented with closed or open ankle syndesmosis injuries, specifically those associated with Weber type B and type C fractures, as classified under the Danis-Weber system, and resulting from trauma [18]. Only those participants who were able and willing to comply with the study's follow-up schedule were enrolled. Patients were excluded if they were under 18 years of age, had a delay of more than 7 days from the time of trauma to surgery, were morbidly obese, or had pathological fractures.

Intervention groups:

Group-A: Patients who received Tightrope fixation.

Group-B: Patients who received syndesmotic screw fixation [Table/Fig-1].



[Table/Fig-1]: Participant flow diagram for this study.

Sample size calculation: The sample size of at least 30 participants in each group (60 participants in total) was calculated based on a similar study by Altmeppen JN et al., [19]. The expected mean OMAS in groups 1 and 2 was taken as 116.5±5.6 and 120.2±4.2, respectively. The level of significance was taken as 5%

$$n \geq \frac{(Z_{1-\alpha/2}+Z_{1-\beta})^2\,(\sigma_1^2+\sigma_2^2)}{(\mu_1-\mu_2)^2}$$

$$n \geq \frac{(1.96+0.84)^2\,(5.6^2+4.2^2)}{(116.5-120.2)^2}$$

$$n \geq \frac{7.84 * 49}{13}$$

n≥30 in each group

The present study employed convenience sampling, a non-randomised method where eligible patients with ankle syndesmosis injuries were recruited. This technique was chosen due to the practical need to recruit patients based on their presentation to the hospital and the specific clinical requirements for each type of fixation.

Study Procedure

Non-randomised assignment was done based on clinical judgment, considering factors such as fracture pattern, soft tissue condition, and surgeon discretion, in accordance with commonly accepted orthopaedic treatment protocols for syndesmotic injuries.

Baseline demographic and clinical profile: The following baseline demographic and clinical variables were included in the study: age, gender, co-morbidities, smoking status, mode of injury, and fracture classification based on the Danis-Weber system.

Preoperative examination: Every patient had thorough preoperative evaluation that included baseline diagnostics, physical evaluation, and comprehensive clinical history. AP, Lateral, and Mortise views of affected ankle are included in imaging for assessing tibiofibular clear space, medial clear space, and tibiofibular overlap.

Postoperative follow-up schedule: The postoperative follow-up schedule at three weeks, six weeks, three months, and six months allowed for close monitoring of healing and functional recovery.

Outcome variables: The study assessed functional and radiological variables:

The functional outcome included OMAS ranging from 0-100, here 0 demonstrates worst possible function (severe disability), 100 represents normal ankle function (perfect health) [20].

FAOS ranges from 0 to 100, where 100 reflects the best possible outcome [21].

VAS for Pain - a 10-point scale, here:0 shows no pain, 10 denotes worst pain imaginable [22].

Radiological outcomes:

- **Tibiofibular clear space:** This has been distance between medial aspect of fibula and tibia at syndesmosis. An increased distance (usually more than 6 mm on the X-ray) may indicate syndesmotic injury or malreduction [23].
- **Tibiofibular overlap:** This measures the amount of overlap between the tibia as well as the fibula at the bone's distal end. Reduced overlap may signal instability or inadequate reduction after surgery [23].
- **Medial clear space:** It is a gap between medial malleolus (inner ankle bone) and the talus (foot bone) on an X-ray. Normal Range <4 mm, an enhanced medial clear space may indicate syndesmotic injury, malreduction, or instability [23].

STATISTICAL ANALYSIS

Categorical variables such as age, gender, co-morbidity, complications were summarised as frequency and percentages. Continuous variables such as OMAS, VAS and FAOS scores were summarised as mean±SD. Chi-square test and independent t- test were employed for comparing the qualitative and quantitative variables respectively between the groups. Statistical significance level was set at a p-value of <0.05. To analyse data, SPSS version 29 was employed.

RESULTS

The distribution of demographic characteristics of study participants was compared between two groups (A and B) were depicted in [Table/Fig-2]. Group-A had 5 (16.7%) participants <20, 7 (23.3%) in the 20-40 range, and 11 (36.7%) in the 40-60 range, while group B had 1 (3.3%), 14 (46.7%), and 9 (30%), respectively. Mean age of participants in groups A and B were 43.2±18.3 years and 42.8±16.2 years, respectively. Gender distribution was also comparable, with 25 (41.7%) females and 35 (58.3%) males across both groups, and no significant difference was observed (p=0.793). Regarding comorbidities, DM was present in 8 (13.3%) of participants overall and HTN was seen in 11 (18.3%), with similar distribution across groups. Smoking habits were nearly evenly distributed, with 40 (66.7%) of participants being non smokers. The mode of injury was also similar between groups, with falls, Road Traffic Accidents (RTA), and sports injuries being the most common mechanisms. In terms of the Weber classification, both groups had a similar proportion of Type B and Type C fractures. The p-values for baseline characteristics exceeded 0.05, demonstrating no statistically significant differences between group A and group B.

Demographic characteristics		Group				Total		p-value
		A		B				
		N=30	%	N=30	%	N=60	%	
Age (years)	<20	5	16.7%	1	3.3%	6	10%	0.153
	20-40	7	23.3%	14	46.7%	21	35%	
	41-60	11	36.7%	9	30%	20	33.3%	
	>60	7	23.3%	6	20%	13	21.7%	
Gender	Female	12	40%	13	43.3%	25	41.7%	0.793
	Male	18	60%	17	56.7%	35	58.3%	
Co-morbidity	DM	3	10%	5	16.7%	8	13.3%	0.667
	HTN	5	16.7%	6	20%	11	18.3%	
	NIL	22	73.3%	19	63.3%	41	68.3%	
Smoking	No	21	70%	19	63.3%	40	66.7%	0.584
	Yes	9	30%	11	36.7%	20	33.3%	
Mode of injury	Fall	9	30%	9	30%	18	30%	0.946
	RTA	15	50%	14	46.7%	29	48.3%	
	Sports	6	20%	7	23.3%	13	21.7%	
Weber classification	B	15	5%	18	60%	33	55%	0.436
	C	15	50%	12	40%	27	45%	

[Table/Fig-2]: Distribution of demographic characteristics of study participants.
#Chi-square test

The comparison of OMAS between Groups A and B at different follow-up points, as shown in [Table/Fig-3]. At baseline, no significant difference in OMAS scores between two groups, group A scoring 12.6±2.5 and group B scoring 12.2±2.5 (p=0.447). However, at three weeks postoperative, group A had a significantly higher OMAS score (29±2.4) compared to group B (26.7±2.3), with a p-value of <0.001. Similarly, at six weeks, three months, and six months, group A consistently outperformed group B with scores of 60.7±6.3, 77.8±5.3, and 91.2±3.6, respectively, compared to group B's scores of 33.1±2.4, 62.5±3.4, and 78±3.3. All these differences were statistically significant (p<0.001).

[Table/Fig-4] presents the comparison of FAOS between Groups A and B at pre-operative and various follow-up time points. Pre-operatively, the mean FAOS was 28.4±8 for group A and 24.5±8.5 for group B, no statistically significant difference (p=0.072). At three weeks, group A having mean FAOS of 45.9±10.4, while group B had 40.4±6.6 (p<0.001). Similarly, at six weeks, three months, and six months, group A consistently outperformed group B. At six months group A mean for FAOS was 86.5±8.3, and group B 63.7±10.4 (p<0.001**).

OMAS	Group		p-value
	A	B	
Preoperative	12.6±2.5	12.2±2.5	0.447
3 weeks	29±2.4	26.7±2.3	<0.001*
6 weeks	60.7±6.3	33.1±2.4	<0.001*
3 months	77.8±5.3	62.5±3.4	<0.001*
6 months	91.2±3.6	78±3.3	<0.001*

[Table/Fig-3]: Comparison of OMAS between groups at different follow-ups.
#Independent t-test

FAOS	Group		p-value
	A	B	
Preoperative	28.4±8	24.5±8.5	0.072
3 weeks	45.9±10.4	40.4±6.6	<0.001*
6 weeks	68.9±15.6	52.6±8.6	<0.001*
3 months	85.7±8.2	63.1±10.3	<0.001*
6 months	86.5±8.3	63.7±10.4	<0.001*

[Table/Fig-4]: Comparison of FAOS between groups at different follow-ups.
#Independent t-test

[Table/Fig-5] presents a comparison of VAS scores between group A and B at pre-operative and various follow-up time points. Pre-operatively, both groups exhibited similar mean VAS scores, with group A at 8.6±1 and group B at 8.6±1.2, indicating no statistically significant difference (p=0.909). However, at three weeks, six weeks, three months, and six months postoperatively, group A demonstrated significantly lower mean VAS scores in contrast to group B. Finally, at six months, group A with mean VAS of 1.6±0.9, and group B had 3.3±1.6 (p<0.001).

VAS	Group		p-value
	A	B	
Preoperative	8.6±1	8.6±1.2	0.909
3 weeks	6.1±0.9	7.3±1.6	<0.001*
6 weeks	4.6±0.9	6.3±1.6	<0.001*
3 months	3.1±0.9	4.8±1.6	<0.001*
6 months	1.6±0.9	3.3±1.6	<0.001*

[Table/Fig-5]: Comparison of VAS score between groups at different follow-ups.
#Independent t-test

The comparison of tibiofibular clear space between Groups A and B at different follow-up points, as shown in the [Table/Fig-6]. At baseline (preoperative), no significant difference in tibiofibular clear space among two groups, group A having value of 8.5±0.51 and group B having value of 8.3±0.47 (p=0.069). However, at three weeks postoperation, group A showed a significantly smaller tibiofibular clear space (6.5±0.51) I comparison to group B (7.5±0.51), having p-value <0.001. Similarly, at six weeks, three months, and six months, group A showed a significantly smaller

Tibiofibular clear space	Group		p-value
	A	B	
Preoperative	8.5±0.51	8.3±0.47	0.069
3 weeks	6.5±0.51	7.5±0.51	<0.001*
6 weeks	5.4±0.5	6.6±0.5	<0.001*
3 months	4.6±0.49	5.5±0.51	<0.001*
6 months	3.9±0.87	5±0.81	<0.001*

[Table/Fig-6]: Comparison of Tibiofibular clear space at different follow-ups.
#Independent t-test

tibiofibular clear space in comparison to group B, with all differences being statistically significant (p<0.001).

The comparison of tibiofibular overlap between Groups A and B at different follow-up points, as shown in [Table/Fig-7]. At baseline (pre-operative), no significant difference between two groups, group A exhibiting tibiofibular overlap of 3.9±0.69 and group B having 4±0.89 (p=0.629). However, at three weeks postoperation, group A showed a significantly greater tibiofibular overlap (4.6±0.5) compared to group B (3.7±0.87), with a p-value of <0.001. Similarly, at six weeks, three months, and six months, group A continued to show significantly greater tibiofibular overlap in comparison to group B, where all differences being statistically significant (p<0.001).

Tibiofibular overlap	Group		p-value
	A	B	
Preoperative	3.9±0.69	4±0.89	0.629
3 weeks	4.6±0.5	3.7±0.87	<0.001*
6 weeks	5.4±0.5	4.4±0.5	<0.001*
3 months	6.4±0.49	4.6±0.5	<0.001*
6 months	7.1±0.78	5.1±0.8	<0.001*

[Table/Fig-7]: Comparison of Tibiofibular overlap at different follow-up.
#Independent t-test

The comparison of medial clear space between Groups A and B at different follow-up points, as shown in [Table/Fig-8]. At baseline (pre-operative), group A have medial clear space of 6.9±0.91, while group B had 7±0.85, having p-value=0.884, showing no significant difference. Likewise, at three weeks, six weeks, three months and six months, the differences in medial clear space between groups remained not statistically significant (p-values of 0.613,0.613,0.125, and 0.612, correspondingly).

Medial clear space	Group		p-value
	A	B	
Preoperative	6.9±0.91	7±0.85	0.884
3 weeks	5.4±0.5	5.5±0.51	0.613
6 weeks	4.5±0.51	4.8±0.51	0.613
3 months	3.6±0.5	3.4±0.49	0.125
6 months	3.4±0.5	3.5±0.51	0.612

[Table/Fig-8]: Comparison of medial clear space at different follow-ups.
#Independent t-test

The comparison of postoperative complications between Groups A and B, as shown in [Table/Fig-9]. Implant failure occurred in 2 (6.7%) of participants in both group A and group B. Infection was more common in group B, affecting 6 (20%) of participants compared to just 1 (3.3%) in group A. Malreduction occurred in 2 (6.7%) of participants in group B, but there were no cases in group A. Finally, 27 (90%) of group A had no complications, compared to 20 (66.7%) within group B. No statistically significant difference (p=0.085).

Preoperative complications	Group				Total		p-value
	A		B				
	N=30	%	N=30	%	N=60	%	
Implant failure	2	6.7%	2	6.7%	4	6.7%	0.085
Infection	1	3.3%	6	20%	7	11.7%	
Malreduction	0	0%	2	6.7%	2	3.3%	
NIL	27	90%	20	66.7%	47	78.3%	

[Table/Fig-9]: Comparison of post-op complications between groups.
#Chi-square test

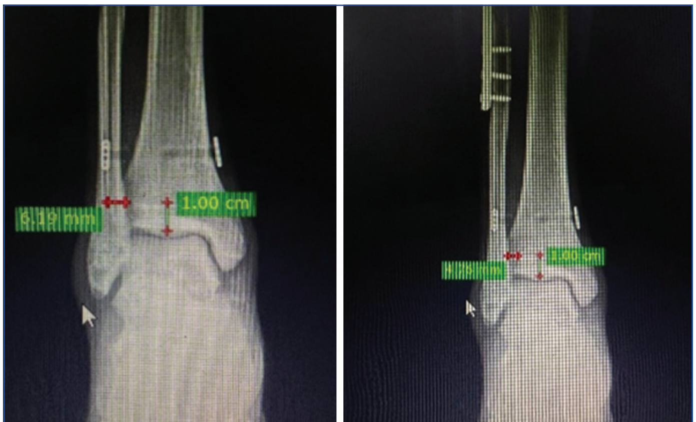
Group-A (Tightrope):

Preoperative radiographic parameters are demonstrated lin [Table/Fig-10-12].

[Table/Fig-10,11]: Tibiofibular overlap (5.2 mm) and tibiofibular clear space (7.7 mm). Images from left to right

[Table/Fig-12]: Medial clear space (5.20 mm).

Postoperative radiographic parameters at six months follow-up are shown in [Table/Fig-13-15].



[Table/Fig-13,14]: Tibiofibular overlap (6.19 mm) and tibiofibular clear space (4.7 mm). (Images from left to right)

Group-B (Syndesmotic Screw):

Pre-operative radiographic parameters [Table/Fig-16-18].

Postoperative radiographic parameters at six months follow-up [Table/Fig-19-21].

DISCUSSION

This prospective interventional study compared the functional and radiological outcomes of Tightrope fixation versus syndesmotic

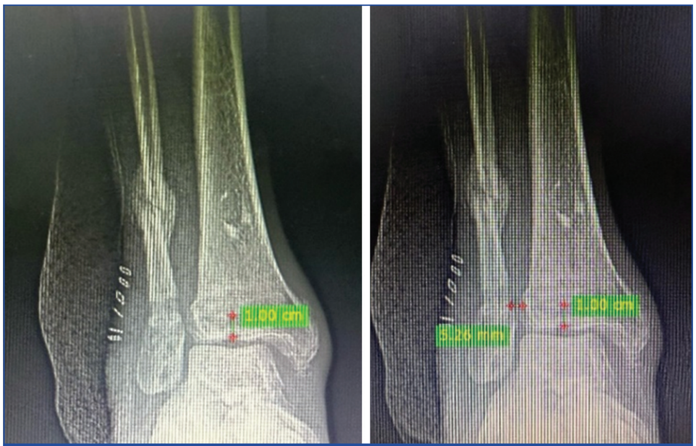
[Table/Fig-15]: Medial clear space (3.87 mm).

[Table/Fig-16,17]: Tibiofibular overlap (3.48 mm) and tibiofibular clear space (7.00 mm). (Images from left to right)

[Table/Fig-18]: Medial clear space (6.96 mm).

screw fixation in ankle syndesmosis injuries. The Tightrope group demonstrated superior results in terms of pain reduction, ankle function, and radiographic alignment, with fewer complications.

In the current study, both groups were demographically comparable, with no significant differences in age (Tightrope fixation group: 43.2±18.3 years; Syndesmotic screw group: 42.8±16.2 years) or gender distribution (p=0.793). These findings align with those of Shevate I et al., and Altmeppen J et al., and who reported similar age profiles in their cohorts, with peaks in the 20-30 and 51-60 year age group [15,19].



[Table/Fig-19,20]: Tibiofibular overlap (5.26 mm) and tibiofibular clear space (1.00 mm). (Images from left to right)

[Table/Fig-21]: Medial clear space (6.52 mm).

In the present study, males constituted 60% of the Tightrope group and 56.7% of the screw fixation group, indicating a male predominance overall (58.3%). This aligns with findings by Sanders D et al., who noted a male predominance in both groups, with 77% in the Tightrope group and 71% in the screw fixation group [24]. Overall, the present study reflects typical demographic patterns observed in syndesmotic injury populations predominantly male and middle-aged supporting the generalisability of the findings.

In the current study, functional outcomes assessed using OMAS and FAOS were significantly better in the Tightrope group at all follow-up intervals (p<0.001). Preoperative scores were comparable, but Tightrope group consistently showed greater improvements postoperatively. These findings align with Altmeppen JN et al., reported higher OMAS scores for Tightrope fixation (mean 98.81) compared to screws (mean 93.00) [19].

Similarly, FAOS scores for Activities of Daily Living (ADL) and sports activity were significantly better in the Tightrope group, with means of 99.22 and 97.03, compared to 95.86 and 91.10 in the screw group. Sanders D et al., observed comparable trends, with OMAS scores in the Tightrope group increasing from 54.0 at six weeks to 84.9 at six months, while the screw fixation group improved from 52.8 to 80.0 over the same period [24]. Postoperative pain scores (VAS) were significantly lower in the Tightrope group compared to the syndesmotic screw fixation group at all follow-up points (p<0.001). In contrast, Xu K et al., reported no significant differences in pain scores between their Suture-Button (SB) and Syndesmotic Screw

(SS) groups, and Shevate I et al., similarly observed no significant difference in postoperative VAS scores between Tightrope (1.9±0.7) and screw fixation (2.0±0.81; p=0.82) [15,25].

Tightrope fixation group showed significantly greater reductions in tibiofibular clear space than syndesmotic screw fixation group at all postoperative intervals (p<0.001). Similar trends were noted by Naqvi GA et al., where the Tightrope group had a significantly smaller TFCS (4.37±1.12 mm) compared to screws (5.16±1.92 mm; p=0.01) [7]. In contrast, Xu K et al., and Raeder BW et al., reported no significant differences in TFCS between the two groups [25,26]. The current study's findings reinforce Tightrope fixation's ability to achieve better syndesmotic reduction over time.

Tightrope fixation group consistently showed significantly higher tibiofibular overlap than syndesmotic screw fixation group at all follow-up points (p<0.001). Yawar B et al., similarly reported significantly higher TFO for Tightrope (7.68±1.80 mm) compared to screws (3.57±1.85 mm) [27]. Anand A et al., found a mean TFO of 10.1 mm postoperatively, while Kim JH et al., observed an improvement for Tightrope from 5.39 mm to 7.21 mm compared to screws (4.43 mm to 6.29 mm), with no statistical significance [28,29].

Medial clear space measurements showed no significant differences between the Tightrope (group A) and syndesmotic screw fixation (group B) groups at any follow-up point (p>0.05). This is consistent with findings by Xu K et al., where no significant differences in medial clear space were reported (p=0.60) [25]. Similarly, Kim JH et al., observed comparable reductions for both Tightrope (from 7.27 mm to 4.25 mm) and screws (from 7.90 mm to 4.32 mm) [29]. These results suggest that medial clear space outcomes are similar across fixation methods, reflecting adequate reduction regardless of the technique used.

Tightrope fixation group demonstrated a better postoperative outcome, with lower infection (3.3% vs. 20%) and malreduction rates (0% vs. 6.7%) compared to syndesmotic screw fixation group aligning with findings from Naqvi et al., who also reported higher malreduction rates with screws [7]. Xu K et al., observed fewer complications like implant failure and local irritation in patients treated with suture-button devices [25]. While Shevate I et al., did not find a significant difference in overall complication rates, they noted that Tightrope cases had more laxity and wound issues, whereas screw fixation was associated with higher rates of breakage and infection [15]. Bawady AH and Pavone V similarly found more mechanical problems and infections in the screw group [16,30]. Sanders D et al., reported a lower need for reoperation with Tightrope, largely because screw fixation often required implant removal [24]. Although rare, Rajagopalan S et al., described two challenging Tightrope cases involving deep infection and fusion [31]. Other researchers, like Yawar B and Raeder BW, highlighted complications in both groups, but synostosis a more serious concern was reported only in the screw fixation group [26,27].

The results of this study strongly support the clinical adoption of Tightrope fixation for the management of ankle syndesmosis injuries. Tightrope fixation demonstrates superior functional recovery, improved radiological alignment, and a lower rate of postoperative complications compared to syndesmotic screw fixation. While the benefits in terms of functional recovery, reduced complications, and better long-term outcomes are clear, healthcare providers must weigh these advantages against the higher costs when making treatment decisions.

Limitation(s)

The study employed a non randomised design, where patient allocation is based on clinical judgment. This approach may introduce potential selection bias. The follow-up duration of six months might not be sufficient to capture long-term complications, consequences, or the durability of the interventions. The findings would not apply as widely to larger populations because of very small sample size of 30 patients in each group. People with diverse healthcare resources might not be able to directly benefit from the study's context-specific insights, cultural practices, or injury profiles. Variability in surgical expertise among clinicians performing the procedures could influence the outcomes, possibly having an impact on the outcomes' dependability and consistency.

CONCLUSION(S)

This study demonstrates that Tightrope fixation provides superior functional outcomes, better radiological alignment, and fewer postoperative complications compared to syndesmotic screw fixation in ankle syndesmosis injuries. Patients treated with Tightrope showed higher OMAS and FAOS scores and experienced lower infection and malreduction rates. The shorter surgical duration also supports its clinical efficiency. These findings support the use of Tightrope as a more effective and reliable alternative in the surgical management of syndesmotic injuries.

REFERENCES

[1] Hermans JJ, Beumer A, de Jong TA, Kleinrensink GJ. Anatomy of the distal tibiofibular syndesmosis in adults: A pictorial essay with a multimodality approach. J Anat. 2010;217(6):633-45.

[2] Hunt KJ. Syndesmosis injuries. Curr Rev Musculoskelet Med. 2013;6(4):304-12.

[3] Court-Brown CM, Caesar B. Epidemiology of adult fractures: A review. Injury. 2006;37(8):691-97.

[4] Miller AN, Paul O, Boraiah S, Parker RJ, Helfet DL, Lorich DG. Functional outcomes after syndesmotic screw fixation and removal. J Orthop Trauma. 2010;24(1):12-16.

[5] Scott LJ, Jones T, Whitehouse MR, Robinson PW, Hollingworth W. Exploring trends in admissions and treatment for ankle fractures: A longitudinal cohort study of routinely collected hospital data in England. BMC Health Serv Res. 2020;20:811. Doi: 10.1186/s12913-020-05682-9.

[6] Qiu HB, Jiang J, Porter D. A new intraoperative syndesmosis instability classification system: Utility and medium-term results in closed displaced ankle fractures. Orthop Surg. 2017;9(4):365-71. Doi: 10.1111/os.12355.

[7] Naqvi GA, Cunningham P, Lynch B, Galvin R, Awan N. Fixation of ankle syndesmotic injuries: Comparison of tightrope fixation and syndesmotic screw fixation for accuracy of syndesmotic reduction. Am J Sports Med. 2012;40(12):2828-35. Doi: 10.1177/0363546512461480.

[8] Ramsey PL, Hamilton W. Changes in tibiotalar area of contact caused by lateral talar shift. J Bone Joint Surg Am. 1976;58(3):356-57.

[9] Patel A, Charles L, Ritchie J. A complication of posterior malleolar fracture fixation. J Foot Ankle Surg. 2016;12:123-28.

[10] Raasch WG, Larkin JJ, Draganich LE. Assessment of the posterior malleolus as a restraint to posterior subluxation of the ankle. J Bone Joint Surg Am. 1992;74(1):12-18.

[11] Velasco BT, DeAngelis RD, Dehghani B, Humbyrd CJ. Foot and ankle tips & tricks: Syndesmotic screw fixation- principles and technique. Foot Ankle Tips Tricks. 2021;31:123-30.

[12] Naqvi GA, Shafqat A, Awan N. Tightrope fixation of ankle syndesmosis injuries: Clinical outcome, complications, and technique modification. Injury. 2012;43(6):838-42.

[13] Cottom JM, Hyer CF, Philbin TM, Berlet GC. Treatment of syndesmotic disruptions with the Arthrex TightRope™: A report of 25 cases. Foot Ankle Int. 2008;29(3):277-82. Doi: 10.3113/FAI.2008.0277.

[14] Treon K, Beastall JE, Kumar K, Hope MJ. Complications of ankle syndesmosis stabilisation using a tightrope. Orthop Proc. 2011;93(Suppl I):62.

[15] Shevate I, Salunkhe R, Pervez F, Pawar P. A prospective study on fixation of syndesmotic ankle injury: Tightrope versus screw fixation. Cureus. 2024;16(8):e67172. Doi: 10.7759/cureus.67172.

[16] Pavone V, Papotto G, Vescio A, Longo G, D'Amato S, Ganci M, et al. Short and middle functional outcome in the static vs. dynamic fixation of syndesmotic injuries in ankle fractures: A retrospective case series study. J Clin Med. 2023;12:3637. Doi: 10.3390/jcm12113637.

[17] Saraglis G, Khan A, Chaudhari H, Pyakurel S, Elahi Rabbani SF, et al. Radiographic evaluation of syndesmosis stabilisation using the TightRope system versus syndesmotic screw fixation for the management of ankle fractures with a syndesmotic injury. Cureus. 2023;15(9):e45910. Doi: 10.7759/cureus.45910.

[18] Wójtowicz B, Chawrylak K, Lesman J, Makowski H, Kuczyński K, Maciejowski M, et al. Primary ankle fracture dislocation is not a negative prognostic factor for the surgical treatment of syndesmotic injury: A retrospective analysis of 246 patients. J Clin Med. 2025;14(4):1215. Doi: 10.3390/jcm14041215.

[19] Altmeppen JN, Colcuc C, Balser C, Gramlich Y, Klug A, Neun O, et al. A 10-year follow-up of ankle syndesmotic injuries: Prospective comparison of knotless suture-button fixation and syndesmotic screw fixation. J Clin Med. 2022;11(9):2524. Doi: 10.3390/jcm11092524.

[20] Olerud C, Molander H. A scoring scale for symptom evaluation after ankle fracture. Arch Orthop Trauma Surg. 1984;103(3):190-94. Doi: 10.1007/BF00435553.

[21] Roos EM, Brandsson S, Karlsson J. Validation of the foot and ankle outcome score for ankle ligament reconstruction. Foot Ankle Int. 2001;22(10):788-94. Doi: 10.1177/107110070102201004.

[22] Ghaderi F, Banakar S, Rostami S. Effect of pre-cooling injection site on pain perception in pediatric dentistry: A randomized clinical trial. Dent Res J (Isfahan). 2013;10(6):790-94. Doi: 10.4103/1735-3327.122486.

[23] Romero J, Lledó Alvarez AM, Moreno Sanchez F, Garcia AP, Porcel PAG, Sarabia RV, et al. Management of syndesmotic injuries of the ankle. EFORT Open Rev. 2017;2(5):160-68. Doi: 10.1302/2058-5241.2.160084.

[24] Sanders D, Schneider P, Taylor M, Tieszer C, Lawendy A. Improved reduction of the tibiofibular syndesmosis with TightRope compared with screw fixation: Results of a randomized controlled study. J Orthop Trauma. 2019;33(11):531-38. Doi: 10.1097/BOT.0000000000001559.

[25] Xu K, Zhang J, Zhang P, Liang Y, Hu JL, Wang X, et al. Comparison of suture-button versus syndesmotic screw in the treatment of distal tibiofibular syndesmosis injury: A meta-analysis. J Foot Ankle Surg. 2021;60(3):555-66. Doi: 10.1053/j.jfas.2020.08.005.

[26] Ræder BW, Stake IK, Madsen JE, Frihagen F, Jacobsen SB, Andersen MR, et al. Randomized trial comparing suture button with single 3.5 mm syndesmotic screw for ankle syndesmosis injury: Similar results at 2 years. Acta Orthop. 2020;91(6):770-75. Doi: 10.1080/17453674.2020.1818175.

[27] Yawar B, Hanratty B, Asim A, Niazi AK, Khan AM. Suture-button versus syndesmotic screw fixation of ankle fractures: A comparative retrospective review over one year. Cureus. 2021;13(9):e17826. Doi: 10.7759/cureus.17826.

[28] Anand A, Wei R, Patel A, Vedi V, Allardice G, Anand BS. Tightrope fixation of syndesmotic injuries in Weber C ankle fractures: A multicentre case series. Eur J Orthop Surg Traumatol. 2017;27(4):461-67. Doi: 10.1007/s00590-016-1882-8.

[29] Kim JH, Gwak HC, Lee CR, Choo HJ, Kim JG, Kim DY. A comparison of screw fixation and suture-button fixation in a syndesmosis injury in an ankle fracture. J Foot Ankle Surg. 2016;55(5):985-90. Doi: 10.1053/j.jfas.2016.05.002.

[30] Bawady AH, Allam AS, Karamany M, Farag HS. Tight rope versus screw fixation in ankle syndesmotic injuries. Benha Med J. 2023;40(surgical issue):112-28.

[31] Rajagopalan S, Moonot P, Sangar A, Taylor H. Revision ankle syndesmosis fixation: Functional outcome after TightRope® fixation. J Foot Ankle Surg Asia-Pacific. 2016;3(1):23-27. Doi:10.5005/jp-journals-10040-1054.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Mar 28, 2025
- Manual Googling: Jul 29, 2025
- iThenticate Software: Aug 09, 2025 (3%)

ETYMOLOGY: Author Origin

EMENDATIONS: 6

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Mar 14, 2025**
Date of Peer Review: **Jul 21, 2025**
Date of Acceptance: **Aug 11, 2025**
Date of Publishing: **Sep 01, 2025**