



DYNAMIC FIXATION WITH FIBER TAPE INTERNAL BRACING FOR DISTAL TIBIOFIBULAR SYNDESMOTIC INJURIES - A PROSPECTIVE COHORT STUDY

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Received: 1/12/2025 Revised: 3/1/2026 Accepted: 17/1/2026 Published: 30/1/2026

Abstract

BACKGROUND & OBJECTIVES: Distal Tibiofibular syndesmotom fixation is paramount important in ankle fracture fixation. Syndesmosis is crucial for integrity of ankle joint and thus for weight bearing. Traditionally, syndesmotom screws are used, but there are increasing reports of screw breakage, loosening, and stiffness due to prolonged immobilization required to protect the screws. Recently, dynamic fixation of syndesmosis using fibre tape internal bracing has gained popularity. The study was planned to evaluate functional outcome of fiber tape internal bracing in syndesmotom injury of ankle joint in a tertiary care center, Kerala. **MATERIALS AND METHODS:** A prospective cohort study was done for 34 patients with ankle syndesmotom injury for whom fiber tape internal bracing was done. Data was collected using a structured proforma one year after surgery. The evaluation of results is based on scoring system given by AOFAS ankle hindfoot score, one year after surgery. **RESULTS:** The mean age of patients was 39.06, with 61.8% in the age group 20-39 years. Males constituted 64.7%. Type-b Weber constituted 64.7%. Right ankle was more affected (58.8%). 38.2% had diabetes. 26.5% had pain at 1 year follow-up. 17.6% had post-op infection. Post-op AOFAS ankle hindfoot score at one year was good or above in 70.6% patients. 59.1% of type-B and 91.7% of type-C weber had good and above functional outcome (p-value= .204). Good and above functional outcomes were seen in 100% non-diabetic and 76.9% diabetic patients (p-value < .001). Good and above functional outcomes were seen in 82.1% patients with no post-op infection and 16.7% patients with post-op infection (p-value < .001). 100% of patients of age group 0-40 years, 77.8% of patients of the age group 40-60 years and 75% of patients above 60 years had good and above functional outcome (p value <0.001). The mean time taken for fracture healing was 14.18 ± 3 weeks. None of the patients required a second surgery for removal of implant during the study period. **CONCLUSION:** Fiber tape internal bracing in ankle syndesmotom injury greatly improves the functional outcome and allows early rehabilitation. It offers standardized elastic fixation without the need for a secondary procedure for implant removal.

KEYWORDS: syndesmotom injury, fibre tape internal brace, dynamic fixation, AOFAS ankle-hindfoot score

INTRODUCTION

The ankle joint is a complex weight-bearing joint that endures significant forces during weight-bearing activities. Ankle fractures account for about 10% of all fractures and are the second most common type of lower limb fracture[1,2]. These fractures occur more frequently in individuals over the age of 45 due to osteoporosis. Ankle fractures can result from various mechanisms that have been extensively studied. One often overlooked complication of these fractures is syndesmotc injury[3]. Syndesmotc ankle injuries fall into two categories: fractures of the ankle with associated syndesmotc disruption and syndesmotc ligamentous disruption without a fracture. The latter refers to the disruption of the anterior inferior tibiofibular ligament (AITFL) and is commonly referred to as a "high ankle sprain" or "isolated syndesmotc injury." Among all ankle sprains that do not involve a fracture, syndesmotc injuries represent approximately 1–11% of cases[4]. These injuries are especially common among athletes, as well as individuals involved in road traffic accidents and household falls. The syndesmosis plays a crucial role in stabilizing the ankle joint, making it significant for weight-bearing functionality[5,6]. Failure to identify a syndesmotc injury can lead to various complications, including post-traumatic arthritis, chronic ankle pain, instability, and difficulties with weight-bearing. The treatment for ankle fractures depends on the specific fracture pattern. Available treatment options include conservative management with a below-knee cast or surgical fixation using techniques such as lag screws, plates and screws, K-wires, intramedullary nails, or external fixation[7-9]. The primary goal of open reduction and internal fixation is to restore joint congruity. Proper reduction and surgical stabilization of the syndesmotc diastasis are crucial to prevent lateral talar shift and arthritis.

Traditionally, syndesmotc screws are used, but there are increasing reports of screw breakage, loosening, and stiffness due to prolonged immobilization required to protect the screws. Additionally, a second surgery is needed to remove the screws after healing [9,10]. The fiber tape internal brace consists of two metallic buttons connected by thick fiber wire sutures. These buttons stabilize either side of the bony structure, providing compression through the fiber wire. Prior reduction is essential before applying any implant, whether it is a screw or a fiber tape internal brace [11-13]. Flexible fixation of syndesmotc injuries can lead to better physiological healing. Using a suture button for fixation of syndesmotc diastasis is a safe, easy, and cost-effective method compared to screw fixation, allowing patients to return to their daily activities more quickly [14,15]. Furthermore, none of the patients treated with a suture button required additional surgery for implant removal. Using a suture button for fixation provides a better range of motion and reduces discomfort. The fiber tape internal brace offers a pulley effect, providing an extra slight compression that aids in joint reduction [16-18].

The purpose of this study was to evaluate the functional outcome of fiber tape internal bracing in managing syndesmotc ankle joint injuries. The secondary objective was to study the factors associated with good functional outcome in fiber tape internal bracing.

MATERIALS AND METHODS

The study was conducted as a prospective cohort study at the Department of Orthopaedics, Government Medical College, Thiruvananthapuram, from March 2023 to August 2024, after IEC approval. 34 consecutive patients, above 20 years, undergoing fiber tape internal bracing for syndesmotc injury, were included in the study. Inclusion criteria was patients with isolated ankle syndesmotc injuries or syndesmotc injuries associated with bimalleolar or trimalleolar fractures. The exclusion criteria were patients with previous ankle injuries, patients with ipsilateral lowerlimb injuries, patients with Weber Type-A fractures and patients who didn't give consent.

SURGICAL PROCEDURE

Based on clinical and radiological assessment, patients with a good soft tissue profile were planned for open reduction and internal fixation of ankle fracture with fiber tape internal bracing for syndesmotc injury. Spinal anaesthesia is typically administered and the patient is positioned supine.

After the area is scrubbed, painted and draped, fibula fixation is done with a lateral approach or posterolateral approach if posterior malleolus fixation is needed, using a one-third tubular plate or distal anatomical fibular plate (Fig-1).

Fig- 1 : Intraoperative fibula plating



Medial malleolus fixation is done using a 4mm cannulated cancellous screw or k-wires, or tension band technique based on the size of the fracture fragment using a medial approach. After fixation of the fibula, a drill hole is made using a drill bit of size 3.2mm through the fibular plate 3 cm above the tibial plafond. Then the fiber tape internal brace passed through the drill hole using inserter instrument. Upon passing the medial cortex of the tibia, the inserter disengages the fibre tape. Subsequently, the syndesmosis is reduced using a reduction clamp under fluoroscopic image guidance. Fiber tape tightening is done on fibular side using a button, under fluoroscopic guidance till acceptable reduction is attained (Fig-2).

Fig- 2 : Intraoperative fluoroscopic image



The wound is closed and a below knee slab is applied for immobilization. Postoperatively, patients were given parenteral antibiotics till post operative day 3 and then oral antibiotics for one week. First wound inspection was done on third postoperative day. Sutures were removed after two weeks.

A pretested questionnaire was given to the study subjects on admission to assess the study variables. Post operatively; routine follow-up done at 2weeks, 6weeks, 12weeks, 6months and one year. At 6th weeks, ankle joint x-ray was taken to assess the fracture healing and patient was advised partial weight bearing with walker & ankle range of movement exercises. At 12th week follow-up, x-ray was taken to assess the fracture healing, position of the fiber tape internal brace. Patient was advised to continue the physiotherapy exercises and allowed to complete weight bear. At 6 months and one year visit, repeat x-ray of ankle was taken to look for fracture healing and implant loosening. Patients were evaluated for functional outcome at the end of one year with AOFAS ankle-hindfoot score (90-100 excellent, 80-89 good, 70-79 fair, <69 poor).

Statistical analysis

Data was entered in MS excel & analysed using SPSS Statistics V27 (Chicago, USA) software. Quantitative variables were expressed as mean and standard deviation and qualitative variables were

expressed as proportions. Association of quantitative variables was determined using t-test and that of qualitative variables using Chi-square test. Significance level was 95% confidence interval for all analysis.

RESULTS

The mean age of patients was 39.06 (21- 66), with 61.8% (n=21) in the age group 20-39 years. Males constituted 64.7% (n=22). Most common cause was road traffic accident (55.9%, n= 19). Type-b Weber constituted 64.7% (n=22). Right ankle was more affected (58.8%, n=20). 38.2% (n=13) had diabetes (*Table-1*).

Table-1: Demography of study subjects

		Number	Percentage
Age group	20-40	21	61.8%
	40-60	9	26.4%
	≥60	4	11.8%
Gender	Male	22	64.7%
	Female	12	35.3%
Side	Left	14	41.2%
	Right	20	58.8%
Mechanism of injury	Fall from height	4	11.8%
	Road traffic accidents	19	55.9%
	Slip & fall	11	32.4%
Weber type	Type-B	22	64.7%
	Type-C	12	35.3%
Diabetes	Yes	13	38.2%
	No	21	61.8%

26.5% (n=9) had pain at 1 year follow-up. 17.6% (n=6) had post-op infection. More than 10° dorsiflexion attained in 91.2% (n=31) patients at one year. Anterior Drawer sign was <5mm in 70.6% (n=24) patients at one year (*Table-2*).

Table-2: Post-op results after 1 year

		Number	Percentage
Post-op pain	Yes	9	26.5%
	no	25	73.5%
Post-op infection	Yes	6	17.6%
	no	28	82.4%
Ankle dorsiflexion	<10°	3	8.8%
	>10°	31	91.2%
Post-op ankle stability (Anterior Drawer sign)	<5mm	24	70.6%
	6-10mm	8	23.5%
	>10mm	2	5.9%

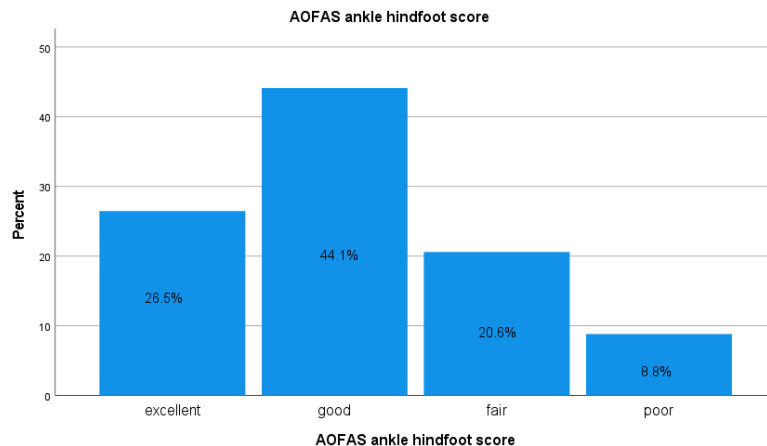
The mean value of ankle translation was 4.02 ± 3.47. Post-op AOFAS ankle hindfoot score at one year was good or above in 70.6% (n=24) patients (*Table-3, Fig-3*).

Table-3: Post-op AOFAS ankle hindfoot score at 1 year

	Number	Percentage
Poor	3	8.8%
Fair	7	20.6%
Good	15	44.1%

Excellent	9	26.5%
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Fig-3 : Post-op AOFAS ankle hindfoot score at 1 year



59.1% of type-B and 91.7% of type-C weber had good and above functional outcome (p-value=.204). Good and above functional outcomes were seen in 100% non-diabetic and 76.9% diabetic patients (p-value < .001). Good and above functional outcomes were seen in 82.1% patients with no post-op infection and 16.7% patients with post-op infection(p-value < .001). 77.4% of patients with >10° of angle dorsiflexion had good and above functional outcome, and 100% of patients with <10° of dorsiflexion had below good functional outcome p value <0.001). 100% of patients of age group 0-40 years, 77.8% of patients of the age group 40-60 years and 75% of patients above 60 years had good and above functional outcome (p value <0.001). The mean time taken for fracture healing was 14.18 ± 3.00 weeks. The mean AOFAS ankle hindfoot score among males and females were 86.68 ± 7.22 and 76.91 ± 9.90 respectively (p value = 0.3). 55.5% of patients having postoperative pain and 76% of patients without post operative pain, had good and above functional outcome (p value= 0.3). None of the patients required a second surgery for removal of implant during the study period.

DISCUSSION

A total of 70.6% of patients had good and above functional outcome where as 29.4% had below good functional outcome. 59.1% of type B Weber fractures and 91.7% of type C Weber fractures had good and above functional outcome, and the finding was not statistically significant (p value of .204 by fisher exact test) indicating that there is no statistical significance between weber type fracture and functional outcome. 38.2% of the total patients were diabetic and 76.9% of diabetic patients had good functional outcome while among non-diabetic patients 100 % had good and above functional outcome. This difference was statistically significant with a p value of < .001 by fisher exact test. 17.6% of total patients had post operative wound infection of which 83.3% had below good functional outcome while 82.1% of patients without infection had good and above functional outcome. This difference was statistically significant with a p value of <.001 by fisher exact test.

On assessing the relationship between the amount of dorsiflexion at the end of one year post op and functional outcome, 77.4% of patients with >10 degree of angle dorsiflexion had good and above functional outcome, and 100% of patients with <10 degree of dorsiflexion had below good functional outcome, this difference was statistically significant with p value of <0.001 by fisher exact test. On assessing the relationship between age category and the functional outcome, 100% of patients below 40 years, 77.8% of patients of the age group 40-60 years and 75% of patients above 60 years had good and above functional outcome and was statistically significant with p value of <0.001.

On comparing the mean AOFAS ankle hindfoot score among males and females using independent t-test it was found that males had a mean score of 86.68 ± 7.22 and females had a mean sore of 76.91

± 9.90. however, this difference was not statistically significant. (p value of 0.3, Levene's test). On assessing the relationship between functional outcome score and post operative pain it was found that 55.5% of those patients having postoperative pain had good and above functional outcome and 76% of patients without post operative pain had good and above functional outcome. However, the difference was not statistically significant (p value 0.3 by fisher exact test).

21 patients of the 34 belonged to the age group of less than 40 years (mean age 39.06). The age distribution is similar to studies by other researchers such as Gohar A Naqvi (mean age 37.7). There was a male preponderance of 64.7% in present study, which was comparable to 65.3% in their study (14). The mean AOFAS score was found to be 85.57 in their study compared to 83.23 in the present study (14). Xiao Fan et al. in their meta-analysis demonstrated that the rate of second procedures was statistically lower in the dynamic fixation (DF) group than in the static fixation(SF) group using screws[19]. The routine removal was the most common reason for a second procedure in the SF group. Nearly 1 in 10 patients in the DF group and nearly 1 in 2 patients in the SF group experienced a complication [19]. Kaifeng Gan et al. in their meta-analysis concluded that significantly improved functional scores and lower rate of post-op complications were elicited in DF group compared to SF group [20].

CONCLUSION

SyndesmotiC injury of ankle joint is caused by high energy trauma to the ankle. There was no significant correlation between the final functional outcome and type of fracture, whether Weber type B or type C. Patients with diabetes and with post-op infection; and older patients had a poorer functional outcome. It is important that the normal reduction is not compromised and that the fibula is properly positioned in the incisura before the application of any implant. Overall, fiber tape internal bracing in ankle syndesmotiC injury greatly improves the functional outcome. It offers standardized elastic fixation without the need for a secondary procedure for implant removal.

Conflicts of interest

Authors declare no conflicts of interest.

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