

## Treatment of Primary Ligamentous Lisfranc Injuries: Comparison between Screw Fixation and Tightrope Fixation

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**Background/Purpose:** Primary ligamentous Lisfranc injuries are frequently missed during initial presentation and are notorious to delayed healing, which leads to long-term disability. The ideal treatment for the primary Lisfranc injury is still under debate with various treatment options including nonoperative, screws, tightropes, and arthrodesis. There are a few case reports on tightrope fixation for Lisfranc injuries reporting advantages including early full weight bearing and no secondary procedure for hardware removal; however, there are no clinical studies. The objective of this study is to analyze and compare the clinical results of the tightrope fixation to the screw fixation for pure ligamentous Lisfranc injuries.

**Methods:** After obtaining IRB approval, we conducted a retrospective study to identify all skeletally mature patients who were treated for Lisfranc fracture-dislocation injuries between September 2006 and November 2014. The inclusion criteria for the study were skeletally mature patients treated with tightropes or screws for acute Lisfranc injury with an injury duration of less than 3 months duration from the date of surgery. Excluded were comminuted intra-articular fractures of 1st and 2nd metatarsal base and other modalities of treatment including nonoperative, Kirshner wires, plates, and arthrodesis. Primary outcomes measured included demographics, mechanism of injury, quality of reduction, rate of planned and unplanned implant removal, complications including infection and hardware irritation, return to preinjury status, full weight bearing, and the reduction maintained or not at last follow-up. Patients with a minimum follow-up of 6 months were included for analysis. The reduction was considered acceptable if the Lisfranc joint was anatomically reduced or diastasis was <2 mm and poor if the diastasis at the joint space was >2 mm.

**Results:** A total of 51 out of 168 patients met the criteria, of which 27 belonged to tightrope group and 24 belonged to screw group. Detailed analysis for each group are in Table 1. Both groups were identical for many of the preoperative characteristics including demographics ( $P = 0.10$ ), surgical wait ( $P = 0.59$ ), smoking ( $P = 0.99$ ), other associated foot and ankle injuries ( $P = 0.53$ ), and diabetes ( $P = 0.99$ ). The quality of reduction based on immediate postoperative radiographs ( $P = 0.07$ ), maintenance of the reduction ( $P = 0.78$ ), infection rate ( $P = 0.99$ ), and skin problems ( $P = 0.15$ ) were similar in both groups. Implant removal rate including planned or unplanned ( $P \leq 0.0001$ ), broken hardware ( $P = 0.02$ ), and return to full weight bearing ( $P \leq 0.0001$ ) are significantly different between the two groups. Average follow-up duration for tightrope group was 72 weeks (range, 38-168) and screw group was 79 weeks (range, 40-175).

**Conclusion:** Our study suggests that the tightrope fixation carries advantage over the screw

**Table 1A.** Comparison of surgical and post-surgical characteristics between patients receiving tightropes vs. screws for Lis Franc fractures.

	<b>Tightrope (n=27)</b>	<b>Screws (n=24)</b>	<b>p-value</b>
Age in years, Mean (SD)	30 (17)	38 (17)	0.10
Males, N (%)	14 (52%)	12 (50%)	0.89
Side, N(%)			0.64
Left	10 (37%)	10 (43%)	
Right	17 (63%)	13 (57%)	
Nunley and Vertillo Classification, N (%)			0.23
II	22 (81%)	16 (67%)	
III	5 (19%)	8 (33%)	
Diagnosed on X-ray, N (%)*	22 (81%)	23 (100%)	0.05
CT scan used in (%)	11 (41%)	14 (58%)	0.21
Mechanism of Injury, N(%)			<b>0.0001</b>
Motor vehicle crash	1 (4%)	11 (46%)	
Crush	1 (4%)	0 (0%)	
Fall	7 (26%)	9 (38%)	
Sports	7 (26%)	0 (0%)	
Twist	11 (41%)	4 (17%)	
Diabetes, N (%)	1 (4%)	1 (4%)	0.99
Smoking, N (%)	4 (15%)	4 (17%)	0.99
Wait between fracture and surgery in days, Mean (SD)	15 (12)	11 (11)	0.16
Other foot and ankle injuries, N (%)	8 (30%)	8 (30%)	0.78
Quality of reduction, N (%)			0.07
Acceptable (<2mm)	6 (22%)	1 (4%)	
Good	20 (74%)	23 (96%)	
Poor	1 (4%)	0 (0%)	
Implants removed, N (%)	0 (0%)	20 (83%)	<b>&lt;0.0001</b>
Hardware broken, N (%)	0 (0%)	5 (21%)	<b>0.02</b>
Infection, N (%)	1 (4%)	3 (13%)	0.33
Skin problems, N (%)	0 (0%)	1 (4%)	0.47
Any revision other than implant removal, N(%)	1 (4%)	2 (8%)	0.46
Radiographs at final follow-up, N(%)			0.66
Good	25 (93%)	21 (88%)	
Poor	2 (7%)	3 (13%)	
Arthritic changes, N (%)	2 (7%)	6 (25%)	0.13
Weeks to full weight bearing, Mean (SD)	6 (2)	13 (5)	<b>&lt;0.0001</b>

fixation in terms of lower reoperation rate and early full weight bearing. Given the high rate of good quality of reduction and its maintenance as well as advantages of low secondary procedures and early weight bearing, tightropes can be utilized routinely in the treatment of primary ligamentous lesions especially for the athletes and the young adults where fine movements are desired.

The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or medical device he or she wishes to use in clinical practice.