

CASE SERIES

Outcome of Modified Technique Using Mini Tightrope Device for Hallux Valgus Surgery: A Case Series

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ABSTRACT

Introduction: Hallux valgus is a common foot ailment that is initially treated conservatively. In failed conservative treatment, many surgical options are available but mainly consists of bony osteotomies which carry potential complications such as shortening of the first metatarsal, dorsiflexion malunion, delayed union, nonunion and osteonecrosis of the capital fragment. **Methods:** We introduce a modified technique using Mini TightRope device for correction of the hallux valgus and present the short-term outcome for 3 informed and consented patients who refused bony osteotomy. **Results:** Results were satisfactory with regards to pain reduction, footwear and daily living activities. **Conclusion:** Selection of patients and surgical technique are important factors to avoid complications such as stress fracture and rupture of the device.

Keywords: Hallux valgus, Mini TightRope, Modified technique, Single attempt, Patient selection

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INTRODUCTION

Hallux valgus is a common foot ailment involving the first ray with complex deformities mainly comprising the hallux valgus angle and intermetatarsal angle and sometimes associated with hallux valgus interphalangeus. Symptoms include pain, difficulty of footwear and poor balance with risk of falling (1). Clinically, the deformity is cosmetically obvious with lateral deviation and pronation of the greater toe and medial deviation of the first metatarsal bone with a pronounced medial eminence also known as a bunion. Epidemiologically, this condition appears to be associated with increasing age and the female sex (2).

Initial treatment is usually conservative; however, it is usually restricted to alleviating symptoms and is unable to correct the deformity. Should symptoms persist, surgical treatment is indicated. Based on

the severity of the deformity, different corrective osteotomies along with soft tissue procedures are employed (3). However, with the challenges and possible complications of bony procedures, other options are being implemented, one of which was using a soft tissue sling via adductor hallucis tendon transfer for the reduction of the first intermetatarsal angle [IMA] as described by Joplin (4). Based on his idea, the Mini TightRope was introduced. At our centre, we selected 3 patients who refused bone osteotomy to undergo surgery using the Mini TightRope. We performed a modified technique and followed up with the patients to determine the short-term outcomes.

MATERIALS AND METHODS

Three patients with mild, moderate and severe hallux valgus, who each failed conservative treatment, reported pain as a symptom and refused bone osteotomy were included in this report. They were given a thorough explanation and consented for the surgery. Demographic data, pre-operative symptoms, visual analogue scale [VAS] score and angle measurements (hallux valgus

angle [HVA] and intermetatarsal angle [IMA]) were collected along with post-operative VAS score, angle measurements, perceptive satisfaction and any report of complications. The severity of hallux valgus is determined by HVA and IMA. For mild is HVA < 25° and IMA < 13°, moderate is HVA 25-40° and IMA 13-15° and for severe is HVA > 40° and IMA > 15°. Patients were further followed up at post-surgery 1-month and 3-months.

The operations were carried out by the same Foot and Ankle surgeon. Patients were operated on in the supine position with padded tourniquet application to the ipsilateral thigh under an appropriate mode of anaesthesia. Fig. 1 shows the procedure. Firstly, an extensive lateral release of the metatarsophalangeal joint complex was done.



Fig. 1 : (A) An extensive lateral release of the metatarsophalangeal joint complex is performed through a dorsal incision. The adductor tendon, intermetatarsal ligament, metatarsal-sesamoid ligament, and lateral joint capsule are completely released. (B) The medial aspect of the joint is exposed through a separate, medial longitudinal incision. The medial capsule is then opened in line with the skin incision to avoid dorsal nerve injury. (C) Resection of the medial eminence just medial to the sulcus is performed. (Bunionectomy) (D) Small lateral longitudinal incision over proximal phalanx is done and Mini TightRope [MTR] guidewire is drilled under fluoroscopy. (E) Second tunnel is created approximately 1-2cm proximal to the first MTR through first and second metatarsals.(F) MTR device is inserted through these tunnels and sutures are tightened after closure of the IMA by medio-lateral compression. (G) Tightening of MTR button on medial side of first metatarsal then lateral side is done and medially directed stress is applied to the hallux until full correction is achieved.

The adductor tendon, intermetatarsal ligament, metatarsal-sesamoid ligament, and lateral joint capsule were completely released (Fig. 1A). The medial aspect of the joint is exposed through a separate, medial longitudinal incision. The medial capsule is then opened in line with the skin incision to avoid dorsal nerve injury (Fig. 1B). Resection of the medial eminence just medial to the sulcus is performed (Fig. 1C). For our modified technique, we proceeded with 1-2cm incisions made on the lateral aspect of the proximal phalanx of the hallux and distal part of the 2nd metatarsal (Fig. 1D). Bone tunnels were made from lateral to medial on the proximal phalanx of the hallux and from the medial aspect of the 1st metatarsal through to the lateral aspect of the 2nd metatarsal bone under image intensifier guidance (Fig. 1E). Tunneling was done meticulously and achieved with a single attempt in each operation. The Mini TightRope was then threaded through these tunnels (Fig. 1F), from the lateral aspect of the proximal phalanx to its medial aspect of the 1st metatarsal to the lateral aspect of the second metatarsal. Medial compression of the hallux was applied for correction of the HVA, followed by tensioning and anchoring of the buttons. A second Mini TightRope was then standardly inserted and tensioned 2-3 cm proximally from the 2nd metatarsal to the 1st metatarsal to correct the IMA (Fig. 1G). Finally, a medial capsular plication was performed followed by wound closure, dressing and bandaging,

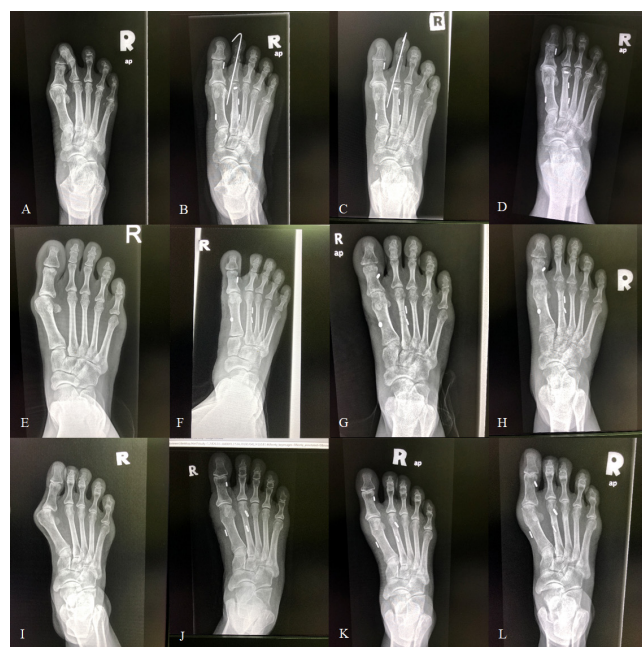


Fig. 2 : AP radiographs of the right foot of patient 1 (A) pre operatively, (B) immediately post-surgery, (C) on follow up 1-month and (D) 3-months post-surgery. AP radiographs of the right foot of patient 2 (E) pre operatively, (F) immediately post-surgery, (G) on follow up 1-month and (H) 3-months post-surgery. AP radiographs of the right foot of patient 3 (I) pre operatively, (J) immediately post-surgery, (K) on follow up 1-month and (L) 3-months post-surgery.

before maintained on a below knee backslab. For the patient with mild hallux valgus, she also had an overriding second toe, in which Weil's osteotomy, screw fixation and K wiring was done.

There were no complications or difficulties reported intraoperatively as compared to other standard procedures. Post operatively, patients were maintained on a below knee backslab and advised to not weight bear on the forefoot for at least 1 month. Toe spacers were advised to be worn for 3 months.

RESULTS

Demographic data, preoperative HVA, IMA, severity, symptoms and VAS of all 3 patients were collected. Patient 1 is a 72 year old female who works as a teacher. The affected foot is the right foot with preoperative HVA of 21.1 degrees and IMA of 10.4 degrees. It is mild in severity and have symptoms of pain with VAS of 7. Patient 2 is a 33 year old female clerk, who complained of pain with VAS of 8 on her right affected foot. It is moderate in severity with preoperative HVA of 26.1 degrees and IMA of 14.9 degrees. Patient 3 is a 58 year old female who also works as a clerk. The affected right foot is severe with symptoms of pain and VAS of 8. The preoperative HVA is 42.8 degrees and IMA is 21.1 degrees.

Fig. 2 show anteroposterior [AP] radiographs of the right foot pre operatively, immediately post-surgery, on follow up 1-month and 3-months post-surgery for patient 1, 2 and 3 respectively. Table I show HVA, IMA and VAS measurements respectively for pre-operatively and post-operatively. The VAS measurements for pre operative and post-operative were taken during clinic follow up. Immediate post-operative measurements showed that the mean HVA

decreased from 30 degrees to 5.5 degrees, mean IMA decreased from 15.5 degrees to 5.1 degrees. At 3 months the mean HVA was 15 degrees and the mean IMA was 10.3 degrees. The mean loss of correction at 3 months for HVA was 9.1 degrees and IMA was 5.2 degrees. Mean VAS score reduced from 7.7 to 1. Patients reported good satisfaction as their pain reduced greatly. They were all reported to have some 'tightness' at the 1st metatarsophalangeal joint but it did not disturb their footwear or daily activities. There were no reports of complications such as infection, rupture of device or fracture.

DISCUSSION

There are multiple surgical methods of correcting hallux valgus according to their severity. Bone osteotomies can prove challenging with possible complications such as shortening of the first metatarsal, dorsiflexion malunion, delayed union, non union and osteonecrosis of the capital fragment (5,6). These complications can be avoided with the Mini TightRope procedure however it also has its own complications such as: stress fractures of the 2nd metatarsals possibly due to an increase in stress at the interosseus tunnel or distal level of the second metatarsal purchase point and rupture of the device (7). Thus, patient selection was recommended with criteria such as having good bone quality, non-athletic demands and no hypermobility of the first metatarsophalangeal/ tarsometatarsal joints (8).

Another advantage of this modified technique is that it utilizes two Mini TightRopes to provide improved stability. The first Mini TightRope is directly maintaining the correction of the HVA. It also provides additional strength to the second Mini TightRope to maintain the correction of the IMA.

Table I : HVA, IMA and VAS measurements pre-operatively and post-operatively

Measurement	Patient / Affected foot	Pre-op	Immediately Post-op	Post op 1 month	Post op 3 months
HVA	1 / Right	21.1	6.9	7.2	11.6
	2 / Right	26.1	1.4	2.4	8.5
	3 / Right	42.8	8.2	10.1	25.1
IMA	1 / Right	10.4	6.5	6.5	7.5
	2 / Right	14.9	2.3	6.2	9.4
	3 / Right	21.1	6.6	8.3	14.0
VAS	1 / Right	7	-	-	1
	2 / Right	8	-	-	2
	3 / Right	8	-	-	0

Besides that, there is no need to wait for bony union as compared to bone osteotomies which allow earlier weight bearing and mobilization for the patient. According to the recommendation of the device manufacturers, it is allowed for the patient to mobilize with full weight bearing in a stiff-soled shoe immediately after repair (9).

Although there is a loss of correction at 3 months post-surgery, which happened in severe hallux valgus patient, our patients still have good satisfaction based on their pain scores which remarkably decreased. Despite the sensation of 'tightness' at the first metatarsophalangeal joint, they were happy that they had no problems with footwear, were able to carry out their daily activities and had no complications. It is worth mentioning that our patients had no athletic demands.

The loss of correction at post-surgery 3 months is a concern for patient 3, due to the patient age which is more than 65 years old and there is a high rate of recurrence. This could suggest that the loss of elasticity of the soft tissue cause the failure of the Mini TightRope in elderly patients. This show that this procedure is not suitable for patients older than 65 years old due to the quality of elasticity of soft tissue. It is recommended that these elderly patients undergo a bony procedure. For these patients, if there is a recurrence, the plan is to proceed with another surgical method which is bony procedure. The surgical technique discussed in this study is more of a soft tissue procedure where it does not involve an osteotomy of the bone. Besides using this method, there are also multiple surgical techniques that are suitable for these patients as this deformity is a well known deformity.

We acknowledge our small sample number and short duration of follow up, but short-term results showed that this procedure does benefit patients of different severities of hallux valgus in terms of cosmetic correction, footwear and pain reduction. It would be noteworthy to select patients with good bone quality and those that have non athletic demands. As for now, we cannot compare our results with other studies as this study is short term and has a small sample size. Therefore, a larger sample size and longer duration follow up is recommended for future studies.

CONCLUSION

The modified technique of Mini TightRope procedure may be of merit to the correction of hallux valgus in appropriately selected patients, in which the surgical technique is done with precision and compliance to post-operative care is successfully met by the patients. Further studies with larger sample size and longer duration follow up is needed for concrete evidence.

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