

A Retrospective Evaluation of Non-Union Percentage Following Trilliant's Minimally Invasive Bunion Plating System Procedure

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Introduction

There is an exhaustible number of procedures aimed at correcting hallux abducto valgus deformities. Recent literature suggest that a triplanar approach is more advantageous than other options to realign the 1st ray¹. We can see the importance of this approach when we learn that the leading cause of bunion reoccurrence is post-operative sesamoid position of a 4 or greater and HAV angle of greater than 8 degrees².

A first metatarsal cuneiform fusion is most commonly the "go to" option for triplanar correction but a large number of patients do not fit the parameters of this procedure and a greater number are resistant because of the large incision, increased healing time and higher non-union rates³.

Recently, there has been a push of minimally invasive procedures to correct a bunion that allows the surgeon to easily obtain triplanar correction. Regularly, this distal procedure requires the surgeon to translate the capital fragment 40% to 90% laterally. With such large translation is it difficult to visualize how the procedure site can be stabilized or even heal. Trilliant has developed a plate (Figure 1) that allows for stable fixation with a large translation and rotation of the capital fragment. The purpose of this study is to determine, if in fact, the minimally invasive bunion procedure with the Trilliant Minimally Invasive Bunion (M.I.B.) Plate maintains a consistent high union rate.

Patients and Methods

There were 23 patients that underwent 26 minimally invasive bunion correction procedures using Trilliant's M.I.B. system by three different surgeons. There was one patient that was undergoing their 4th surgical correction

of their bunion. This patient already had their natural anatomy and blood supply disrupted. We want to look at bone healing rates by affecting the blood supply to the osteotomy site as little as possible so any revisional bunionectomy procedures were omitted. The inclusion criteria was a mild to moderate bunion deformity (IM angle 9 to 17 degrees) with absent or mild arthritic changes at the 1st metatarsal phalangeal joint and neurovascular status intact. Upon applying the exclusion criteria, this leaves us with 22 patients that underwent 25 of the procedures (Table 1).

Surgical Technique

A percutaneous adductor hallucis tendon release was performed under fluoroscopy with a beaver blade. A 2cm longitudinal, medial incision was then created over the intended osteotomy site. Dissection was carried down to bone, and all vital neurovascular structures were retracted out of the surgical site. The dorsal and plantar vital structures were then protected and an osteotomy is then created at the neck of the 1st metatarsal that splits the difference between the perpendicular long axis of the metatarsal and perpendicular long axis of the weight bearing surface, while aiming towards the 5th metatarsal head to maintain length.

A broach is then inserted at the osteotomy site in the proximal medullary canal. The capital fragment is then translated laterally while distracting the distal bone segment and rotating the valgus deformity out until it is in near anatomic position, which is checked under fluoroscopy. The assembled plate and guide construct is then placed where the bone was just broached. The construct is temporarily secured with two K-wires.

The two distal screw holes of the plate are then filled with 2.4mm locking screws that go into the 1st metatarsal head. The guide construct is then removed from the plate and the two proximal remaining screw holes are filled with 2.4mm screws. The remaining k-wire is removed. The surgical site is then closed per standard surgical technique.

During the post-operative course the patients were weight bearing as tolerated in a post-operative shoe for four weeks. X-rays were taken at 2 weeks out, 4 weeks out and 3 months out. Patients would begin to transition to good supportive shoe gear at 4 weeks following the



Figure 1. The Minimally Invasive Bunion Plating System Plates.

Age	Sex	Past Medical History	Smoker	Fusion at 3 Months	Fusion at 6 months
59	M	HLD	No	Yes	Yes
53	F	HTN	No	Yes	Yes
48	F	HTN, Hypothyroidism, GERD	Yes	Yes	Yes
48	F	HTN, Hypothyroidism, GERD	Yes	Yes	Yes
63	F	HTN HLD, Hypothyroid, DM II, Seizures	Yes	Yes	Yes
63	F	HTN HLD, Hypothyroid, DM II, Seizures	Yes	Yes	Yes
54	F	Hep C	Yes	Yes	Yes
29	F	None	No	Yes	Yes
44	F	DM II	No	Yes	Yes
52	F	HTN, HLD	No	Yes	Yes
54	F	HTN	No	Yes	Yes
55	F	Asthma	No	Yes	Yes
55	F	Asthma	No	Yes	Yes
59	F	Asthma, Hypothyroid, Seizures	No	Yes	Yes
64	M	None	No	Yes	Yes
66	M	HLD	Yes	Yes	Yes
57	F	HLD, HTN	Yes	Yes	Yes
21	F	None	No	Yes	Yes
38	F	None	No	No	Yes
61	F	HTN, HLD	No	Yes	Yes
54	M	HTN, Hypothyroid	Yes	Yes	Yes
28	F	None	No	Yes	Yes
51	F	HTN	No	Yes	Yes
41	F	None	No	Yes	Yes
44	F	None	No	Yes	Yes

Table 1. Patient Demographics

procedure, if swelling allowed. At 2 months out, patients would begin to increase their activity level and were back to their baseline by 3 months out (Figures 2-5).

X-rays would usually show the start of bone callus formation at 4 weeks out from surgery and there is complete union visible 3 months following the surgical procedure. It was considered union if there was visible callus crossing the osteotomy site as well as no pain while putting the procedure site through stress.

Results

Of the 25 surgical procedures from the 22 patients, all 25 went on to heal. 24/25 osteotomies showed complete bone callus across the osteotomy site at 3 months while the remaining patient went on to show complete bone callus formation at the 6 month x-ray. The delayed union patient did have tenderness at the procedure

site until about 3 months out. The patient was kept in a post-operative shoe until the 3 month out mark then transitioned into a supportive tennis shoe until complete healing was visualized on x-ray. The patient did not have any co-morbidities and was a non-smoker.

Of the 25 surgical procedures, eight were performed on current, every day smokers. These eight patients went on to show full callus formation across the osteotomy site at 3 months following the surgical procedure and were pain free 4 weeks after the surgical date.

Two of the patients shared that they were having a “tingling” sensation over the hardware and asked for the plate and screws to be removed. This was just over three months following the initial procedure. The plates and screws were removed and the patients healed uneventfully without any future complications. X-rays



Figure 2. Pre-operative radiograph.



Figure 3. Post-operative radiograph.



Figure 4. 1-month post-operative radiograph.



Figure 5. 3-month post-operative radiograph.

were taken following the hardware removal to show the extent of the bone callus formation.

Discussion

Through this retrospective study we have concluded that Trilliant's M.I.B. procedure allows us to achieve triplanar correction with up to 90% lateral translation with stable hardware while preserving a significant amount of blood flow to the capital fragment maintaining a 100% union rate.

Kuhn et al. was able to see how undergoing a chevron bunion correction would affect the blood flow to the metatarsal head. The portion of the procedure that decreased the blood flow the most was the medial capsulotomy, 45% decrease, followed by the lateral release, adductor tenotomy and chevron osteotomy each causing 13% decrease of blood flow to the metatarsal head with a total decrease of 71%⁴. Even with the reduction in blood flow, a chevron osteotomy still has a low non-union rate. With Trilliant's M.I.B.

plating system there is generally no need for a medial capsulotomy, lateral release and only a percutaneous adductor release was performed per the surgeon's discretion.

With over 100 different bunion procedures described in literature⁵ and with no gold standard for correcting a bunion, most trained surgeons would agree that triplanar correction, while preserving blood flow will decrease non-union and reoccurrence rates. Even

with a chevron osteotomy, which is arguably the most common bunion correction performed, we see a reoccurrence rate of 10%⁶. It is possible that this is due to the limiting geometry of biplane correction with a chevron osteotomy. With a 100% union rate in this retrospective evaluation, Trilliant's minimally invasive bunion procedure has the characteristics and potential to become the "go to" procedure for bunion correction. ▲

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References

1. Dayton P et al. Why Frontal Plane Correction is a Vital Component of Bunion Surgery. *Podiatry Today*. 2017 July;30(7):28-34.
2. Park CH, Lee W-C. Recurrence of Hallux Valgus Can Be Predicted from Immediate Postoperative Non-Weight-Bearing Radiographs. *J Bone Joint Surg Am*. 2017 99:1190-1197.
3. Saffo G, Desnoyers R, Wooster M, et al. First Metatarsocuneiform Joint Arthrodesis: A Five Year Retrospective Analysis. *J Foot Surgery*. 1989;5:459-465.
4. Kuhn MA, et al. Blood Flow to the Metatarsal Head After Chevron Bunionectomy. *Foot Ankle Int*. 2005 Jul;26(7):526-529.
5. Kelikian H: Hallux Valgus. Allied Deformities of the Forefoot and Metatarsalgia. WB Saunders, Philadelphia, 1965.
6. Austin DW, Leventen ED. A New Osteotomy for Hallux Valgus. *Clin Orthop*. 1981;157:25-30.

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