Sliding Distal Metatarsal Minimally Invasive Osteotomy (S-DMMO) for the Treatment of Tailor's Bunion

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Abstract: Bunionette, or Tailor's bunion, refers to a painful lateral prominence at the fifth metatarsal head. Metatarsal osteotomies have proved to be a successful treatment, and have been described at the distal, diaphyseal, and proximal levels. Distal metatarsal osteotomies have been reported as effective in bunionette correction in several clinical studies. In the last decade, there has been a growing interest in the use of percutaneous or minimally invasive surgery for the treatment of this condition. Minimally invasive distal metatarsal metaphyseal osteotomy (DMMO) has proved to be successful when treating metatarsalgia. We present a surgical technique consisting in a distal osteotomy of the fifth metatarsal, which resembles DMMO, but requires a lateral displacement. We retrospectively investigated 38 feet from 32 patients with symptomatic bunionette deformity and showed good to excellent functional and clinical results. The S-DMMO proved to be a safe (low complication rate) and effective (adequate clinical results and powerful radiologic correction) procedure for the treatment of bunionette deformity.

Level of Evidence: Diagnostic Level 4. See Instructions for Authors for a complete description of levels of evidence.

Key Words: Tailor's bunion, minimally invasive surgery, sliding DMMO

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HISTORICAL PERSPECTIVE

Bunionette, or Tailor's bunion, refers to a painful lateral prominence at the fifth metatarsal head. This disorder is frequently associated with painful keratosis on the lateral or plantar aspect of the fifth metatarsal head. Symptoms usually include pain, erythema, hyperkeratosis, and swelling at the lateral border of the fifth metatarsal head.

For severe or refractory cases, surgical intervention is indicated. Surgeries are used to treat Tailor's bunions.[1–4] Resective surgery, reported to be ineffective or associated with a high prevalence of morbidity, includes metatarsal head resection, fifth metatarsal ray resection, and isolated soft tissue procedures on the fifth metatarsophalangeal joint.[5] Resection of the lateral third of the fifth metatarsal head can be useful with a type 1 deformity.[1] However, disadvantages include deformity recurrence, joint instability, and an incongruous joint. Resection of the entire metatarsal head can be used as a salvage procedure.[6,7]

Metatarsal osteotomies have proved to be a successful treatment, and have been described at the distal, diaphyseal, and proximal levels. Proximal and diaphyseal osteotomies achieve the best deformity correction at the expense of increased technical complexity, less fixation stability, and delay in bone healing.[8–10] Distal metatarsal osteotomies are effective in bunionette correction in several clinical studies[11,12] but have been associated with the risk of osteonecrosis of the metatarsal head.[13–15] Open techniques have been associated with delayed wound healing, pain related to osteosynthesis, and infection.[11]

In the last decade, there has been a growing interest in the use of percutaneous or minimally invasive surgery (MIS) for the treatment of this condition.[14,16–18] MIS techniques are being adopted in all surgical specialties, essentially because of its

FIGURE 1. Percutaneous portal. Made 5 mm proximally to the fifth MTP joint.

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FIGURE 2. A–C, Creation of the working area.

inherent advantages of less operative trauma, and preservation of the blood supply. This has a direct impact leading to lower morbidity rates and faster recovery with immediate weight-bearing[19]—which happens also with some open surgeries. Minimally invasive techniques also have the potential added benefit for patients in whom wound healing is an issue.[20] However, it has to be noted that MIS techniques have an important learning curve, and experience is a key factor for its effectiveness.

Minimally invasive distal metatarsal metaphyseal osteotomy (DMMO) has proved to be successful when treating metatarsalgia in several clinical studies.[21–23] The minimally invasive technique described in this study is a modification of the DMMO, which was popularized in Europe by Dr De Prado et al.[24,25]

We present a surgical technique consisting in a distal osteotomy of the fifth metatarsal, which resembles DMMO but requires a medial displacement, for the treatment of Tailor's bunions. This procedure offers some advantages over other published minimally invasive techniques. In 2014, Lui[26] published a percutaneous technique wherein patients were not allowed to bear weight during the first 4 postoperative weeks. Our technique by allowing immediate weight-bearing, stimulates bone consolidation, and decreases postoperative soft tissue edema, as it promotes venous drainage by early mobilization. The absence of osteosynthesis provides a definite advantage over other minimally invasive techniques, most of which are associated with superficial infection (pins) or symptomatic skin irritation caused by a prominent fixation device.[16,27,28] In addition, the intramedullary K-wire position makes it difficult to remove the bone excess of the lateral metaphyseal region.

Michels et al[29] described a technique with proximal oblique osteotomy associated with a condilectomy. If the osteotomy is performed more proximally, it may be unstable in

FIGURE 3. Sliding distal metatarsal minimally invasive osteotomy with an angulation of 45 degrees.

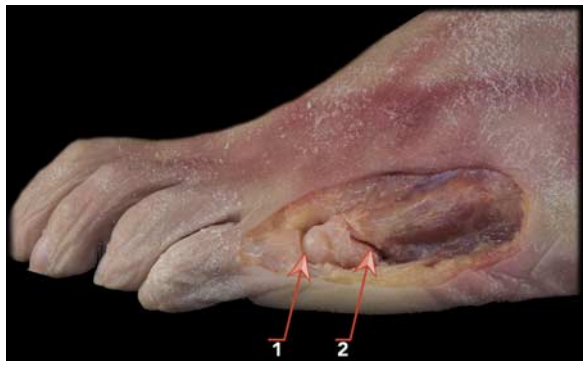

FIGURE 4. Cadaveric model: (1) 5th MTP joint; (2) orientation of sliding distal metatarsal minimally invasive osteotomy.

terms of cephalic control. In our described technique, it was not necessary to resect any portion of the metatarsal head.

PREOPERATIVE PLANNING

Dorsoplantar and lateral weight-bearing radiographs are obtained. Moreover, non—weight-bearing medial oblique x-ray was performed. The radiographic assessment includes evaluation of the fifth metatarsophalangeal angle (MPA) and the 4 to 5 intermetatarsal angles. The 4 to 5 intermetatarsal angles are measured between lines drawn through the center of the proximal and distal ends of the fourth and fifth metatarsals. We categorized the cases of bunionette deformity according to the Fallat's classification.[30] Although this classification did not directly influence the indication of S-DMMO, it provided information in relation to the power of correction and displacement.

The patients were asked to complete a visual analog scale (VAS) pain score.

Patient satisfaction was also assessed with use of the Coughlin score. Postoperative outcomes were also graded, as described by Coughlin,[8] as follows:

(1) Excellent: the patient had no problems, was very satisfied, had mild or no pain, and was able to walk without difficulty.
(2) Good: the patient had a few problems, was satisfied, had mild pain, was able to walk with or without difficulty, and would still have undergone the operation under similar circumstances.
(3) Fair: the patient had moderate pain, had limited walking ability, and was in doubt about the success of the operation.
(4) Poor: the patient had continuous pain, with little improvement in walking ability, and regretted having undergone the operation.

SURGICAL TECHNIQUE

The patient is placed in the supine position. The foot hangs over the edge of the operating table, with the contralateral limb bent. The procedure is performed under fluoroscopic guidance with a C-arm. No tourniquet is required. All operations are performed under regional anesthesia. A 3 mm stab percutaneous portal is made 5 mm proximally of the fifth metatarsophalangeal joint, medial or lateral to the extensor tendon, using a Beaver Miniblade 64 (Fig. 1). The soft tissues are dissected from the bone with a mini bone elevator. This creates a secure working area and minimizes the risk of injury (Fig. 2).

Fifth metatarsal osteotomy is performed at 45 degrees using an Isham straight flute burr (Vilex Inc., McMinnville, TN) (Figs. 3, 4). The distal fragment of the fifth metatarsal is displaced medially, with a manual "sliding" maneuver, correcting the deformity, and this is maintained with a gauze (Fig. 5). Thus, no internal or external fixation is needed. A potential advantage of the oblique osteotomy is the ability to easily elevate the metatarsal head, as it is translated medially, by angling the osteotomy slightly with a plantar-lateral to

FIGURE 5. A,B, Manual and medial displacement of the head of the fifth metatarsal. C, Stabilization with a gauze.

FIGURE 6. A–C, X-ray. Result case # 21.

dorsal-medial direction. This is desirable when a plantar callosity is present in addition to lateral pain.

If a lateral prominence of the fifth metatarsal head persists after sliding of the osteotomy, the prominence is reduced using the Isham wedge burr 3.1 (Vilex Inc.). Incisions are closed using 4-0 Ethilon suture (Ethicon Endo-Surgery, Blue Ash, OH).

In cases with an added adduction deformity of the fifth toe, the following percutaneous procedures could be associated: medial capsulotomy, extensor tenotomy, flexor tenotomy, and phalangeal osteotomy.

Bandage is a very important tool in MIS, as no internal fixation is used. Dressings stabilize the osteotomy during the first 6 weeks after surgery.

Radiographic control (6-week follow-up of patient #21) is shown in Figure 6.

POSTOPERATIVE MANAGEMENT

The surgeries are performed on an outpatient basis. In the first 3 days, elevation and rest were recommended to minimize swelling, pain, and inflammation, although full weight-bearing was allowed in a postoperative shoe (until the fourth week) immediately. All patients were followed-up at 1 week for wound check, at 6 weeks, 12 weeks, and 6 months with radiographs, and at 12 months for clinical assessment.

RESULTS/COMPLICATIONS

We retrospectively evaluated 38 feet from 32 patients, with symptomatic bunionette deformity, who were treated at our hospital, consecutively, between 2012 and 2016. The mean follow-up was 49.76 months (range, 7 to 113 mo). The average age was 48 (range, 26 to 76) years.

The associated surgical procedures were the following: modified Bosch,[31,32] Akin,[33,34] percutaneous intra-articular Chevron osteotomy (PICO),[35] and DMMO[23] among others (Table 1).

The average preoperative 4 to 5 intermetatarsis angle was 10.88 (range, 5 to 16) degrees, whereas the average postoperative 4 to 5 intermetatarsis angle showed a reduction to 3.77 (range, 1 to 9) degrees. The average preoperative MPA was 21 (range, 10 to 34) degrees, whereas the average postoperative fifth MPA decreased to 6 (range, −7 to 15) degrees.

TABLE 1. Demographics and Results of S-DMMO

Number	Associated Procedures	4-5 An.Pr.	4-5 An.Po.	MTFA.Pr.	MTFA.Po.	VASPr.	VASPo.	Coughlin	MD (mm)
1	Bosch+Akin	15	7	21	9	10	2	Excellent	3
2	Bosch+Akin	5	4	12	1	9	2	Excellent	4
3	Bosch+Akin	11	8	18	4	8	1	Excellent	5
4	PICO+Akin	6	4	9	4	9	1	Excellent	5
5	Bosch+Akin	11	6	12	3	10	3	Good	6
6		11	8	12	4	9	0	Excellent	4
7		12	8	12	4	7	3	Good	3
8	Bosch+Akin	11	8	20	11	10	2	Excellent	4
9	PICO+DMMO 2-4	10	8	8	2	8	1	Excellent	4
10	Bosch+Akin	12	4	9	5	8	0	Excellent	5
11	Bosch+Akin	10	6	14	9	9	1	Excellent	5
12		11	8	16	8	9	1	Excellent	3
13		10.5	8	12	4	7	0	Excellent	3
14		9	6	16	6	8	1	Excellent	4
15		7	5	14	9	9	2	Excellent	5
16	Bosch+Akin	11	7	16	5	10	1	Excellent	5
17		13	8	12	8	10	2	Good	3
18	Bosch+Akin	10	7	11	6	8	0	Excellent	4
19	Bosch+Akin	12	9	20	8	7	3	Regular	4
20		9	6	12	4	8	1	Excellent	5
21	4th Clinodactyly+5th cock up	10	7	14	11	9	1	Excellent	2
22	Bosch	12	10	21	8	10	3	Regular	3
23	Clinodactyly	16	7	16	4	8	1	Excellent	5
24	Clinodactyly	11	3	14	6	7	0	Excellent	6
25		12	8	11	6	7	1	Good	2
26		12	9	6	4	8	0	Excellent	4
27		12	8	7	4	6	0	Excellent	5
28		12	8	14	9	8	0	Excellent	3
29	Bosch+Clinodactyly	12	8	14	4	9	1	Excellent	4
30	Bosch	12	6	28	5	10	1	Excellent	5
31	Bosch	10	8	23	13	7	0	Excellent	2
32		12	8	16	8	8	0	Excellent	3
33	Bosch	11	7	20	11	7	1	Excellent	2
34		10	8	13	8	7	0	Excellent	2
35		11	9	14	5	8	1	Excellent	2
36	Bosch	11	9	5	3	9	1	Excellent	2
37	Bosch+DMMO 2,3	12	6	24	11	7	0	Excellent	2
38		9	6	23	12	7	2	Good	4
	A	10.88158	7.1052632	14.71053	6.4736842	8.2895	1.05263	—	3.73684

A, average; An., Angle; DMMO, distal metatarsal minimally invasive osteotomy; MD, metatarsal's displacement; MTFA, metatarsophalangeal angle; PICO, percutaneous intra-articular Chevron osteotomy; Po., postoperative; Pr., preoperative; S-DMMO, sliding distal metatarsal minimally invasive osteotomy; VAS, visual analog scale.

The average medial displacement of the fifth metatarsal was 3.73 mm (range, 2 to 6 mm). The patients had a type I (n = 15), type III (n = 22), and 1 type IV Fallat's deformity.

The average improvement in VAS score was 7.23. The average preoperative VAS score was 8.28 (range, 6 to 10), and average postoperative VAS score was 1.05 (range, 0 to 3).

Patient's subjective satisfaction according to the Coughlin classification was excellent in 31 feet (81.57%), good in 5 feet (13.15%), and regular in 1 foot (2.63%).

All patients were able to return to their sports activities in an average period of 8.3 weeks (range, 7 to 11 wk). There were no major complications in our series of patients (nerve, superficial or deep infections, or deep vein thrombosis). There was no malunion, nonunion, or osteonecrosis. Two patients (2 feet, 5.2%) complained of a prominent lateral lump over the osteotomy site, and both needed reoperation (percutaneous bone resection).

POSSIBLE CONCERNS, FUTURE OF THE TECHNIQUE

The S-DMMO proved to be a safe (low complication rate) and effective (adequate clinical results and powerful radiologic correction) procedure for the treatment of bunionette deformity. It also offers certain advantages over the percutaneous techniques described (immediate weight-bearing, no need for osteosynthesis or for condilectomy). It is necessary to emphasize the importance of prevention of complications by a correct surgical procedure (specific instruments are required) and a close postoperative follow-up.

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