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Tips, Quips, and Pearls

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An Approach to Transmetatarsal Amputation to Encourage Immediate Weightbearing in Diabetic Patients

Michael B. Canales, DPM, FACFAS [1], Maureen E. Heurich, DPM [2], Ashley M. Mandela, DPM [3], Mark C. Razzante, DPM, MA [4]

[1] *Chief, Division of Podiatry, Podiatric Surgical Residency, St. Vincent Charity Medical Center, Cleveland, OH*
[2] *Resident, Postgraduate Year 2, Podiatric Surgical Residency, St. Vincent Charity Medical Center, Cleveland, OH*
[3] *Resident, Postgraduate Year 1, Podiatric Surgical Residency, St. Vincent Charity Medical Center, Cleveland, OH*
[4] *Resident, Postgraduate Year 3, Podiatric Surgical Residency, St. Vincent Charity Medical Center, Cleveland, OH*

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ABSTRACT

Transmetatarsal amputation remains the standard treatment for the unsalvageable diabetic forefoot; however, this operation is often complicated by wound dehiscence, ulceration, and the need for additional surgery and tendon balancing. The technique described in the present report provides an uncomplicated suturing method for closure of a standard transmetatarsal amputation. A drill hole is created through the first, second, and fourth metatarsals, which facilitates added stability to the plantar flap of the residual metatarsals. The patients are encouraged to begin protected weightbearing as early as the first postoperative day. The security of the flap promotes immediate weightbearing, which could result in fewer postoperative complications of transmetatarsal amputations. Early weightbearing will not only encourage tendon rebalancing, but also could improve angiogenesis through capillary ingrowth.

Transmetatarsal amputation (TMA) is a common and effective procedure for limb salvage in the diabetic population. The value of this amputation level is the improved efficiency and functionality of gait. A functional limb is imperative for limb preservation and overall mortality of diabetic patients (1).

The mortality rate of patients with diabetes increases significantly with more proximal levels of amputation (2). Brown et al (3) compared the 5-year mortality rates in patients with transtibial amputations, partial and total calcanectomy, Chopart's amputation, and TMA and noted that patients undergoing TMA had the lowest 5-year mortality rate at 30%. Functionality and a sound frame of mind are the primary goals when choosing a procedure for limb preservation. In a study by Anthony et al (4), 52 TMAs were performed, and only 18% healed after the initial operation. A more proximal amputation was required in 56% of the patients, and 83% were ambulatory at a median follow-up point of 18 months (4).

Wound dehiscence with subsequent infection can lead to a more proximal amputation. Dunkel et al (5) found that of 289 patients undergoing TMA, 16.3% developed wound dehiscence and 21.8% developed a stump infection. Higher rates of complications associated with TMA have been observed in patients with diabetes mellitus and peripheral vascular disease (Fig. 1). A TMA in a patient with infection but no underlying peripheral vascular disease was significantly more likely to heal (6). Pollard et al (7) found that in 101 TMAs, end-stage renal disease was a predictor of poor wound healing potential. In their study, 57.4% of the TMAs healed completely; however, 87.1% developed postoperative complications. O'Brien et al (8) evaluated 1205 TMAs and found that early amputation failure occurred in 26.4% of cases. Of these TMAs, reoperation to a more proximal amputation was performed within 30 days (8). Nguyen et al (9) studied 33 patients with TMAs. Of these patients, 36% required a more proximal amputation, and the average time to the more proximal amputation was 3.5 months (9).

The published data support adequate peripheral perfusion and glycemic control in preventing postoperative complications in patients with diabetes. Younger et al (10) concluded that the primary factor determining healing potential was glucose control, suggesting that patients with diabetes should never undergo elective surgery

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Address correspondence to: Maureen E. Heurich, DPM, Podiatric Surgical Residency, St. Vincent Charity Medical Center, 2351 East 22nd Street, Cleveland, OH 44115.
E-mail address: meadpm@gmail.com (M.E. Heurich).

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Fig. 1. Transmetatarsal amputation complications often require additional surgical procedures and significant delays in unassisted locomotion. The wound healing complication experienced by the patient shown delayed functional ambulation for 8 months.

with a hemoglobin A1c >8 mmol/mol, unless surgery is necessary to save the life or limb.

Overall, TMA has been found to be a stable procedure with functional outcomes. Various modifications of the technique have been described. We report a technical modification that has encouraged early weightbearing in the postoperative course.

Surgical Technique

Ancillary tendon balancing procedures can be performed at the discretion of the surgeon. The TMA is performed in a standard fashion, maintaining the appropriate metatarsal parabola for optimal plantar pressure across the distal residual foot. The second metatarsal should remain the longest, followed by the first, third, fourth, and fifth metatarsals (11). The metatarsals can be beveled plantarly, medially, and laterally in an effort to reduce bony prominences, at discretion of the surgeon (12). All tendons should be gently pulled distally with a hemostat and transected, allowing them to retract into the proximal residual foot to rid the distal incision of avascular soft tissue and a potential nidus of infection. Interosseous tissues can be kept longer than the metatarsals, as described by Terashi et al (13), or can be excised flush with the surrounding bony structures. Once the parabola has been confirmed clinically and radiographically, a 0.054-in. Kirschner wire is passed through the dorsal cortex of the first, second, and fourth metatarsals. The fasciocutaneous flap is then approximated to the metatarsals with a horizontal mattress suture of 2-0 polypropylene (Prolene®; Ethicon, Somerville, NJ; Fig. 2). A similar technique has been described by Bibbo (14) during the Syme level of ankle disarticulation to further stabilize the heel pad to the plantar tibia. The senior author (M.B.C.) prefers using an FS-1 needle in lieu of a PS-2 or SH needle for ease of passage through the drill hole. The mattress suture begins externally through the plantar flap, passes through the metatarsal drill hole in a dorsal to plantar direction, and exits parallel to the entrance site of the suture, where it is then instrument tied (Fig. 2). The subcutaneous layer can be closed with simple interrupted sutures of 4-0 absorbable polyglactin 910 (Vicryl®;

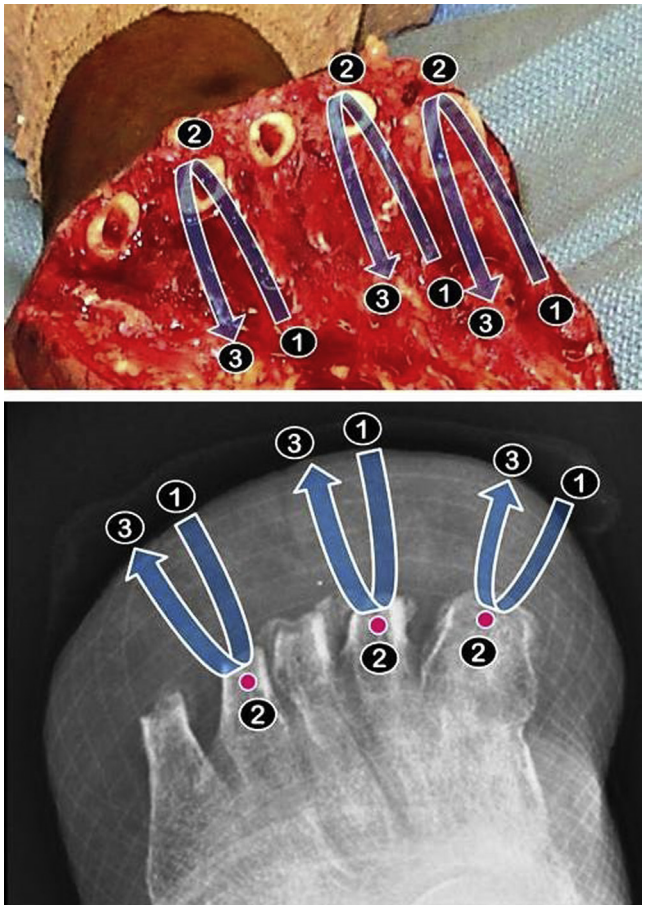

Fig. 2. Two depictions of the course of the suture used to secure the raised fasciocutaneous flap. The horizontal mattress suture begins externally *(1)*, passes through the drill hole in the metatarsal's dorsal cortex *(2)*, and exits parallel to the entrance point of the suture *(3)*.