

## PLANTAR INCISION FOR EXCISION OF INTERMETATARSAL NEUROMA

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Intermetatarsal space pain and neuroma symptoms are a common clinical entity in the private podiatric physician's practice. These patients usually present with numbness of the contiguous digits, commonly the 3rd and 4th, however all other digits including the hallux can be affected by this entity. Pain is usually slowly progressive and can be a serious deterrent to daily activities and shoe wear. Patients will often have neuritic pains that are only relieved by limiting activities, removing shoes, and rubbing the involved areas. Activities that exacerbate this condition include walking, jogging, squatting, working on ladders, and wearing high-heeled shoes.

Conservative local therapy usually consists of decreasing activities, wearing wider shoes with low heels, analgesics, nonsteroidal antiinflammatory drugs, and injection therapy using a local anesthetic mixed with a soluble corticosteroid (typically dexamethasone). When the condition is resistant to conservative therapy, surgical excision is the treatment of choice.

Historically most clinicians have used a dorsal approach to excise the neuroma (Figure 1A). The plantar approach was first described by Hoadley in 1893 (Figure 1B). This approach is selected because of less certain generally accepted beliefs: there is a fear that plantar incisions do not heal well and there is a possibility of the formation of painful scars, there can be an unfamiliarity with plantar anatomy, and a dislike for the patient to be non-weightbearing for 3-4 weeks with crutches.

The dorsal approach has the following potential problems, damage to extensor tendons, potential for stress fracture or periostitis as a result of aggressive intermetatarsal spreaders, cutting deep transverse intermetatarsal ligament reducing the lever affect this ligament provides for the lumbricals for distal stabilization, damage to vascular structures resulting in hematoma formation creating either blue or white toes, skin and/or soft tissue dehiscence or postoperative infection, and hammer-toe or transverse plane deformities at the MPJ.

The dorsal incision approach may extend onto the dorsal aspect of the digit. If the scar contracts

excessively during healing, extension/contraction may occur at the MPJ. During dissection of the intermetatarsal area, dorsal/plantar interosseosei may be damaged altering their muscle function and creating a muscle tendon imbalance that may allow adduction of the more medial digit and abduction of the more lateral digit. When intermetatarsal spreaders are placed between metatarsals, extreme pressure may be placed on the contiguous metatarsals possibly irritating or fracturing one or both. The surgeon is faced with treating a metatarsal fracture. This is especially important in a metatarsus adductus foot where the metatarsals are very tight. In order to access the neuroma for adequate excision, the intermetatarsal ligament must be incised. During the healing phase, this ligament may not heal appropriately, allowing for increase sagittal and possibly tri-plane motion of either one or both of the metatarsals resulting in pathologic metatarsal and/or digital malalignments. While dissecting for the nerve, additional trauma may occur to the arteries and veins since they are so intimately associated with the nerve. Trauma to the vein may cause retrograde venous engorgement and blue toes. Damage to the arteries may cause compromised circulation to the digit. Continued vascularity relies on three-vessel perfusion of the involved digit that can cause the digit to turn white for a short period of time. However in those patients who have more compromised vascular systems, particularly if intermetatarsal contiguous neuromas are performed, damage to two or more arteries may cause gangrenous changes of the digit. Another problem with the dorsal approach to the neuroma is that cutting the nerve may not be proximal enough. The most proximal aspect of the remaining neural branch may result in axonal regeneration which can form pseudopods that may grow and adhere to soft tissues and/or the deep intermetatarsal ligament, creating significant postoperative neuritic symptoms.

An alternative approach is to use the plantar incision to access intermetatarsal neuromas. The

disadvantage of this procedure is that the subcutaneous layer is more vascular and thicker on the plantar aspect of the forefoot than the surgeon would usually face in the dorsal approach. It is generally recommended that an ankle tourniquet be used. When the incision is appropriately placed, the fear of poor scar healing and callus formation will be diminished.

## PROCEDURE

The plantar aspect of the proposed surgical site is visualized. Let us assume that a neuroma is going to be removed from the third intermetatarsal space. Each contiguous metatarsal head is palpated at the surgical site. The most inferior lateral aspect of the 3rd metatarsal and the most medial aspect of the 4th metatarsal are marked. The incision is marked just posterior to the web space extending proximally between the metatarsals, ending 2.5cm proximal to the intermetatarsal ligament (Figure 2). A posterior tibial nerve block and/or local infiltration are used for anesthesia. The foot is exsanguinated and an ankle tourniquet is used.

After the skin incision, the incision is deepened through the subcutaneous tissues and panniculus addiposus. The subcutaneous layer will be thinner towards the midfoot and thicker underneath and distal to the metatarsals. Dissection is enhanced by first seeing the white structures at the most proximal aspect of the incision which is the plantar fascia (Figure 3). This will allow the surgeon to follow the layer distally and cleanly dissect via sharp and blunt dissection this full layer from the deep fascia. A large Weitlaner retractor is very advantageous in retracting this thick subcutaneous layer (Figure 4). Once these layers are retracted, it is not unusual for the nerve to be either laterally or medially displaced at the proximal aspect of the incision. Once the nerve is identified, it is followed via blunt dissection while mobilizing it from the contiguous arteries and veins, ending distally at its bifurcation (Figure 5). The nerve is cut proximally, allowing the proximal aspect of the nerve to fall deep within the vault of the midfoot. The nerve is then followed distally to the bifurcation then to the contiguous digits and each nerve is sacrificed via sharp dissection (Figure 6). With careful dissection, trauma to the lumbricales is avoided and the deep transverse intermetatarsal ligament can easily be identified within the incision (Figure 7). The ligament is not cut. The tourniquet is

released and any active bleeders are cauterized.

The wound is lavaged and prepared for closure. No deep sutures are used in the closure. As described by Boberg in 1997, one or two horizontal mattress sutures using a non-absorbable suture are placed well outside the skin margins (Figure 8). These will allow mild eversion of the skin without introducing absorbable sutures within the wound because there is a possibility that subcutaneous fibrosis may occur in this area. The linear incision is then closed using multiple interrupted sutures of 4.0 non-absorbable suture (Figure 9). When nerves are freshly cut, ectopic neural discharges of the abnormally excitable nerve fibers occurs. This may result in early axonal regeneration and pseudopod formation. Therefore 1cc of dexamethasone is injected to bathe the nerve endings thus limiting this activity. A dry sterile dressing is applied and the patient is placed in a wedge postoperative surgical shoe, minimizing weightbearing on the forefoot (Figure 10). The skin sutures are removed in two weeks and regular postoperative care is encouraged.

In summary, the plantar approach to excision of neuroma has proven to be 95% successful in my patient population. Patients have had no negative sequelae with respect to scarring. After the wound heals, it is virtually unidentifiable 6 months later. No activity limitations have been identified. I prefer the plantar incision because the dorsal approach can cause morbidity such as hammertoe deformity, metatarsophalangeal joint contracture, transverse plane MPJ deformities, hematoma, and vascular insults to digits. After using the plantar approach, I have not noticed any of these complications. The surgeon is encouraged to use this incisional approach without fear of adverse morbidity.

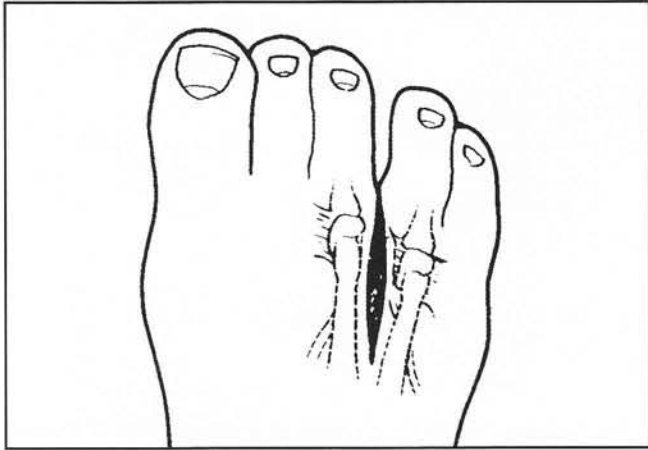


Figure 1A. Dorsal incision .

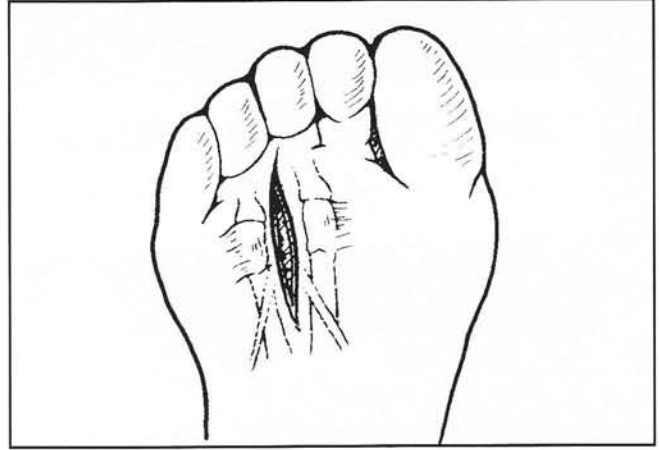


Figure 1B. Longitudinal plantar incision.



Figure 2. Metatarsal 3 and 4 and planned line of incision are marked. Note that the incision starts just proximal to the third web space, runs proximally between metatarsal three and four, and ends proximally to the transverse intermetatarsal ligament.

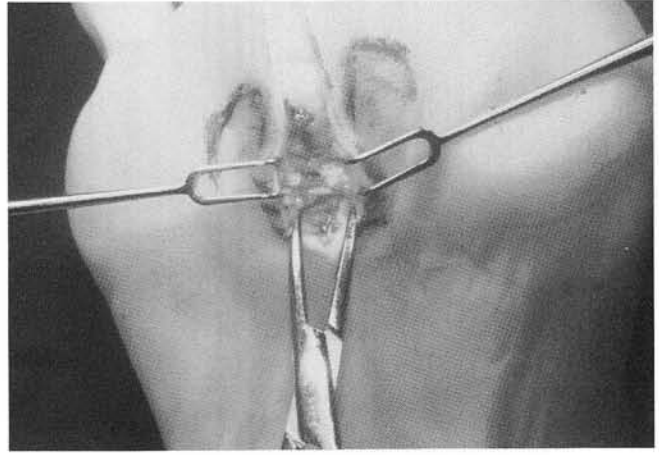


Figure 3. The incision is deepened at the proximal aspect to the point where the plantar fascia is identified.



Figure 4. Retraction of the subcutaneous tissue with large, sharp-toothed Weitlaner retractor.

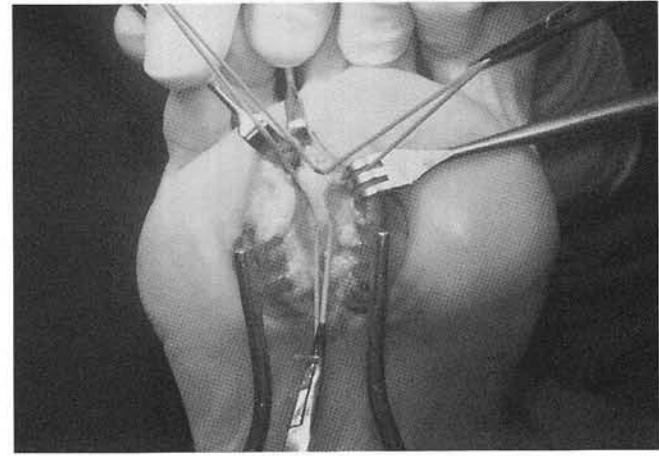


Figure 5. Third intermetatarsal neuroma is isolated as well as the distal, medial, and lateral digital branches.



Figure 6. Cleanly excised intermetatarsal neuroma specimen.

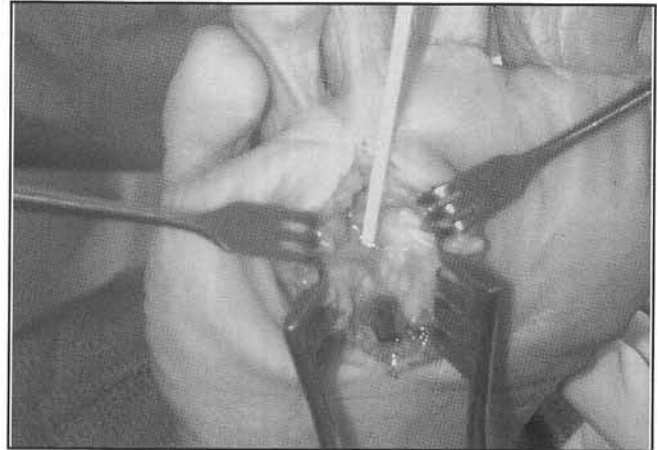


Figure 7. Cotton tipped applicator placed superior to the intermetatarsal ligament.

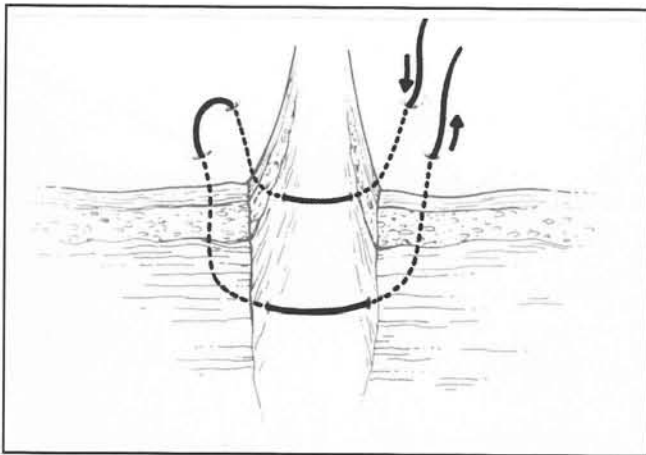


Figure 8A. Horizontal retention suture of 3-0 nonabsorbable material placed outside of the wound.

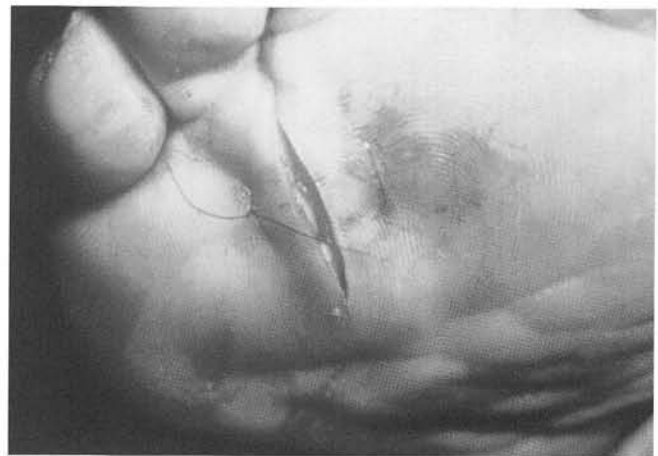


Figure 8B. No deep sutures are used.

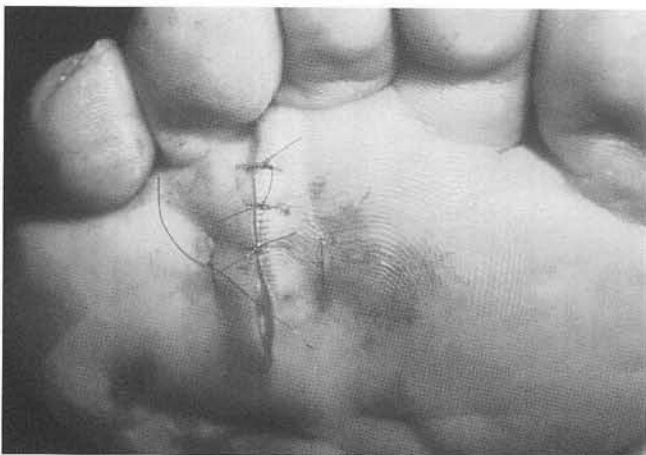


Figure 9. Incision is closed with 4.0 multiple interrupted nonabsorbable sutures.



Figure 10. Postoperative wedge shoe worn for approximately two weeks.



Figure 11A. Four week postoperative view following 3rd intermetatarsal neuroma resection.



Figure 11B. At eighteen months postoperative, the scar is negligible.