Tarsometatarsal Joint Arthrodesis: Is the Underutilized Trephine Technique Superior to Traditional Joint Preparation?

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Statement of Purpose

Arthrodesis has long been the treatment of choice for arthritis of the tarsometatarsal joint complex. This procedure is usually accomplished by using traditional joint preparation such as planal resection or curettage. However, this procedure is often complicated by widening of the joint space after cartilage resection and often have to undergo intra-operative bone grafting to maintain length or shortening of the surgical ray to achieve bony apposition. This study evaluates the fusion rates of 32 combined second and third tarsometatarsal joints using the trephine technique. Our goal is to determine if this trephine technique using a press-fit autograft for central tarsometatarsal joint arthrodesis provided superior rates of arthrodesis when compared to the published literature involving standard joint preparation.

Methodology and Hypothesis

A retrospective review was performed searching the electronic medical record system of the senior author (A.B.). An extensive chart review was conducted on patients receiving the CPT code 28730 and 29740 from January 1, 2014 to January 1, 2017. Of the patients receiving this surgical code, the inclusion criteria were patients without the need for midfoot deformity correction with the primary diagnosis of primary osteoarthritis of the foot (ICD code M19.079) or post-traumatic osteoarthritis of the foot (ICD code M19.171 or M19.172). This search led to 32 joints being evaluated post operatively for rate of fusion. Standard post-operative radiographs were reviewed by the junior author (D.C.C.) to determine union of each joint. Radiographic union was defined as follows: the presence of 2 cortical continuations or bridging at the arthrodesis site, absence of hardware failure, and the absence of lytic gapping at the arthrodesis site. It is our hypothesis that the trephine technique using autograft for obtaining central tarsometatarsal joint arthrodesis would produce comparable and even superior rates of union when compared to the published literature describing traditional joint preparation techniques. We believe that this joint preparation technique provides the foot and ankle surgeon with a reproducible method to achieve excellent bony apposition when performing arthrodesis of the midfoot that does not require correction of deformity.

Procedures

The tarsometatarsal joint requiring arthrodesis was exposed using a standard dorsal incision. Osteophytes overlying the tarsometatarsal joint were then resected until flush with surrounding bone and the joint was readily visualized and accessible. The joint was then measured using ACL reamers to determine the best size that would allow complete removal of articular cartilage and subchondral bone. This selected reamer was used to penetrate the joint from dorsal to plantar completely with care taken not to overzealously violate the plantar soft tissues. This core of bone was then removed from the surgical site and discarded. The joint was then inspected to ensure adequate cartilage resection.

After preparation of the joint, the autograft was harvested from the distal tibia. The distal tibia was accessed through and incision just medial to the tibialis anterior tendon. The incision was carried down to the tendon sheath where a deep fascia/periosteal incision was made just medial to the tendon with care taken to not violate this sheath. A periosteal elevator was used to reflect the tissues to expose the underlying distal tibia. Next, a guide wire from the ACL reamer tray was placed into the distal tibia and proper position confirmed using c-arm fluoroscopy. After confirming proper position, an ACL reamer 2 mm larger than the previous one used for joint resection was used to harvest autograft from anterior to posterior. This autograft was then removed and the harvest site immediately filled with either cancellous bone chips or calcium sulfate.

The previously harvested bone graft was then placed into the prepared central tarsometatarsal joint and tamped into place. Permanent fixation was then achieved by placing a compression staple over the autograft using the manufacturers recommended instruction technique. Stability of the graft was inspected with manual manipulation of the joint and with C-arm fluoroscopy.

The surgical sites were then irrigated with copious amounts of saline. The fusion site and autograft harvest site was then closed in layers. A cast then used to immobilize the patients postoperatively for 4 weeks followed by 2 additional weeks of protected weightbearing.

All operations were performed by or under the direct supervision of one primary foot and ankle surgeon (A.B.) and patients placed in a strict post-operative protocol designed by the primary surgeon.

Fig 1A

Fig 1B

Fig 1 A-B: Typical pre-operative AP and lateral radiographs showing advanced tarsometatarsal joint arthritis

Fig 2A

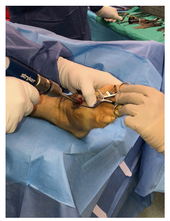

Fig 2B

Fig 2C

Fig 2D

Fig 2E

Fig 2 A-E: Series of steps needed to complete TMTJ arthrodesis with distal tibia autograft

Fig 3A

Fig 3B

Fig 3 A-B: Immediate post-operative AP and lateral radiographs showing proper placement of autograft and TMTJ hardware

Results

Review of post-operative radiographs revealed radiographic union of 30 of the 32 tarsometatarsal joints undergoing arthrodesis using a trephine technique (94%). Average time to union was 6.4 weeks. Our results were similar to the published literature for midfoot arthrodesis using standard joint preparation methods.

Conclusions

Our study suggests that the trephine tarsometatarsal joint arthrodesis using autograft from the ipsilateral distal tibia provides slightly higher union rates and a faster time to fusion than traditional joint preparation techniques. This surgical technique has proved to be time efficient in the operating room as it eliminates the need for time consuming articular debridement. Furthermore it ensures that complete joint removal with subchondral bone penetration is achieved. While, it is still recommended to use traditional joint preparation in joints requiring deformity correction, this method has been proven to be effective in treated osteoarthritis in a foot types not requiring deformity correction

References

1. Cassebaum WH. Lisfranc fracture- dislocations. Clin Orthop Relat Res. 1963; 30:116-129.
2. Hardcastle PH, Reschauer R, Kutscha-Lissberg E, Schoffmann W. Injuries to the tarsometatarsal joint. Incidence, classification and treatment. Bone Joint J. 1982; 64(3):349-356.
3. Goossens M, De Stoop N. Lisfranc's fracture-dislocations: etiology, radiology, and results of treatment. Clin Orthop Relat Res. 1983; 176:154-162.
4. Rao S, Nawoczenski DA, Baumhauer JF. Midfoot arthritis: nonoperative options and decision making for fusion: nonoperative options and decision making for fusions. Tech Foot Ankle Surg. 2008; 7(3):188-195.
5. Watson TS, Shurnas PS, Denker J. Treatment of Lisfranc joint injury: current concepts. J Am Acad Orthoped Surg. 2010; 18(12):718-728.
6. Jung HG, Myerson MS, Schon LC. Spectrum of operative treatments and clinical outcomes for atraumatic osteoarthritis of the tarsometatarsal joints. Foot Ankle Int. 2007; 28(4):482-489.
7. Mann RA, Prieskorn D, Sobel M. Mid-tarsal and tarsometatarsal arthrodesis for primary degenerative osteoarthrosis or osteoarthrosis after trauma. J Bone Joint Surg Am. 1996; 78(9):1376-85.
8. Nemec SA, Habbu RA, Anderson JG, Bohay DR. Outcomes following midfoot arthrodesis for primary arthritis. Foot Ankle Int. 2011; 32(4):355-361.