

In Situ Trepphine Joint Resection and Dowel Joint Arthrodesis of the Foot: Case Series

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Introduction

Primary or secondary osteoarthritis of various joints in the foot can be debilitating and conservative treatments using non-steroidal anti-inflammatories or intra-articular injections with corticosteroids are not always effective (4).

Other potential painful factors may include metabolic, developmental, or hereditary considerations. If not adequately treated, osteoarthritis can lead to chronic inflammatory and post-traumatic arthritides.

When conservative treatments have been exhausted, planar joint resection and traditional open reduction internal fixation are common surgical treatments. In our case series, we have found that open reduction internal fixation is most effective when trephine dowel arthrodesis is paired with cancellous plugs.

Methods and Materials

A case series is presented of ten patients who underwent various arthrodesis procedures in the foot using trephine joint resection and dowel grafts in conjunction with internal fixation.

The procedure starts by obtaining bone marrow aspirate harvest from the proximal tibia (an average of 20mL). Drill holes are then fenestrated into the dowel grafts and then soaked in the bone marrow aspirate until ready to be tamped into the bone void. A linear incision is created overlying the affected joint(s). Upon careful dissection to the level of the joint, a guidewire is placed within the joint. An 8-12mm trephine is then introduced to remove a cylinder of bone directly over the joint. A 10-12mm bone dowel that has been soaking in the bone marrow aspirate is now ready to be tamped into the bone void. The bone dowel is cut to size and placed within the cylinder of the bone void. The dowel is then tamped and secured using internal fixation based on surgeon preference. Screw holes located over the dowel are not filled as to avoid fixation through the allograft (dowel).



Figure 1. Harvest bone marrow aspirate from the proximal tibia.



Figure 2. A trephine system is introduced directly over the joint to remove a cylinder of bone.



Figure 3. A cylinder of bone was removed from the 1st TMTJ.



Figure 4. A cylinder of bone was removed from the 2nd, 3rd, and 4th TMTJs.

Results

The cases of ten patients who underwent various dowel joint arthrodesis procedures were reviewed within a period of 12-24 months. The joints in the study include: 1st-4th TMTJ, naviculo-cuneiform joint, talonavicular joint, calcaneocuboid joint, and the subtalar joint.

In our experience, there is less bone resected intraoperatively and use of the trephine system leads to reproducible results. With traditional end-to-end arthrodesis, excess cartilage and subchondral bone can be removed and this method avoids shortening of bone segments. On average, our patients were instructed to start weight-bearing as tolerated within 4-6 weeks. Gentle weight-bearing activity provides the benefit of securing the bone graft wedges in place. Bony consolidation and cortical bridging across the arthrodesis sites are visualized approximately the same amount of time comparable to traditional open reduction internal fixation arthrodesis procedures.

Buda et al report that there is no gold standard fixation method to help minimize the risk for a nonunion of the tarsometatarsal joints. With there being a 7-10% symptomatic nonunion rate with TMTJ arthrodesis procedures, the addition of bone graft may reduce the risk for nonunion after isolated procedures. Available current biomechanical data is inconclusive. There are several risk factors that predisposes patients to an increased rate of nonunion, which include tobacco use, past medical history significant for diabetes mellitus, osteoporosis, stability of the construct, and noncompliance with weight bearing instructions (1-3). Before filling the bone void with the dowel bone graft, we have ensured to fenestrate the graft with multiple drill holes and soak into the patient's bone marrow aspirate in attempts to improve the bone healing process (1).



Figure 5. Dowel bone grafts are tamped into the bone voids.



Figure 6. Internal fixation is secured overlying the affected joints based on surgeon preference.

Discussion

Excessive subchondral bone and cartilage can be removed with traditional end-to-end arthrodesis. Thus, it is crucial to preserve the relative length and prevent plantarflexion to limit the risk of iatrogenic transfer metatarsalgia. This is made possible with the use of a trephine system for joint preparation and subsequently, dowel graft placement. This procedure has several distinct advantages when compared to other techniques which include minimally invasive incisions, less instrumentation, and decreased soft tissue and ligamentous dissection of the TMTJ region. While this procedure does not accelerate the bone healing process, we have found that there is less soft tissue dissection involved and for the most part, follows the traditional arthrodesis procedure.

The literature on this topic is currently outdated and further research is necessary. We acknowledge the limitations to this current study with a small number of patients with an early follow-up period, but we plan on utilizing this technique for future cases. Although seldom considered, trephine dowel arthrodesis is an alternate surgical approach with distinct advantages.

References

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