CASE STUDY

Tarsometatarsal Arthrodesis with Length Sparing Dowel Fusion Technique for End-Stage Arthritis

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CoLink®
Bone Graft Harvester

CoLag®
Compression Screw

CoLink® Mfx
1st TMT Plate

CoLink®
4-Hole Straight Plate

In2Bones

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INTRODUCTION

A male patient in his mid-forties had been seen several times in the office for painful osteoarthritis of the left midfoot as a result of pain caused by lifting a heavy object. Upon physical examination, he experienced significant pain on palpation and during range of motion of the left foot tarsometatarsal joints. The patient is unable to perform his job due to compromised weight bearing for long periods of time.

Figure 1. Pre-op X-rays

Radiographs and MRI were ordered and performed. Advanced imaging impressions showed osteoarthritic changes and end-stage arthritis to the tarsometatarsal joint complex as well as increased swelling of the soft tissue envelope. (**Figure 1**)

The patient had exhausted all conservative treatment options including icing, stretching, cortisone injection, immobilization (CAM walker), and anti-inflammatory medications. The patient elected to proceed with first, second, and third tarsometatarsal joint arthrodesis of the left foot with major bone graft harvesting.

PROCEDURE

With the patient in the supine position, a well-padded pneumatic thigh tourniquet was placed on the patient's left lower extremity. Attention was directed to the proximal aspect of the left tibia, where the autogenous bone for the dowel fusion site was collected through a stab incision backfilled with a synthetic bone substitute void filler and closed in a layered fashion.

At the medial aspect of the left foot, a 5cm linear incision was performed extending from the medial cuneiform distally to the proximal one-third of the first metatarsal. The incision was deepened from the skin down to the level of the subcutaneous tissue, taking care to avoid any vital neurovascular structures. Deep dissection was then performed with a tenotomy and pick-up, where the medial dorsal cutaneous nerve was identified and retracted medially. Next, a periosteal incision was made medial and parallel to the extensor hallucis longus tendon, where a subperiosteal and subcapsular dissection was performed.

Once all soft tissue was removed, an osteotome was utilized to pierce the plantar ligament. All cartilage was resected from the base of the first metatarsal and the distal cortex of the medial cuneiform utilizing a sagittal saw. A 2.0mm drill bit was then used to fenestrate the fusion site to allow for subchondral bleeding, and K-wires were placed for temporary fixation of the first tarsometatarsal joint. Intraoperative fluoroscopy confirmed successful alignment and compression of the fusion site.

CoLag® Compression Screw

Two 4.0mm CoLag® Compression Screws were inserted across the arthrodesis site for interfragmentary compression. The first screw was placed from distal lateral to proximal lateral, and the second screw from proximal medial to distal medial, with compression being noted at the fusion site.

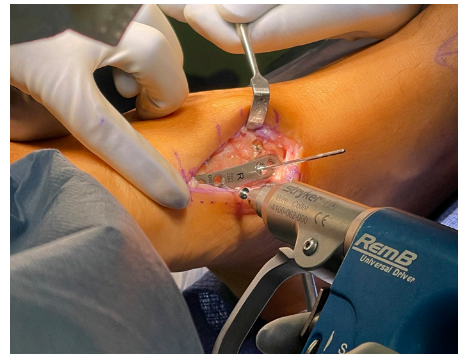

Figure 2. CoLink® Mfx 1st TMT plate

The CoLink® Mfx 1st TMT Plate (**Figure 2**) was applied at the medial aspect of the fusion site and secured to the adjacent bone utilizing 3.5mm locking and non-locking screws. Following placement of the hardware, intraoperative fluoroscopy confirmed that the fusion site achieved excellent stability and compression.

To prepare for the second and third tarsometatarsal fusions, an incision was mapped out with a skin marker with the use of intraoperative fluoroscopy. A 4cm linear incision was made directly over the second intermetatarsal space. The incision was deepened to the level of subcutaneous tissue and care was taken to avoid any vital neurovascular structures. Deep dissection was performed, and a periosteal incision was made over the second tarsometatarsal joint. All soft tissue periosteum and subcapsular dissection were carried out with a #15 blade and freer elevator. An identical incision and soft tissue dissection were made over the second and third tarsometatarsal joints.

With a direct view, the joints were noted to be highly irregular with fibrillation and denuding of the adjacent cartilage of the metatarsal base and the cuneiforms. To remove all cartilage from the fusion site, a CoLink® Bone Graft Harvester was used as a trephine to take dowel plugs directly and centrally from the second

Figure 3. Bone Graft Harvester was used as a trephine to take dowel plugs from the 2nd and 3rd TMT Joints.

Figure 4. Autograft tamped flush with bone

Figure 5. CoLink® 4-Hole Straight Plate placed over the tarsometatarsal joint

and third tarsometatarsal joint (**Figure 3**).

The autograft bone previously taken from the proximal tibia was placed over the fusion site and tamped flush with the bone (**Figure 4**).

A CoLink® 4-Hole Straight Plate was then placed over the second tarsometatarsal joint and secured with 3.5 locking and non-locking screw per the standard technique (**Figure 5**). The same procedure was performed over the third tarsometatarsal joint with a second CoLink® 4-Hole Straight Plate applied with 3.5mm locking and non-locking screws.

Final X-rays were taken, and closure was performed in a standard layered fashion (**Figure 6**). The left lower extremity was placed in a well-padded posterior splint.

POST-OP COURSE

The patient remained non-weight bearing for 6-8 weeks in a cast then a splint. He proceeded to weight-bearing in a CAM walker for 4-6 weeks. He then progressed to weight-bearing in a surgical shoe for 2 weeks and weight-bearing in supportive shoes with custom orthotics for 2-4 weeks.

DISCUSSION

The dowel fusion technique as described by C.J. Withey *et al* has been shown to result in osseous fusion, and it is technically relatively simple to perform.[1] Dowel fusion allows for less trauma to the midfoot while keeping the proper anatomic alignment of the metatarsal and offers more control during surgery while performing arthrodesis.

Figure 6. Post-op X-rays

The CoLink® Bone Graft Harvester (provided prepackaged and pre-sterilized) is used as a trephine to remove the cylindrical plug from the center of the tarsometatarsal joint. The plug includes the subchondral plate to reduce the risk of non-union. The author prefers autogenous bone grafts compared to bone substitutes to allow for biological osteoconductive, osteoinductive, and osteogenic properties.

The CoLag® Screws allowed for ideal compression and stability of the first TMT. The screws feature dual-lead primary threads to aid fast insertion, and differential pitch secondary threads. The primary and secondary threads work together to deliver significantly greater compression than both headless compression and headed lag screws. The low-profile head is also less prominent than the traditional-headed screw, which can result in less irritation or need for hardware removal.

The low-profile design with tapered contours of the CoLink® plates minimized soft tissue prominence in this case. The plates are derived from type II anodized titanium alloy which has been shown to increase fatigue strength during the healing process.

All In2Bones products are delivered in individual, sterile packaging, reducing sterilization requirements and equipment needed for each case and thereby providing cost-savings and efficiencies for the hospital, surgical staff, and surgeon.

1. Whithey C, Murphy A, Horner R. Tarsometatarsal Joint Arthrodesis with Trephine Joint Resection and Dowel Calcaneal Bone Graft. *J Foot & Ankle Surgery* 53: 243-247, 2014.

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