

# Complications Following Allograft and Xenograft Resurfacing of the First Metatarsal Head: A Case Series



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## KEYWORDS

- Joint resurfacing • Allograft • Xenograft • Hallux limitus • Hallux rigidus
- Metatarsal phalangeal joint • Decellularized collagen • Foreign body reaction

## KEY POINTS

- In some cases, resurfacing of the metatarsal head with a decellularized collagen material may result in severe erosion and destruction of the underlying bone.
- Foreign body reactions to decellularized collagen may occur.
- Bone destruction following joint resurfacing can be treated with joint replacement if sufficient healthy bone remains.

## INTRODUCTION

Hallux limitus/rigidus is the second most common pathologic condition of the first metatarsophalangeal joint. However, surgical treatment options remain somewhat limited.<sup>1</sup> Surgical techniques include both joint salvage and joint destructive procedures. The latter represents joint arthrodesis, total joint replacement, or semijoint resurfacing, whereas the former includes a cheilectomy, decompression osteotomy, or the interpositional arthroplasty.<sup>1</sup>

Original interposition arthroplasties involved placement of an autograft within the joint interface, often leading to donor site morbidity and a less-than-optimal clinical outcome.<sup>1</sup> As a result, recent developments have geared toward placement of a decellularized xenograft or allograft within the joint interface.

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Disclosure: The authors have nothing to disclose.

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Clin Podiatr Med Surg 35 (2018) 271–280

<https://doi.org/10.1016/j.cpm.2018.02.001>

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There are numerous collagen bio-scaffold products available with variable surgical applications. When evaluating the application of an interpositional joint collagen graft, some products may serve better than others. The graft must provide strength to withstand the shearing and compressive forces within a weight-bearing joint, without being too bulky to limit joint motion. As the thickness of a graft increases, so does the load capacity; however, the graft loses malleability. There are both cross-linked and non-cross-linked graft products available. The strength of a graft increases proportionally to the amount of cross-linking present. On the other hand, artificial cross-linking decreases the susceptibility of the collagen to undergo enzymatic degradation, thereby limiting incorporation into host tissues.<sup>2,3</sup>

Human or bovine dermal matrix grafts provide an ideal compromise of the aforementioned criteria in comparison with other commercially available products. Porcine small intestine submucosa is thin, weak, highly cross-linked, and, therefore, unable to withstand forces through a weight-bearing joint.<sup>4</sup> Equine pericardium is typically cross-linked, restraining incorporation into host tissue.<sup>4</sup> Bovine and porcine bio-scaffolds are similar to human dermal matrix in strength as well as non-cross-linked availability; however, human tissue may decrease the risk of graft-host rejection.<sup>4</sup> Donated human and bovine dermal matrix can withstand forces within a joint interface and is available non-cross-linked to allow improved incorporation.

In making the decision to resurface a joint, the advantages and disadvantages must be carefully weighed. First and foremost is the condition of the joint before surgery and the reasons why the surgery is necessary. Joint resurfacing is designed to recreate the gliding cartilaginous surface. In cases whereby the preoperative range of motion is poor or is zero, the reason for this must be ascertained and addressed. In some cases, large osteophytes may limit the range of motion; these can be removed, making the process of joint restoration much more simple. However, in other cases, hallux limitus or rigidus is the result of elongated metatarsal, subchondral defects, such as cysts, metatarsal elevation, sesamoid pathology, or extensive damage to the phalangeal base. In these cases, joint replacement or arthrodesis may make more sense.

Another consideration is whether or not inflammatory arthritis, such as rheumatoid arthritis or gout, is present. In these cases, it is more likely that the chronic inflammation will have a destructive effect on the collagen before it can become fully incorporated into the joint surface, because collagen is a competitive inhibitor of matrix metalloproteinases.

At this time, the authors have completed 10 cases in which the first metatarsal head was resurfaced using either a decellularized collagen allograft or xenograft. The technique used to perform the joint resurfacing has been previously described.<sup>5</sup> In 3 of these cases, significant degeneration and erosion of the metatarsal head became apparent approximately 6 to 9 months postoperatively. In all 3 cases, the salvage for this was to remove the remnants of the graft as well as resect degenerative bone and cartilage. The damaged joint was then repaired in 2 of the cases, as described here, using a silicone joint. In the third case where bony erosion of the first metatarsal head occurred, a metallic hemi implant was used instead. Although this patient recovered without complications, there were some technical complications unrelated to her joint pathology that made her particular case unsuitable to be included as part of this series.

## CASE REPORT 1

An active, 48-year-old Caucasian woman with no significant past medical history presented to the clinic, under the care of the authors, with a chief complaint of pain in her

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