

Statement of Purpose

Subchondral drilling with application of a synthetic extracellular cartilage matrix for the treatment of traumatic osteochondral defects are routinely performed in other joints, however reported less common in the first metatarsal phalangeal joint (1st MTPJ). To determine if this is a viable treatment option - preventing the advancement of osteoarthritis (OA) and return patients back to pre-injury activity and pain levels.

Literature Review

Osteochondral lesions or osteochondritis dessicans, usually leads to progressive osteoarthritis. These lesions in the 1st MTPJ are either biomechanical, years of wear and tear, or trauma and can lead to hallux limitus/rigidus. In the literature lesions of the knee and ankle are well described with good treatment modalities, with results favoring microfracturing with extracellular matrix. However lesions of the 1st metatarsal are not well described. Most lesions of the 1st metatarsal are thought to originate from trauma, this will likely lead to progressive arthritis and hallux limitus in the future. Osteochondral lesions treated with subchondral drilling, curettage, microabrasion, microfracture of the talus have shown mixed results. In mid-term results these lesions have commonly progressed with further destruction of surrounding cartilage, possibly due to the in adequacy of the fibrocartilage and scar tissue commonly formed with these techniques. It is possible that this may be the same with the 1 MTPJ and will ultimately lead to hallux rigidus. Treatment for the ankle which include osteochondral grafting, frozen osteochondral allografts or extracellular matrix help prevent hallux rigidus. However very few of these studies have been published in the literature.

Methodology and Procedure

At Hennepin Health we have now been using Microfracture with application of synthetic extracellular cartilage matrix for several patients who can recall a specific traumatic event leading to acute 1st MTPJ pain. Currently 6 patients have presented with acute 1st MTPJ pain and radiographic or MRI confirmed osteochondral defect (OCD).

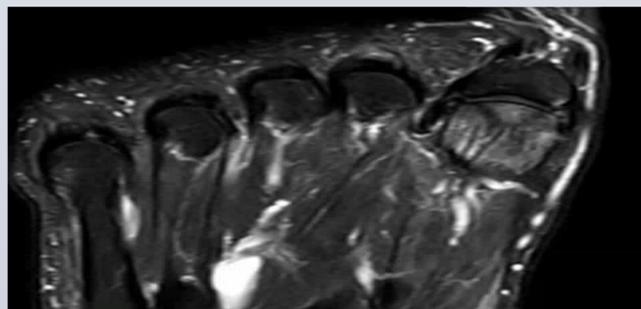


Figure 1. (Patient 1) Pre operative MRI revealing OCD of the 1st metatarsal head measuring 0.5 cm x 0.9 cm.

Methodology and Procedure Continued

Each patient underwent subchondral drilling along with the application of an extracellular cartilage matrix. Calcaneal bone mineral aspirate (BMA) was harvested and mixed with the extracellular matrix. Four of the six patients had additional decompressive osteotomies or cheilectomies performed.

Surgical Technique

Patients were placed in the Supine position. Prior to inflation of the tourniquet BMA was harvested from the calcaneus, see figure 2.



Figure 2. Harvesting BMA from calcaneus with Jamshidi Needle

Next the 1st metatarsal phalangeal joint was accessed through standard dorsal technique. The joint was then inspected and the osteochondral lesion was identified (figure 3). Next using a curette the lesion was prepared by removing the loose cartilage and curetting to obtain 90 degrees at all borders (figure 4). Next, subchondral drilling was performed using a 0.045 k-wire. The primary surgeon then determined the need for a decompressive osteotomy or cheilectomy based on biomechanical joint structure or extent of the lesion. Finally, the extracellular matrix combined with BMA was applied into the lesion. Care was taken to maintain the curvature of the metatarsal head (figure 5). Next a fibrin glue was placed over the defect. The joint was held distracted for 5 minutes to allow for the glue to dry.



Figure 3. Identification of the lesion



Figure 4. Preparation of the lesion

Surgical technique continued



Figure 5. Application of BMA with extracellular matrix into defect with application of fibrin glue

Following the procedure patients were recommended a non weightbearing period of 4 weeks.

Results

Patient 1 who was as 66 year old male who fell from a height of 4 feet and sustained an injury to his right great to 4 months prior to being seen in our clinic. Patient continued to have pain across his first metatarsal phalangeal joint throughout range of motion. It was determined to obtain an MRI given the duration of the symptoms. Patient was noted to have a 0.5 cm x 0.9 cm osteochondral defect of the 1st metatarsal head seen in figure 1. Patient had an uneventful post operative period and return to regular shoe gear at 6 weeks and pre operative activity level with minimal pain at 18 weeks. Patient then returned to clinic at 7 months post operative with minimal pain to his operative side while golfing. An MRI was obtained (figure 6) showing resolution of patients prior osteochondral lesion. Patient had no pain with any other activities.

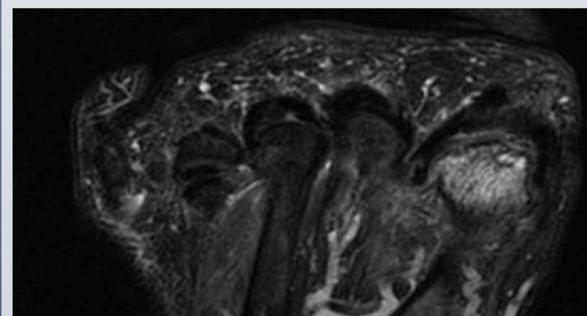


Figure 6. MRI follow up on patient 1, 7 months from original surgery

Patient 3 was a 36 year old female who had a prior bunion surgery 16 years prior who injured her great toe 1 month prior when falling. An MRI was also obtained prior to surgery (figure 7.).

Results Continued

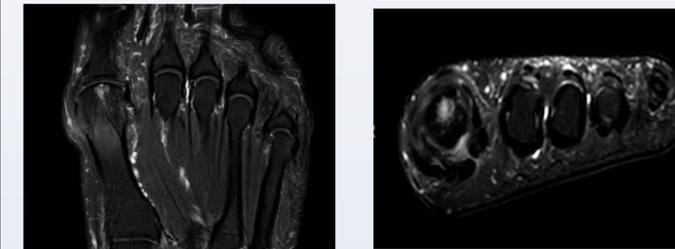


Figure 7. Pre operative MRI of patient 3 showing a 0.5 cm in diameter by 0.2 cm deep lesion in the central metatarsal head.

Patient underwent the procedure outlined along with a cheilectomy. Intraoperative images are shown in figure 8. Patient was back to normal shoe gear at 5 weeks and had returned to pre injury activity level.



Figure 8. Patient 3 intraoperative lesion in central metatarsal head after extracellular matrix application

PATIENT	Sex	Age	Time out from surgery (months)	Return to pre injury activity levels
1	M	66	32	Y
2	F	66	43	Y
3	F	36	3	Y
4	F	45	17	Y
5	F	68	9	Y
6	M	28	5	N

TABLE 1. RESULTS FOR PATIENTS RETURNING TO PRE INJURY ACTIVITY LEVEL

Table 1 shows the results of our 6 patients who underwent microfracture with application of extracellular cartilage matrix. The average age of our patients and time out from surgery was 45 years old and 18 months respectively. Of our 6 patients 5 (83%) have returned to their pre injury activity level. Patient 6 who sustained an open fracture of the base of the proximal phalanx and extensor hallucis longus tendon rupture is the only patient who has not fully returned to pre injury activity level.

Patient is currently in regular shoe gear and ambulating with minimal pain, but is unable to return to full sporting activity level.

Analysis and Discussion:

The goals of this procedure were to reduce pain, to increase function, and to prevent long-term joint arthrosis. This case series shows that microfracture with biocartilage application with BMA could be a viable treatment option for osteochondral defect of the first metatarsal head. Current data shows that 5/6 have returned to pre injury activity level with minimal to no pain. One patient who continues to have ongoing pain following surgery has returned to regular shoe gear but not to full activity. Patient is likely to need a 1st metatarsal phalangeal joint fusion, but at this time patient does not want to proceed with any further surgery. A larger population of patients with a longer follow up is needed to determine if this is a viable option to help decrease the chance of needing a 1st metatarsal phalangeal joint fusion following an osteochondral lesion of the 1st MPJ. However current results and data are promising.

References

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Financial Disclosures

None

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