

# Autograft Osteochondral Transplantation and Extracellular Cartilage Matrix for the Treatment of Osteochondral Lesions of the Talus

Alan P. Samsonov BS, Nate P. Mercer BS, MS, & John G. Kennedy M.D., MMSc, MCh, F.R.C.S. (Orth)

*NYU Langone Health, NYU Orthopedic Hospital*

*Department of Foot and Ankle Surgery*

*New York, NY, USA*



# Background

- Cartilage has limited regenerative potential<sup>1</sup>
- Osteochondral lesions of the talus (OLTs) are injuries spanning the articular cartilage and subchondral bone?
- OLT containment, size, and previous surgery determine choice of treatment<sup>6</sup>
  - For uncontained lesions and/or lesions  $> 10 \text{ mm}^2$ , AOT is indicated
  - For smaller lesions, BMS has favorable short-term clinical outcomes, but the fibrocartilage and underlying subchondral plate can deteriorate over time<sup>6</sup>
  - BMS with EMCA did not yield superior clinical function scores compared with BMS alone; however, cartilage infill on MRI was greater<sup>7</sup>

# Background

- Augmenting AOT with a biologic may be beneficial
  - Including cBMA reduces post-operative cyst formation by 20%<sup>3</sup>
  - Augmentation with cBMA allowed for restoration of talar dome radius curvature and color stratification on MRI<sup>4</sup>
- The addition of EMCA to cBMA in BMS led to almost twice as much cartilage infill compared to the BMS and cBMA group alone<sup>8</sup>

# Purpose

- We sought to determine if the addition of EMCA (BioCartilage<sup>®</sup> Extracellular Matrix (Arthrex, Naples, Florida) to AOT and cBMA for the management of OLTs leads to superior outcomes than AOT and cBMA alone

# Hypothesis

- We hypothesized that augmenting AOT and cBMA with EMCA would **enhance integration** of the host-graft interface, thereby **reducing post-operative cyst formation** after AOT
- Additionally, we hypothesized that the medley of cBMA and EMCA in AOT would lead to **improved** Magnetic Resonance Observation of Cartilage Repair Tissue (**MOCART**) **scores** and **functional outcome scores** at a minimum follow up of 2 years post-operatively

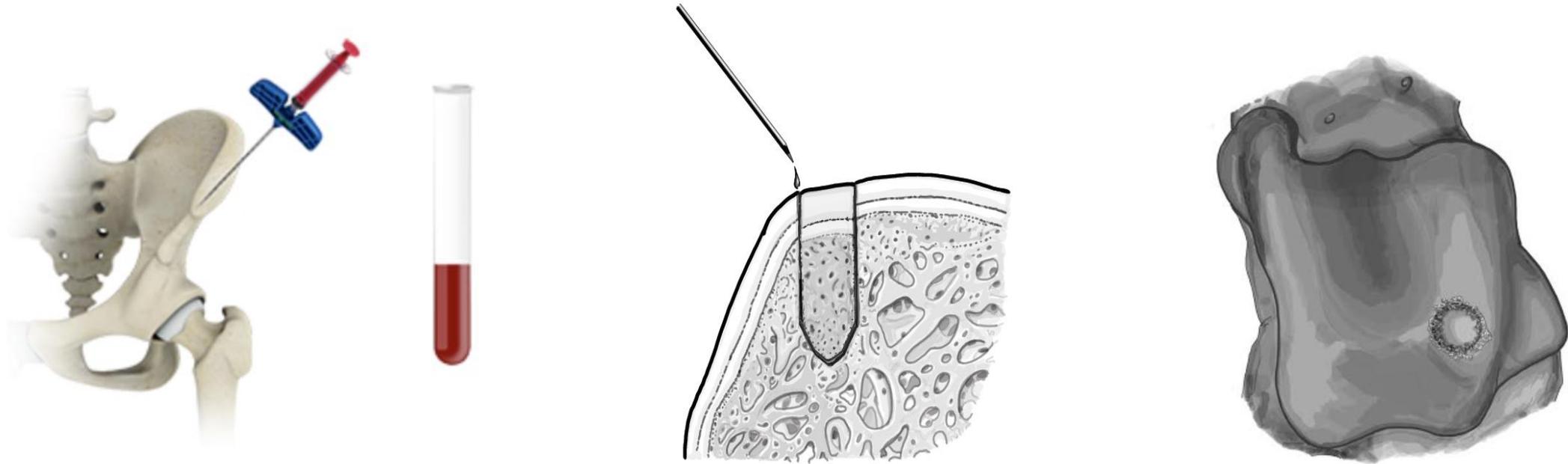
# Methods

- A retrospective comparative analysis was performed for all patients treated with AOT for the treatment of OLT between 2012 and 2018
  - **AOT/cBMA** was used from 2012-2015
  - **AOT/cBMA + EMCA** was used from 2016-2018
- Foot and Ankle Outcome Scores (**FAOS**) pain subscale and Visual Analog Score (**VAS**). Post-operative MRIs were evaluated using the **MOCART score** and compared with pre-operative MRIs
- Surgical technique: AOT/cBMA  $\pm$ EMCA

# Methods

## *Surgical Technique*

- All AOT procedures were performed arthroscopically



# Methods

## *Statistical Analysis*

- Data of both groups were compared using the Man-Whitney U test for continuous variables and the Fisher exact test for categorical variables
- The Wilcoxon signed-rank test was performed to compare preoperative and postoperative outcome scores and MOCART score
- A value of  $p < 0.05$  was considered statistically significant

# Results

## *Clinical Characteristics*

- 60 patients were included in our analysis
  - **AOT/cBMA = 34 patients**
  - **AOT/cBMA + EMCA = 26 patients**
- Mean follow-up times were
  - **AOT/cBMA = 45.1 ± 15.7 mo**
  - **AOT/cBMA + EMCA = 31.3 ± 12.5 mo**

Clinical Characteristics	AOT/CBM	AOT + CBMA/ECMA	P Value
	A alone (N = 34)	(N = 26)	
Age, mean	38.1 ± 14.7	36.7 ± 14.5	0.711
Male gender, No. (%)	17 (50.0%)	10 (38.5%)	0.373
Right ankle, No. (%)	20 (58.8%)	14 (57.7%)	0.700
Duration of symptoms, mo, mean	27.7 ± 27.8	30.9 ± 25.0	0.688
Follow-up, mo, mean	45.1 ± 15.7	31.3 ± 12.5	<0.001
Follow-up, MRI, mo, mean	33.6 ± 19.37.	24.4 ± 5.4.	0.054

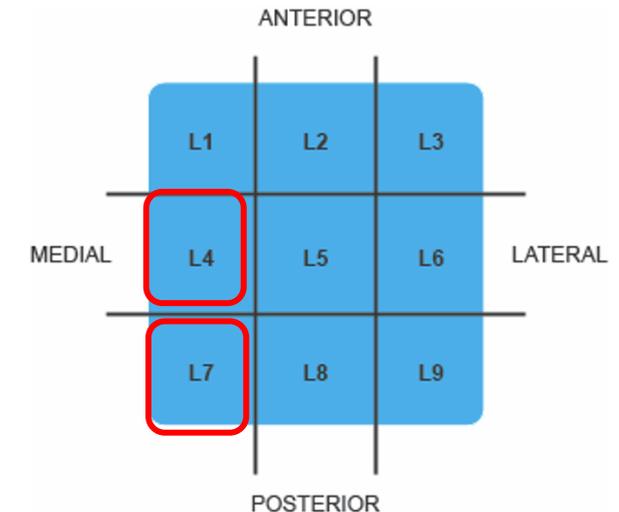
# Results

## Lesion Containment & Location

- Most of the lesions occurred primarily in the anatomic zone **L4**, followed by **L7**
- Over 92% of the lesions in the **AOT/cBMA + EMCA** group were uncontained; almost 71% in the **AOT/cBMA** group were uncontained

	Defect location on the talus		
L1, No. (%)	0 (0%)	0 (0%)	N/A
L2, No. (%)	0 (0%)	0 (0%)	N/A
L3, No. (%)	0 (0%)	0 (0%)	N/A
L4, No. (%)	20 (58.8%)	19 (73.1%)	0.251
L5, No. (%)	0 (0%)	0 (0%)	N/A
L6, No. (%)	2 (5.9%)	1 (3.8%)	0.720
L7, No. (%)	10 (29.4%)	6 (23.1%)	0.582
L8, No. (%)	0 (0%)	0 (0%)	N/A
L9, No. (%)	0 (0%)	0 (0%)	N/A
Defect size, mm <sup>2</sup> , mean	102.7 ± 52.3	136.6 ± 23.3	0.208
Uncontained lesion, No. (%)	24 (70.6%)	24 (92.3%)	0.037
Cystic, No. (%)	17 (50.0%)	15 (57.7%)	0.554
Prior microfracture, No. (%)	12 (35.3%)	9 (34.6%)	0.956
Concomitant procedure, No. (%)	11 (32.4%)	11 (42.3%)	0.428
No. of grafts, No. (%)			
Single	25 (73.5%)	19 (73.1%)	0.969
Double	9 (26.5%)	7 (26.9%)	0.969

Figure 3. Talar dome defect location



# Results

## *Clinical Outcomes*

Table 2. FAOS and MOCART outcomes

FAOS Subgroup		AOT/CBMA Alone (N = 34)	AOT + CBMA/ECMA (N = 26)	P Value
Symptoms	Pre-Op	70.1 ± 20.2	64.0 ± 13.0	0.494
	Post-Op	75.3 ± 23.0	79.5 ± 13.1	0.661
Pain	Pre-Op	64.2 ± 17.4	60.6 ± 10.7	0.618
	Post-Op	85.5 ± 10.0	85.9 ± 12.7	0.905
ADL	Pre-Op	75.2 ± 12.2	73.6 ± 8.8	0.760
	Post-Op	95.0 ± 4.3	92.8 ± 8.4	0.392
Sports	Pre-Op	50.2 ± 30.8	33.0 ± 12.9	0.234
	Post-Op	77.5 ± 20.6	69.5 ± 21.8	0.405
QOL	Pre-Op	24.3 ± 24.2	20.5 ± 13.3	0.694
	Post-Op	64.1 ± 26.7	60.2 ± 21.9	0.739
MOCART	Post-Op	85.4 ± 9.7	78.9 ± 14.5	0.118

- In both groups, the mean FAOS scores significantly improved from before to after surgery ( $p < 0.001$ )
- There was no statistically significant difference in FAOS score between the **AOT/cBMA** group and **AOT/cBMA + EMCA** group for any of the subgroups

# Results

## MRI Outcomes



MRI depicting OCL on the medial talar dome



X-ray showing talar dome infill

- There was no statistically significant difference in MOCART scores between the **AOT/cBMA** and **AOT/cBMA + EMCA** groups

MOCART	Post-Op	85.4 ± 9.7	78.9 ± 14.5	0.118
--------	---------	------------	-------------	-------

# Limitations

- Retrospective study design with different follow-up times for each treatment group ( $45.1 \pm 15.7$  vs  $31.3 \pm 12.5$  mo, AOT/cBMA and AOT/cBMA + EMCA, respectively)
  - This may be why the MOCART scores between the two groups were similar
- 92% of the lesions in the AOT/cBMA + EMCA group were uncontained, as compared to 73% in the AOT/cBMA group
  - Patients with uncontained-type OLTs treated with AOT had poorer clinical outcomes than those with uncontained-type OLTs<sup>5</sup>

# Conclusions

- AOT/cBMA + micronized EMCA augmentation was an effective surgical treatment for OLT, providing good clinical and radiological outcomes
- Biologic augmentation with cBMA may be sufficient to augment bone healing and cartilage incorporation in the graft-host interface
- cBMA + EMCA augmentation may be useful for lesions that require more than just a cylindrical autograft
- While EMCA + cBMA has benefit in regeneration and repair of OLTs after BMS, there appears to be little benefit of EMCA over cBMA as a physiologic grout between the graft host interface in OLTs treated with AOT

# References

1. Tuan RS, Chen AF, Klatt BA. Cartilage regeneration. *J Am Acad Orthop Surg.* 2013;21(5):303-311.
2. Hurley ET, Murawski CD, Paul J, et al. Osteochondral Autograft: Proceedings of the International Consensus Meeting on Cartilage Repair of the Ankle. *Foot Ankle Int.* 2018;39(1\_suppl):28S-34S.
3. Shimozono Y, Yasui Y, Hurley ET, et al. Concentrated Bone Marrow Aspirate May Decrease Postoperative Cyst Occurrence Rate in Autologous Osteochondral Transplantation for Osteochondral Lesions of the Talus. *Arthroscopy.* 2019;35(1):99-105.
4. Kennedy J, Murawski C. The treatment of osteochondral lesions of the talus with autologous osteochondral transplantation and bone marrow aspirate concentrate: surgical technique. *Cartilage.* 2011;2(4):327-36.
5. Shimozono Y, Donders JCE, Yasui Y, et al. Effect of the Containment Type on Clinical Outcomes in Osteochondral Lesions of the Talus Treated With Autologous Osteochondral Transplantation. *Am J Sports Med.* 2018;46(9):2096-2102.
6. Yoshiharu Shimozono MD , John F. Dankert MD, PhD , Timothy W. Deyer MD , Nathaniel P. Mercer , John G. Kennedy MD, MCh, MMSc, FFSEM, FRCS(Orth) , Predictors of Outcomes of Microfracture with Concentrated Bone Marrow Aspirate for Osteochondral Lesions of the Talus, *Journal of Cartilage & Joint Preservation*TM (2021), doi: <https://doi.org/10.1016/j.jcjp.2021.100008>
7. Shimozono Y, Williamson ERC, Mercer NP, Hurley ET, Huang H, Deyer TW, Kennedy JG, Use of Extracellular Matrix Cartilage Allograft May Improve Infill of the Defects in Bone Marrow Stimulation for Osteochondral Lesions of the Talus., *Arthroscopy: The Journal of Arthroscopic and Related Surgery* (2021), doi: <https://doi.org/10.1016/j.arthro.2021.03.032>.



**THANK YOU**

