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Patient-specific guides for subchondroplasty of the knee: short-term clinical outcomes

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Faculty Disclosure Information

- Nothing to disclose

Background

- Traditional **subchondroplasty**, based on **calcium phosphate** injection, showed good outcomes for treating **bone marrow edema (BME)**, but lacks biological activity and may disrupt the subchondral environment. Leakage into the joint is a known complication[1].

- **Autologous Bone Marrow Aspirate Concentrate (BMAC)**, rich in mesenchymal stem cells (MSCs), enhances subchondroplasty by promoting osteogenesis, angiogenesis, and reducing fibrosis and inflammation[2].

- A major limitation remains the accurate **targeting** of BME lesions, currently guided only by intraoperative **fluoroscopy**[3].

Purpose

- Evaluate the short-term clinical and radiological outcomes of knee BME treated with BMAC using patient-specific (PS) guides.

- The hypothesis was that PS guides would enable more precise management of BME, reduce intraoperative radiation exposure, and result in favorable clinical outcomes and post-operative MRI findings.

Methods

- **Study design:** Retrospective study
- **Period:** December 2021 – April 2024

Inclusion criteria:

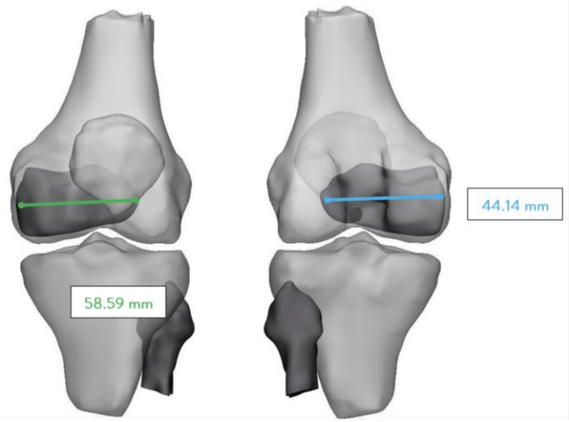
- ✓ Knee BME with MRI confirmed ARCO stage 1-3
- ✓ Failure of ≥ 3 months of conservative treatment
- ✓ Follow-up ≥ 3 months

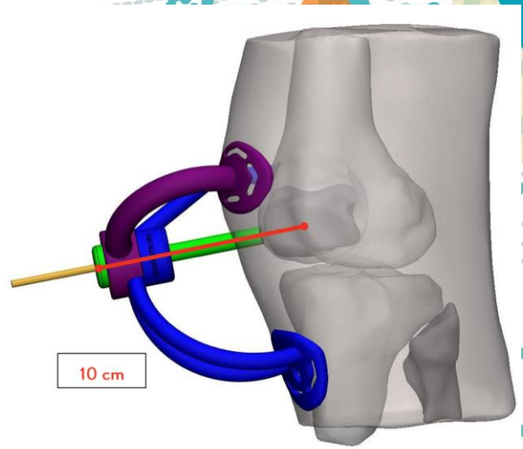
Exclusion criteria:

- ✓ Severe osteoarthritis and/or malalignment
- ✓ Systemic/local neurogical or inflammatory disorders
- ✓ Inability to complete questionnaires

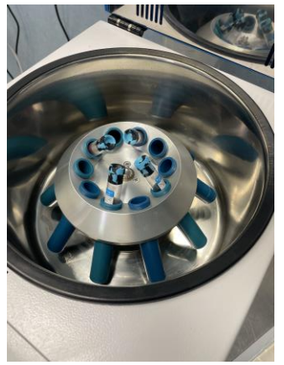
Procedure

- Patient-Specific (PS) guides designed from 3D MRI reconstructions





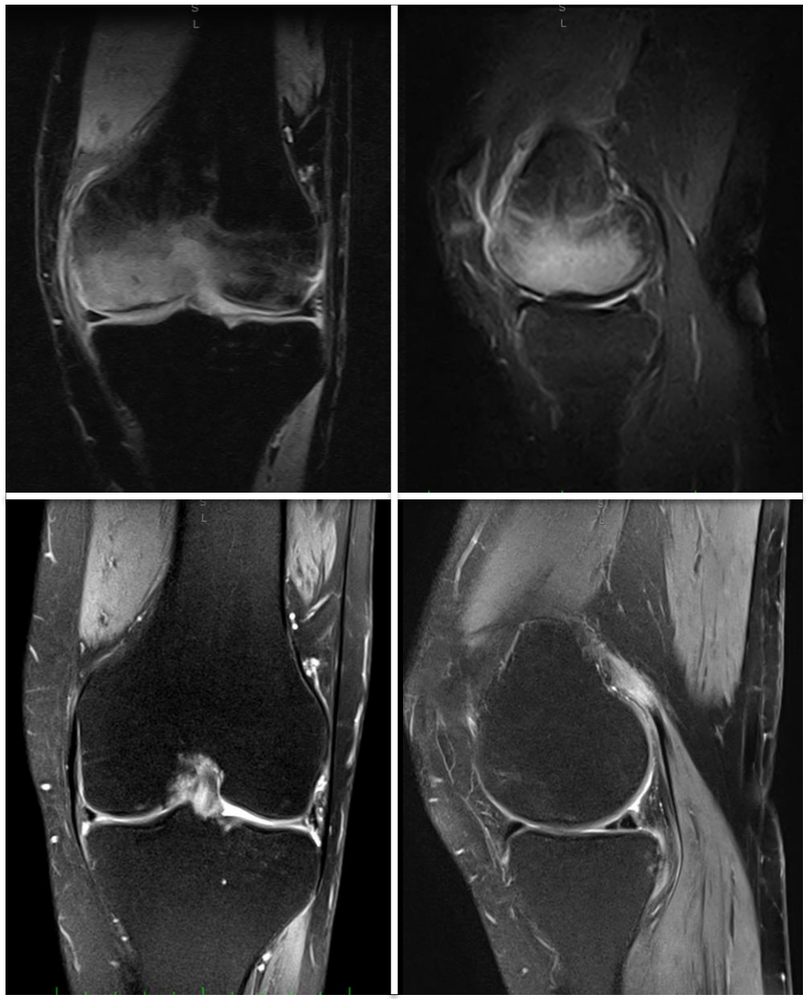
- Bone marrow aspirate collected with dedicated kit



- BMAC injected into BME center using PS guides

Outcome measures

- MRI at 3 months post-procedure
- Clinical assessment with VAS and KOOS
- Intention-to-treat analysis for conversions to knee replacement



Results

Patient demographics & Lesion characteristics

Parameter	Value
N° of patients	10 (8M, 2F)
Mean age (years)	62.9 ± 10
BME location	Femur: 3 Tibia: 3 Both: 4
ARCO stage	Stage I: 2 Stage II: 4 Stage III: 4
Mean F-U (months)	11.6 ± 6.0

Clinical and Radiological Outcomes

Outcome	Result
Radiological BME resolution	9/10
Conversion to TKA	1/10 (ARCO stage I)
VAS (pain)	2.5 ± 2.2
KOOS – Pain	84.3 ± 15.3
KOOS – Other symptoms	79.3 ± 16.6
KOOS – Daily activities	69.8 ± 29.8
KOOS – Sports	67.1 ± 26
KOOS - QoL	73.9 ± 28.3

VAS indicates mild pain. KOOS scores fall in the good-to-excellent range across domains, supporting effective symptom relief and functional recovery

Conclusions

Subchondroplasty with BMAC can be considered a safe and encouraging procedure for the treatment of knee BME. The use of PS guides allows an accurate and targeted treatment of bone marrow lesions, optimizing the procedure and preserving soft tissues with less intraoperative radiation exposure.

References

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2. **Kon E, Boffa A, Andriolo L, Di Martino A, Di Matteo B, Magarelli N, Trenti N, Zaffagnini S, Filardo G.** Combined subchondral and intra-articular injections of bone marrow aspirate concentrate provide stable results up to 24 months. *Knee Surg Sports Traumatol Arthrosc. 2023 Jun*;31(6):2511-2517. doi: 10.1007/s00167-022-07195-w. Epub 2022 Nov 3. PMID: 36326876.

3. **Dragoo JL, Hirpara A, Constantine E, Williams KG, Fry SA, Kandil R.** Intraosseous Treatment of Bone Marrow Lesions in the Knee: Surgical Technique. *Arthrosc Tech. 2024* Mar 18;13(6):102965. doi: 10.1016/j.eats.2024.102965. PMID: 39036410; PMCID: PMC11258708.