

Clinical Case 4

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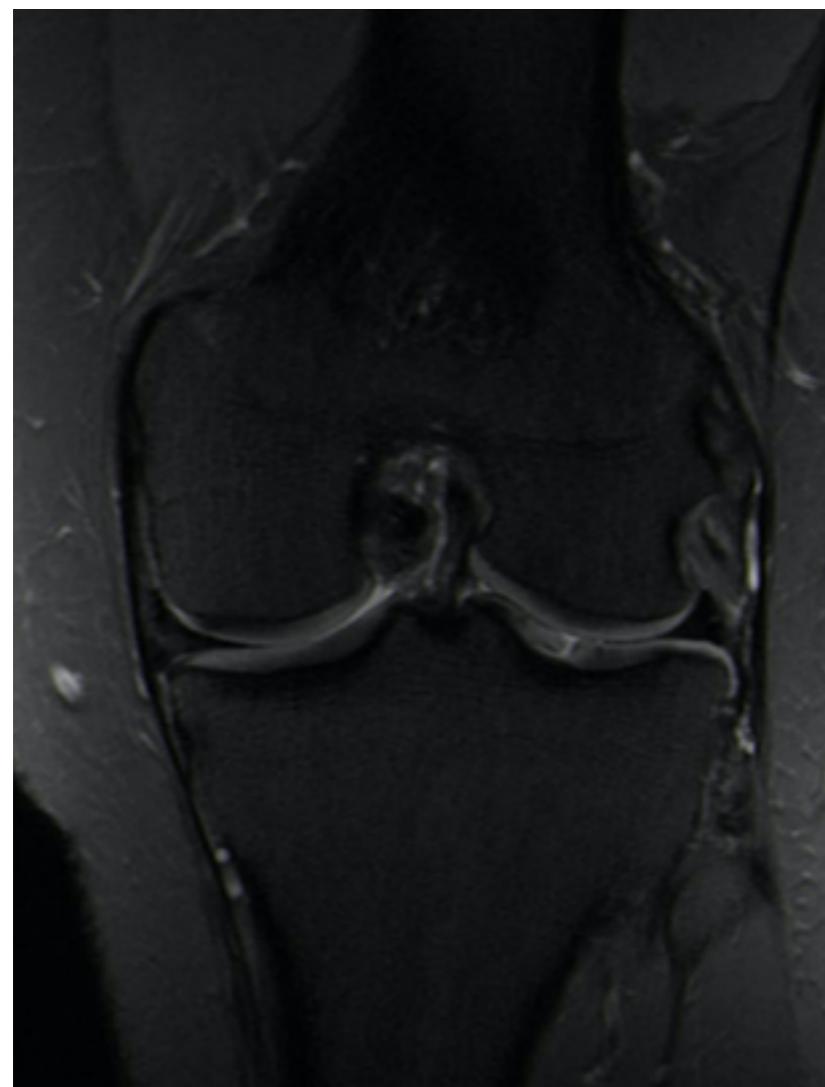
Case 4

- 27 y.o. Recreational football player.
- Left knee chronic lateral pain. Swelling. No instability. No locking.
- Cannot play football.
- Had partial medial meniscectomy on the same knee few years ago.
- PE: Mild varus alignment. Full ROM. No laxity. Very mild effusion. No tenderness.

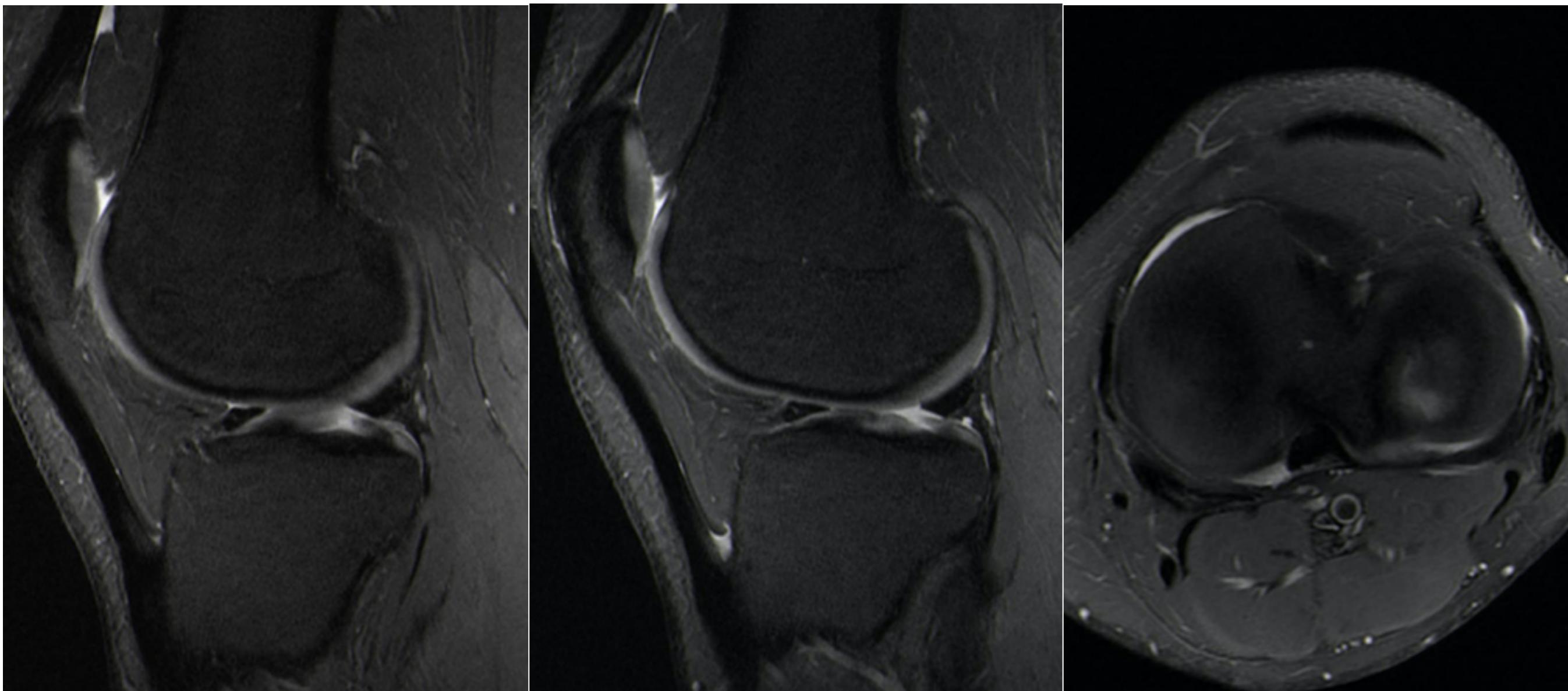
Case 4



Case 4



Case 4



Case 4

- Which Treatment?



- Prepared by combining 2 components: A **chitosan** (Chitosan is derived from chitin, the second most abundant natural polymer on earth after cellulose) and a **buffer**.
- Acts as a **scaffold to physically stabilize the blood clot** in the cartilage lesion.
- **Impedes** blood clot retraction while allowing for normal clotting to occur.
- **Adheres** to the cartilage lesion surfaces.

BST CARGEL®

BST-CarGel® Product Preparation



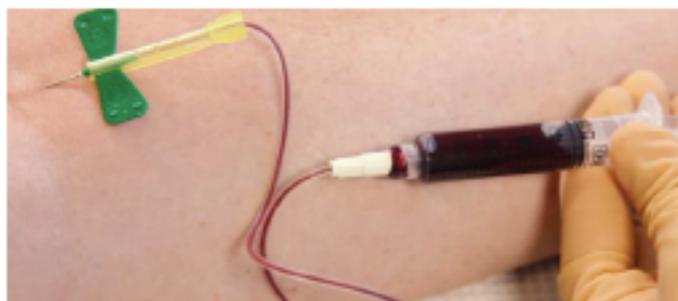
- ① Draw exactly 0.3 mL from the ADD vial.



- ② Inject the ADD solution in a drop-wise manner into the MIX vial.



- ③ Do not shake. Leave undisturbed for a minimum of 10 minutes.



- ④ Once the cartilage lesion is ready, draw 5 mL of fresh autologous blood.

Steps 1-3 can be done by a non-sterile nurse while the lesion is being surgically prepared.



- ⑤ Using a dispensing pin, slowly inject exactly 4.5 mL of blood into the MIX vial.



- ⑥ Immediately shake MIX vial vigorously for 10 seconds.



- ⑦ Using a second dispensing pin, draw 4 to 5 mL of the BST-CarGel®/blood mixture into a syringe.



- ⑧ Administer the BST-CarGel®/blood mixture to the lesion in a drop-wise manner without overfilling.

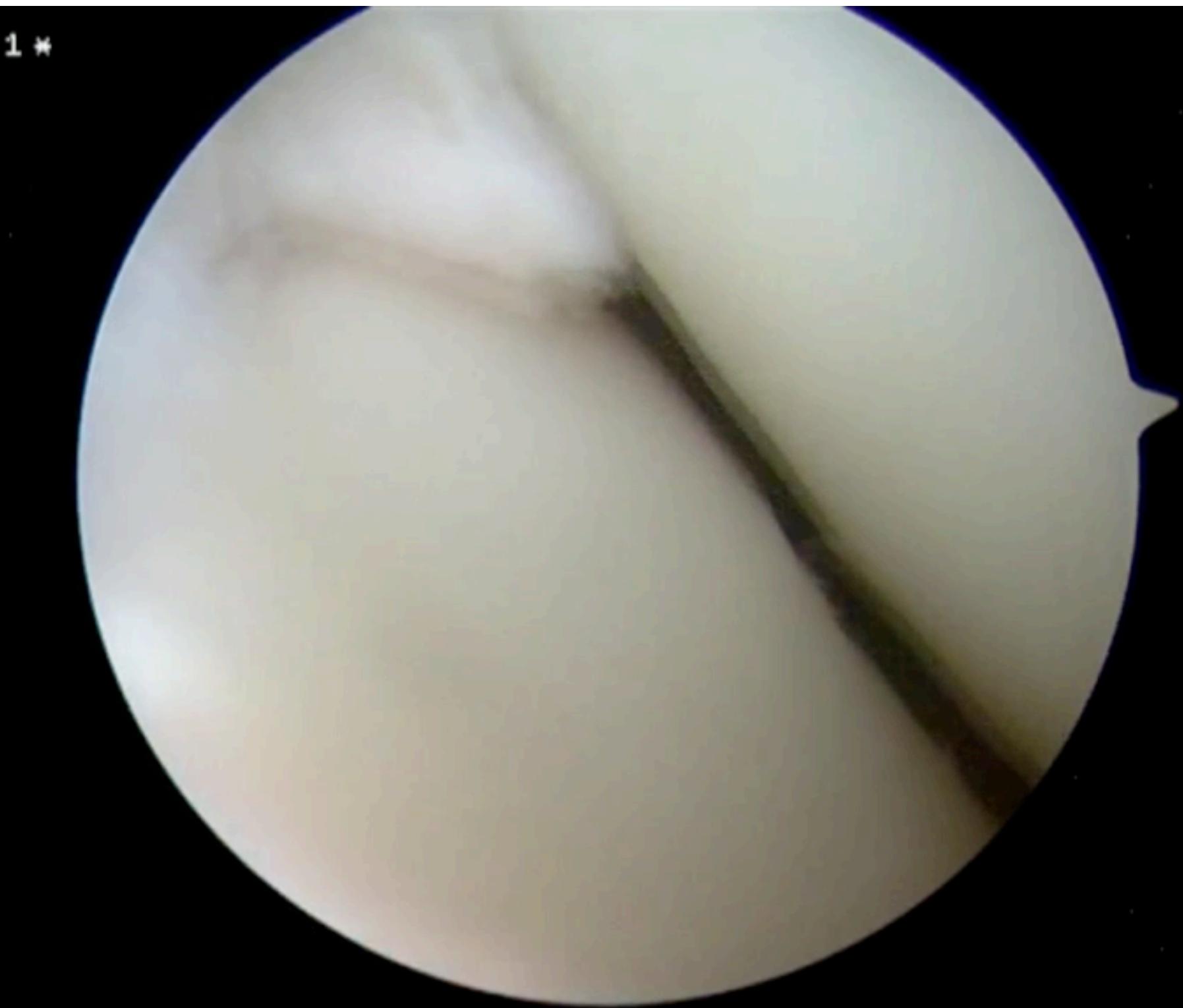
Wait 15 minutes to allow implant to clot and maintain its integrity.



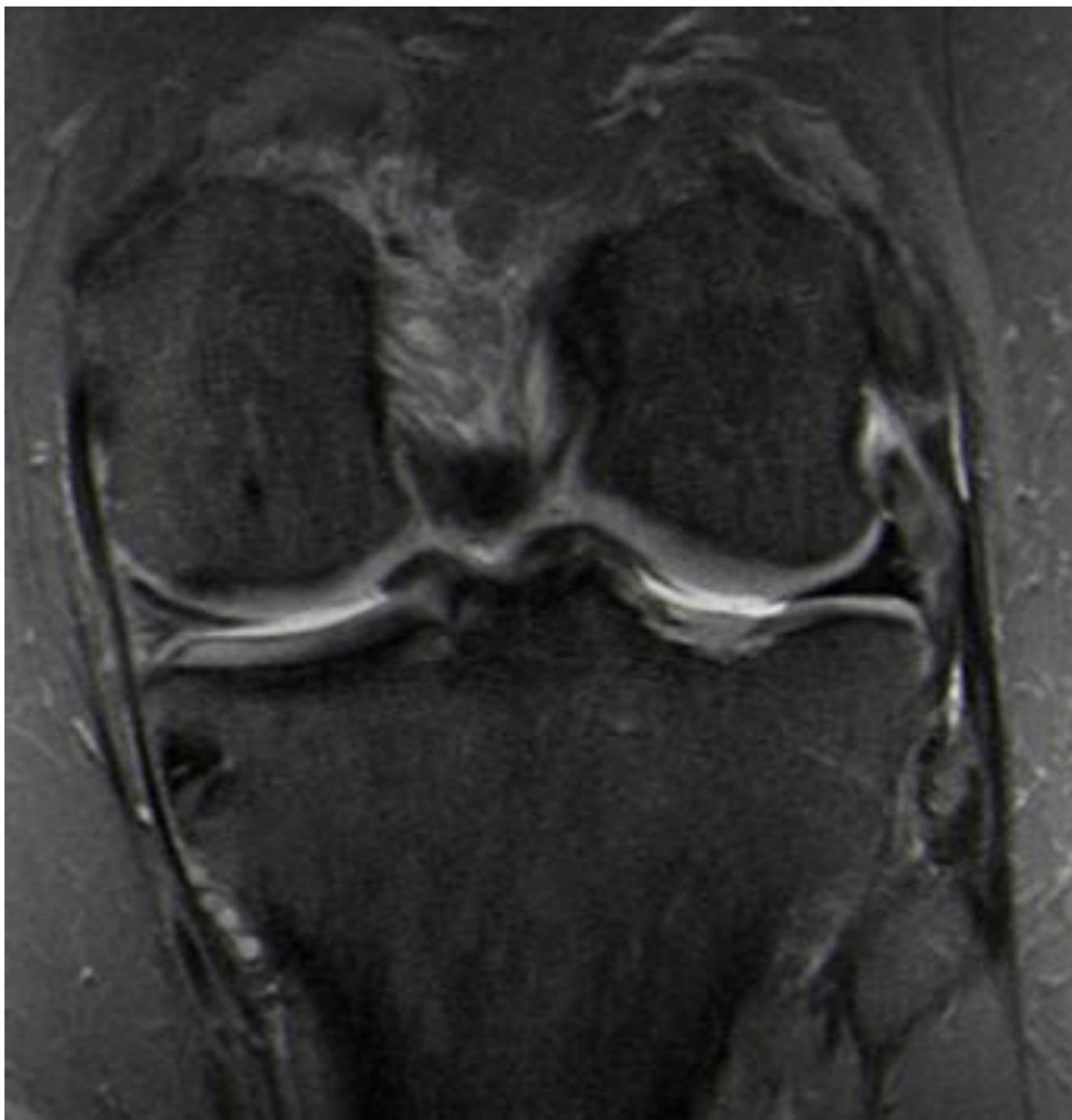
Accessories Required but not Provided with BST-CarGel®

- one 1.0 mL, sterile syringe with 0.1 mL graduations and a 26G sterile needle
- two 5.0 mL, sterile syringes with 0.5 mL graduations
- two sterile dispensing pins vented with a 0.2 µm filter membrane
- one sterile phlebotomy needle
- one 18G sterile needle

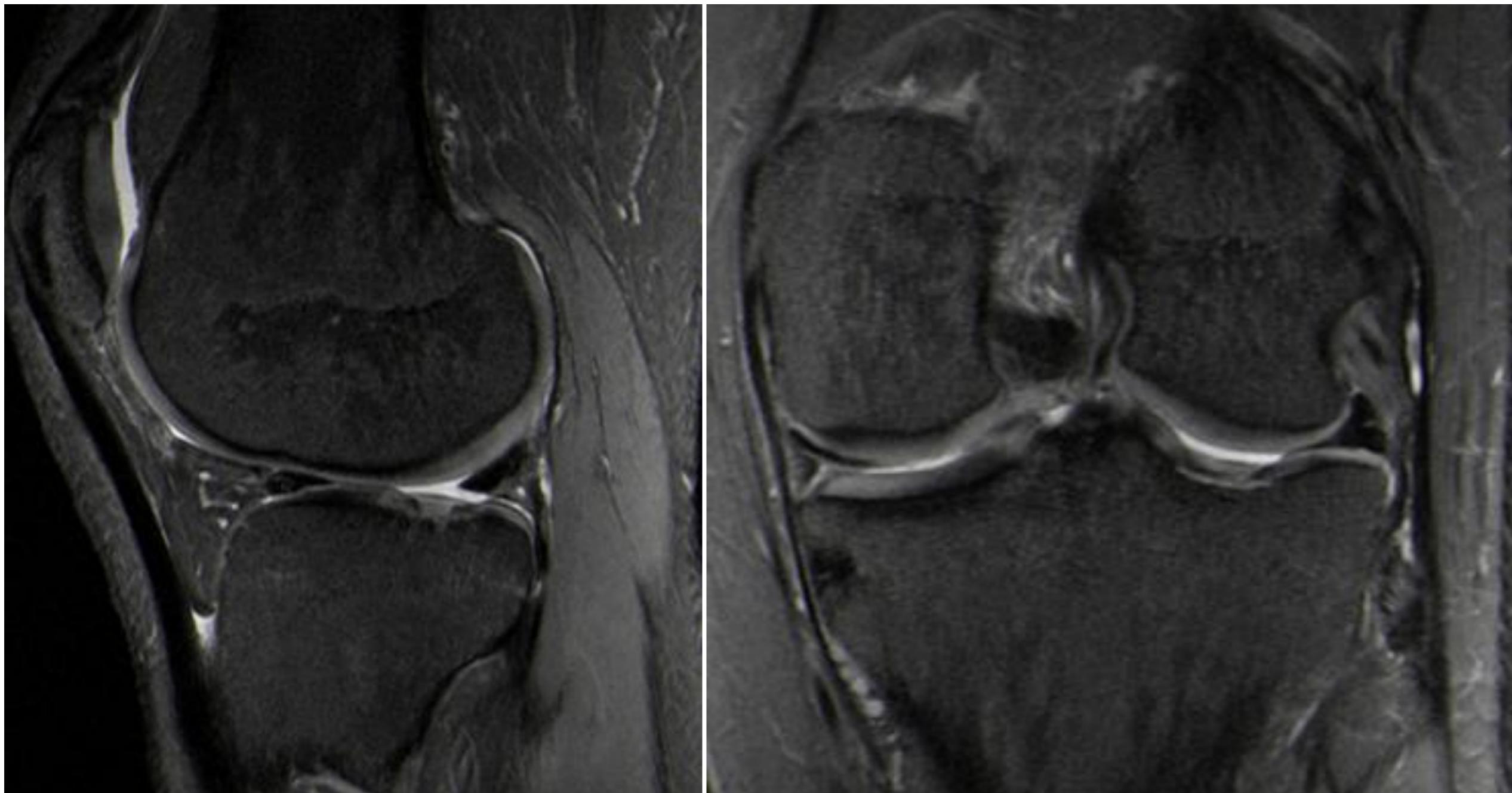
Case 4: BST-CarGel



Case 4: 3 months

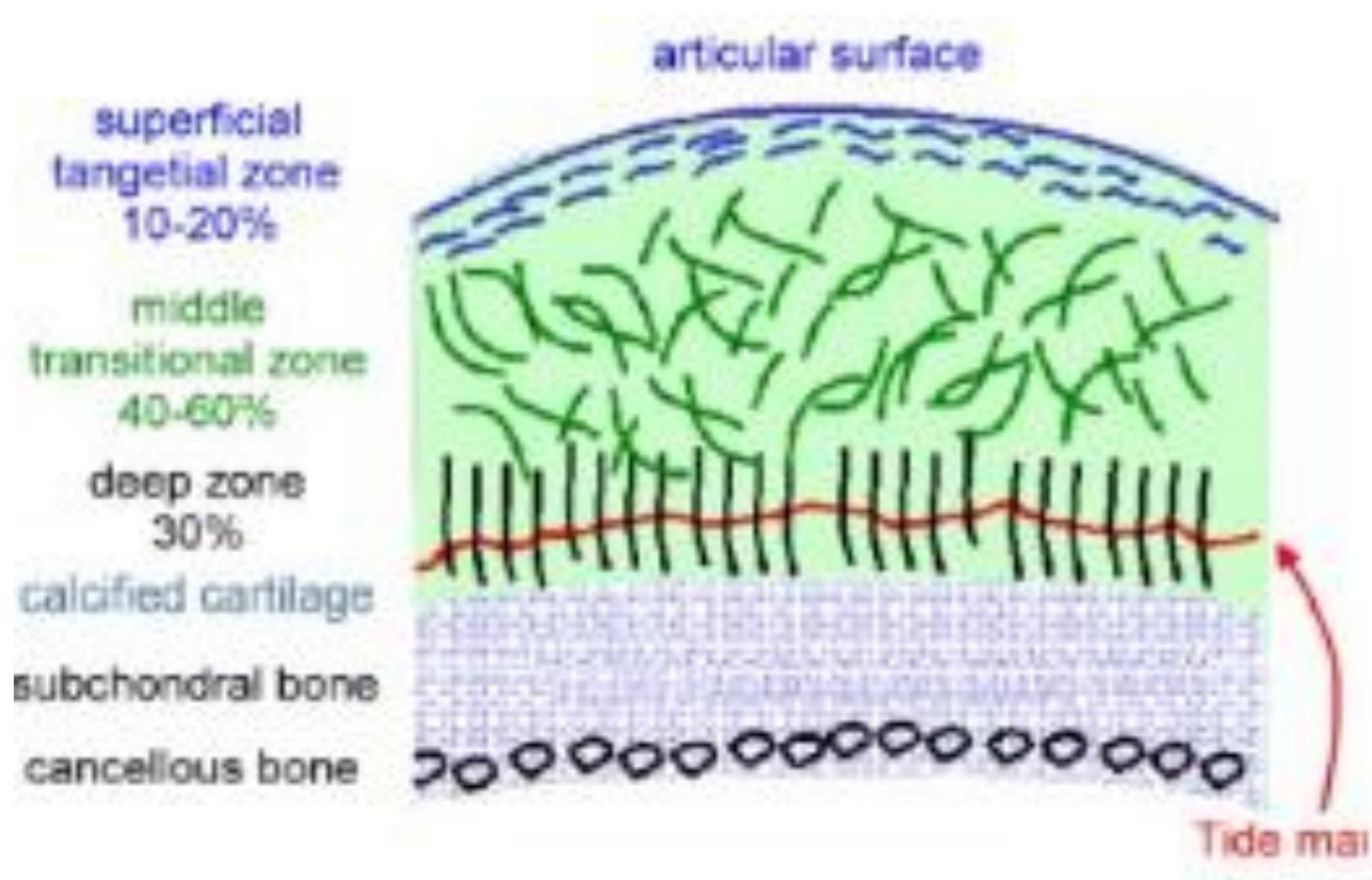


Case 4: 6 months

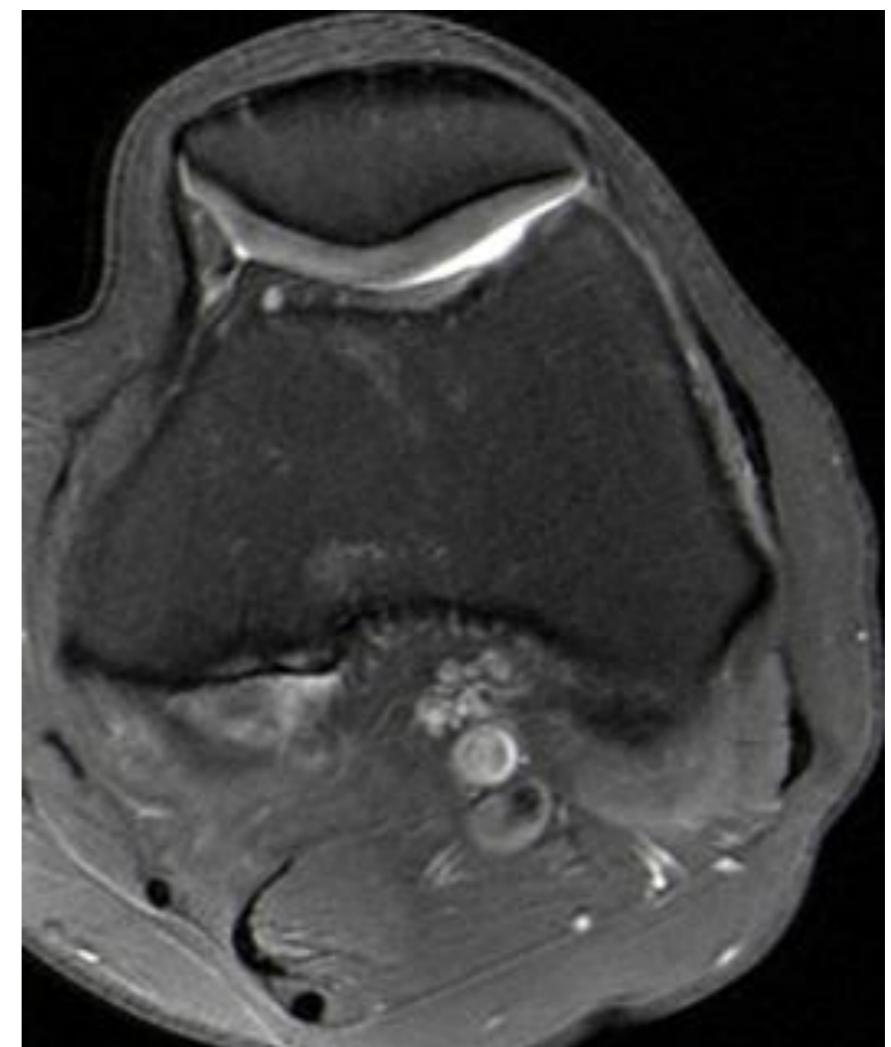


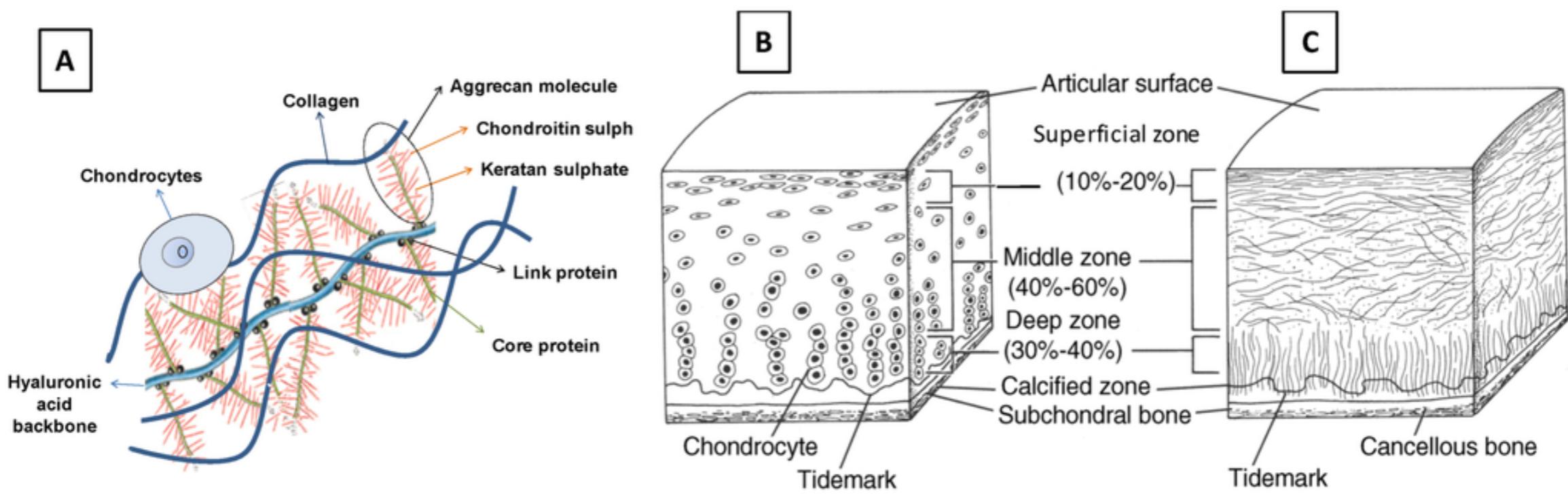
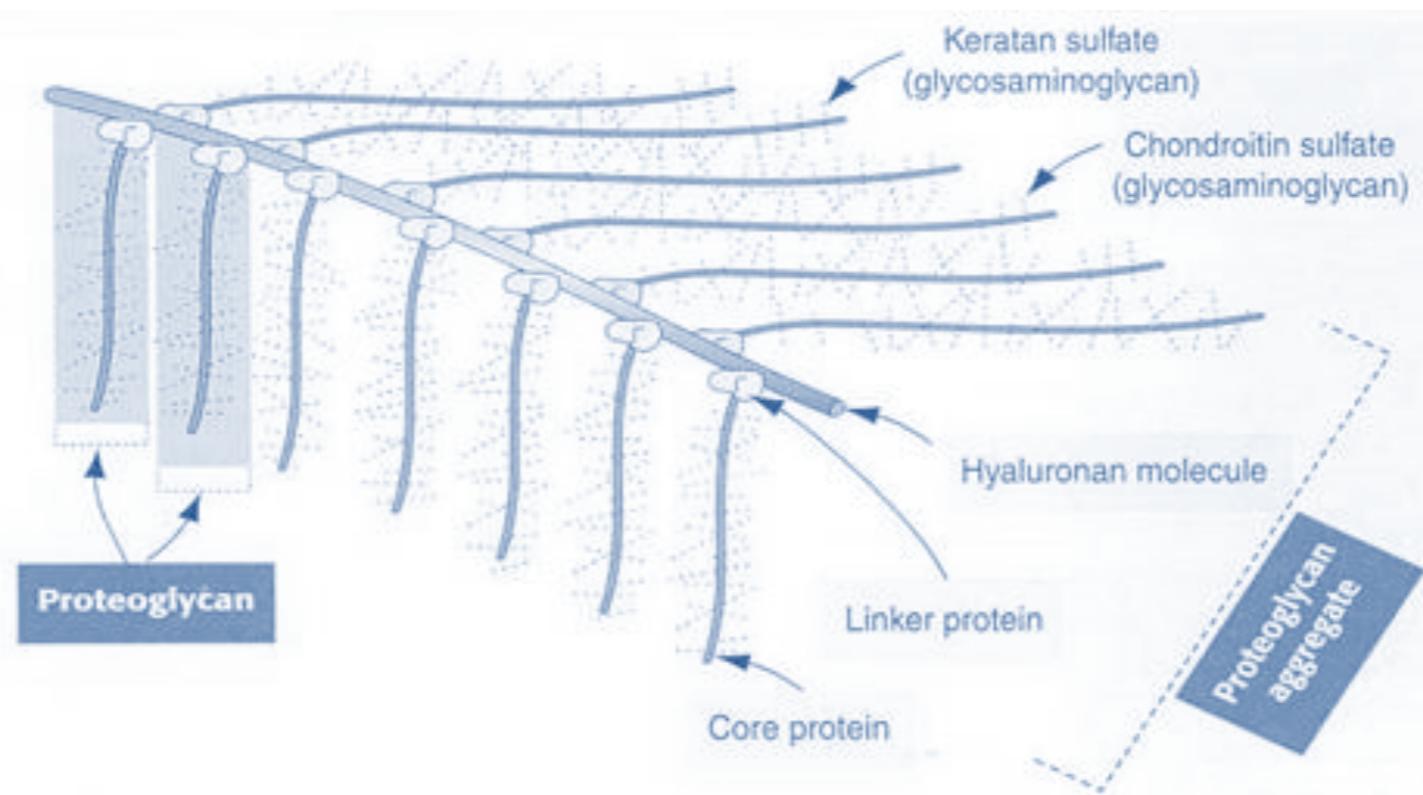
Cartilage imaging techniques

- Morphological Shape



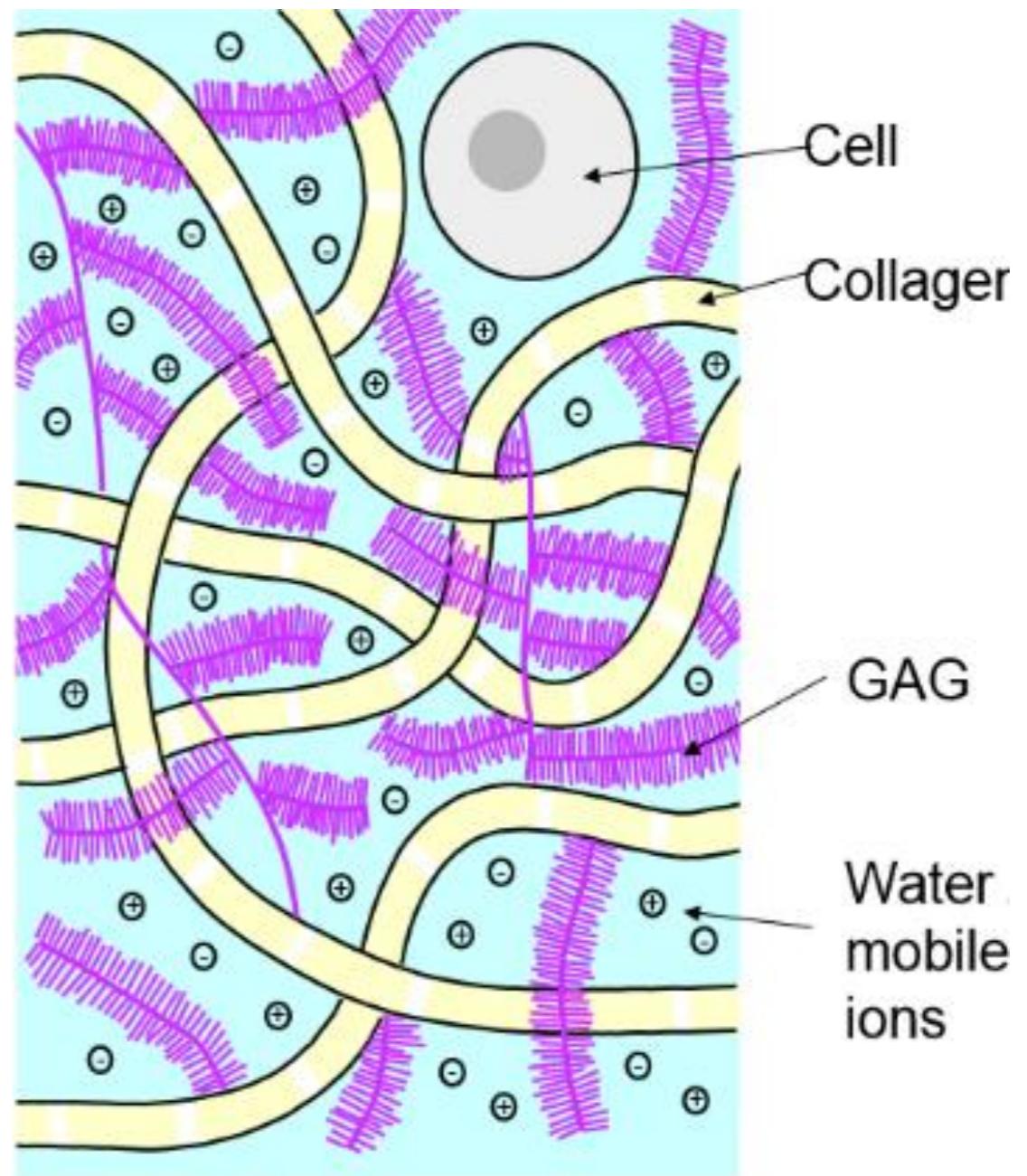
Collagen Arrangement of the Articular Cartilage





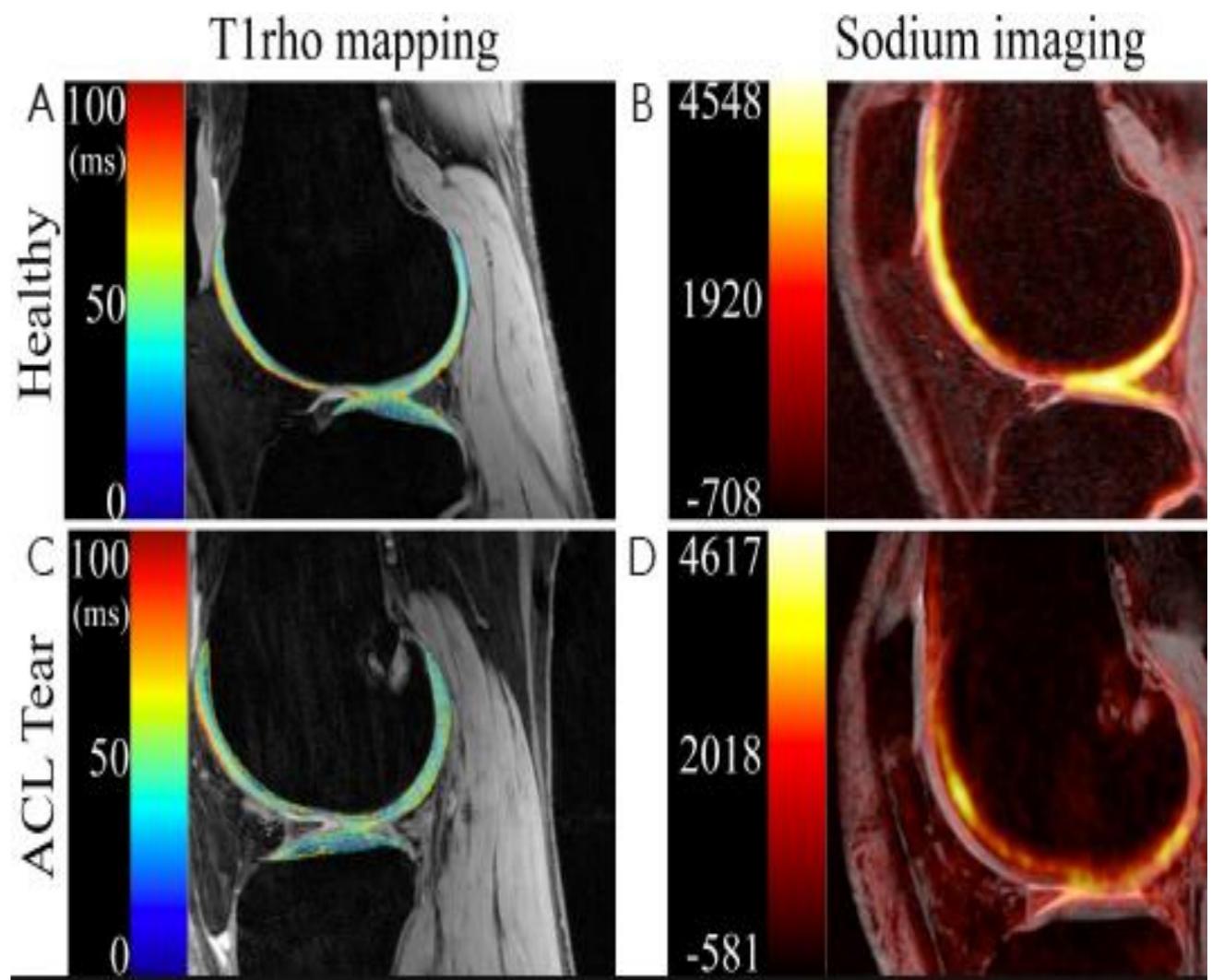
Cartilage imaging techniques

- Biochemical MRI
- Proteoglycans
- Collagen network
- Combination



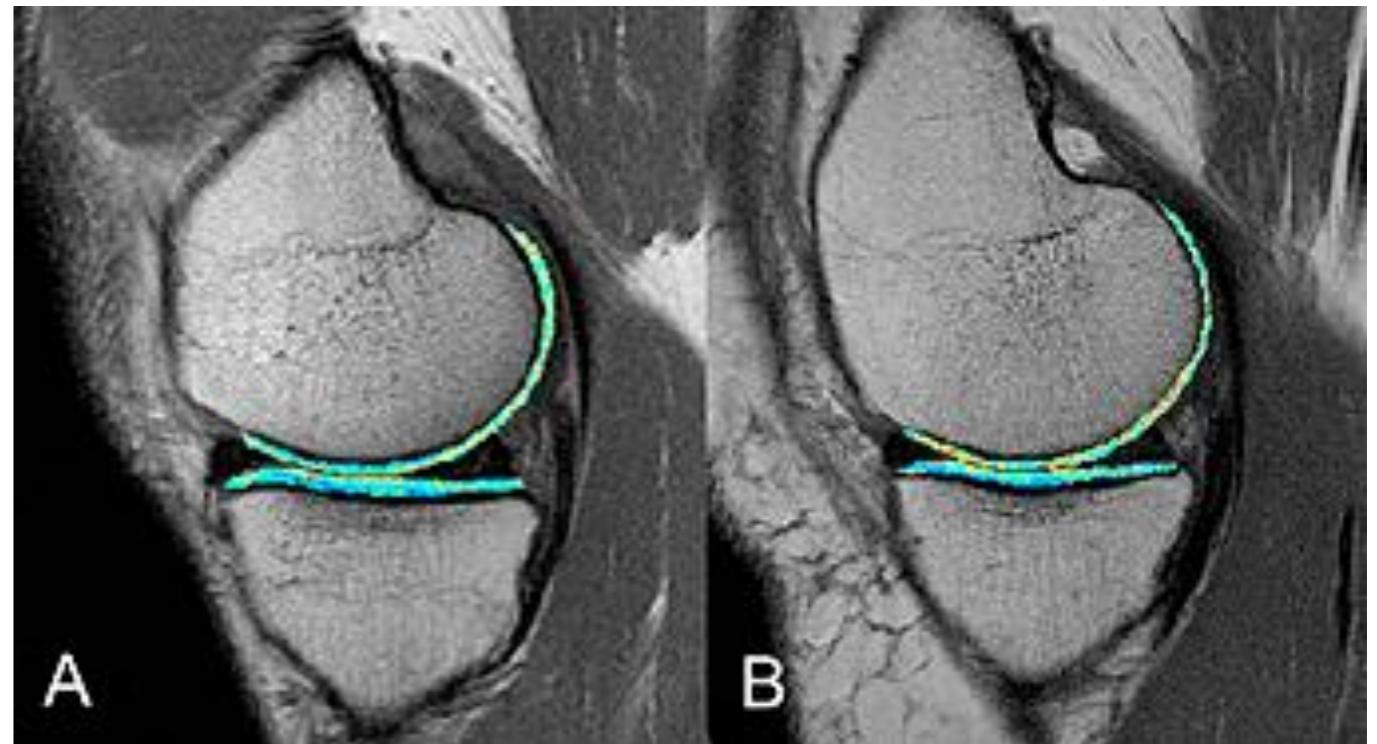
Biochemical - Proteoglycan

- Chemical Exchange Saturation Transfer (CEST)
- Sodium
- Delayed gadolinium enhanced MRI of cartilage (dGEMRIC)



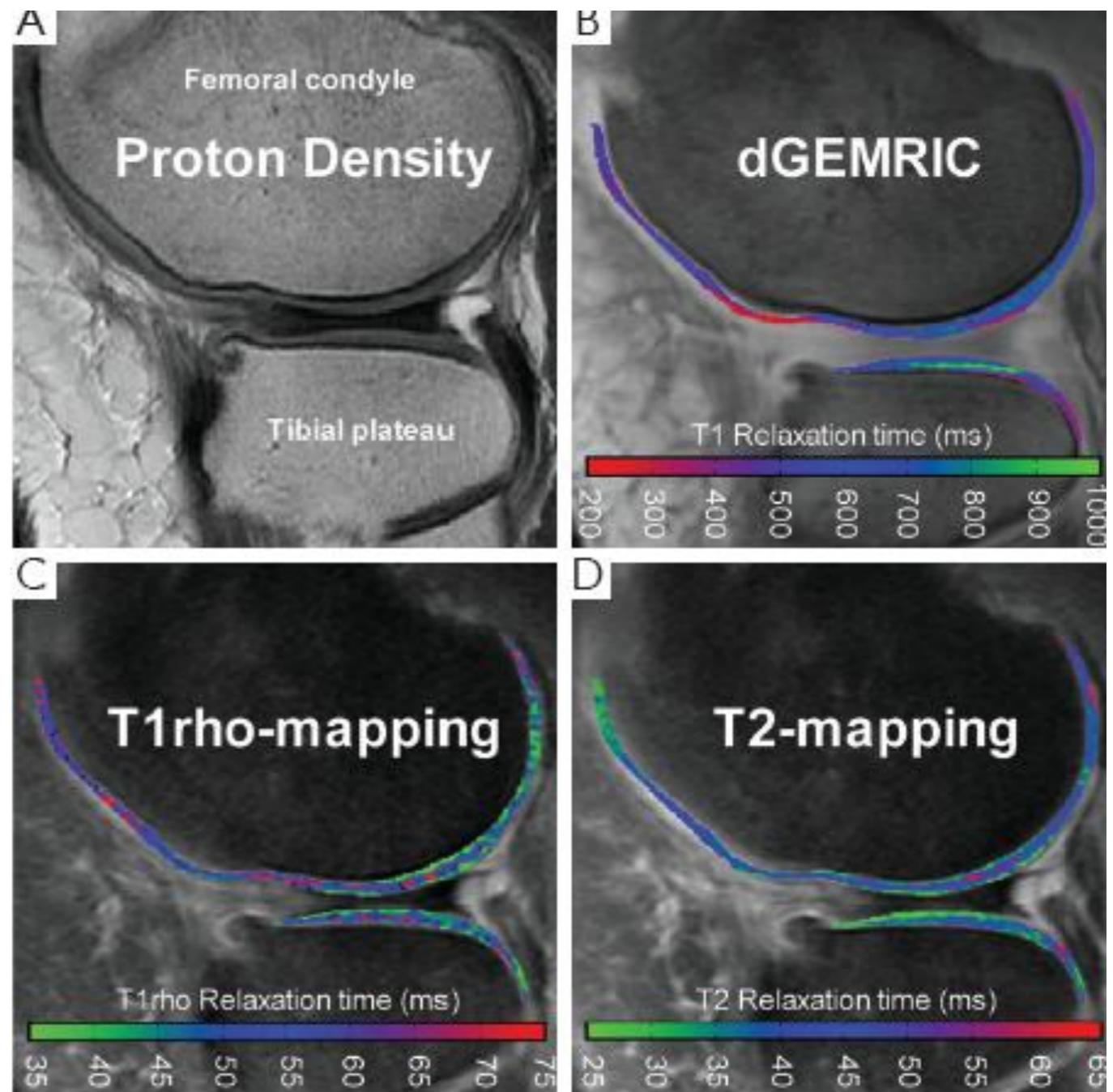
Biochemical – Collagen network

- T2 mapping
- Magnetization transfer (MT)

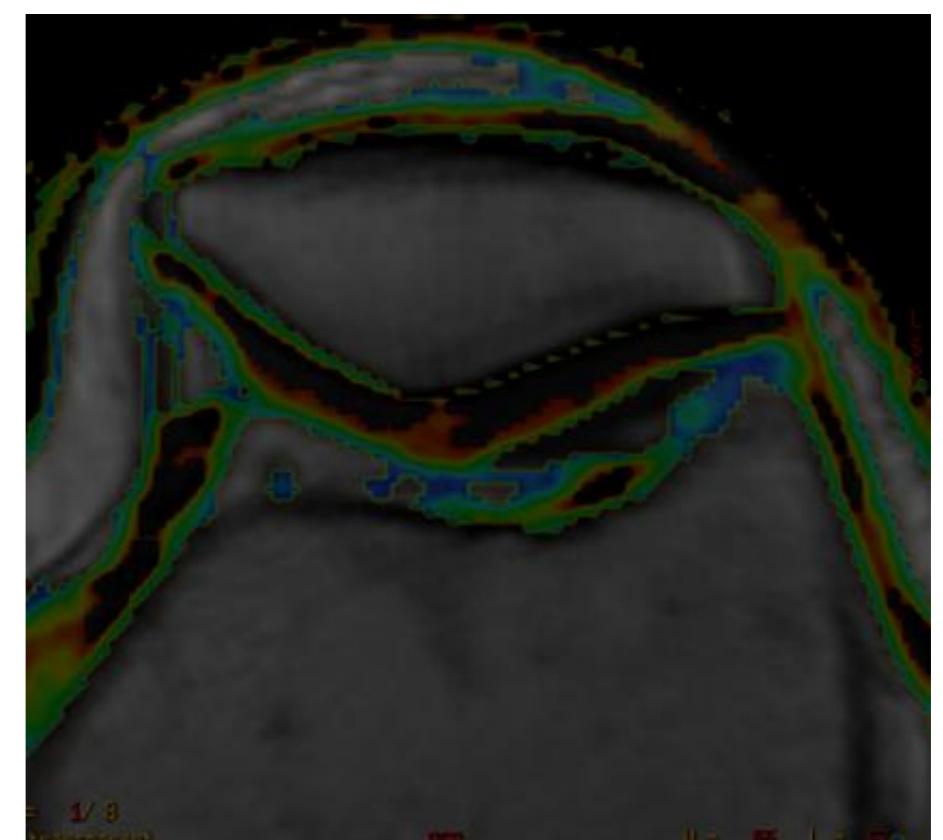
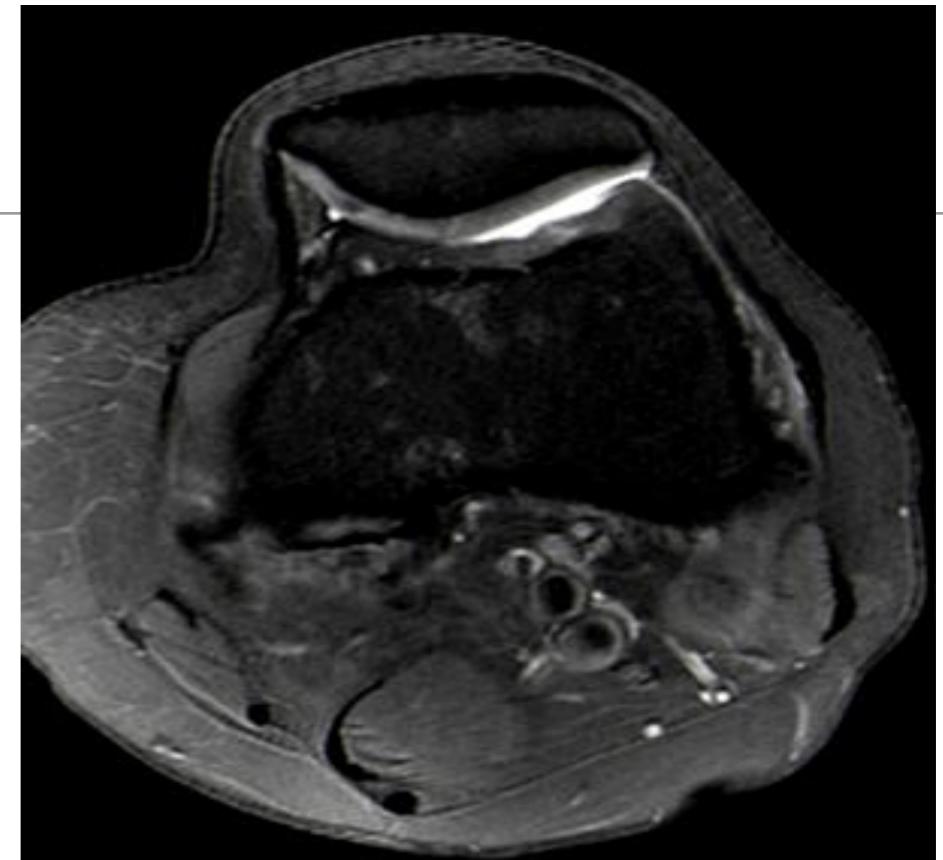
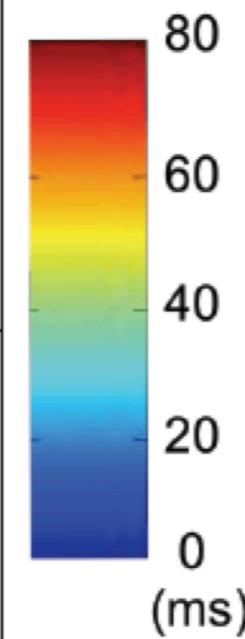
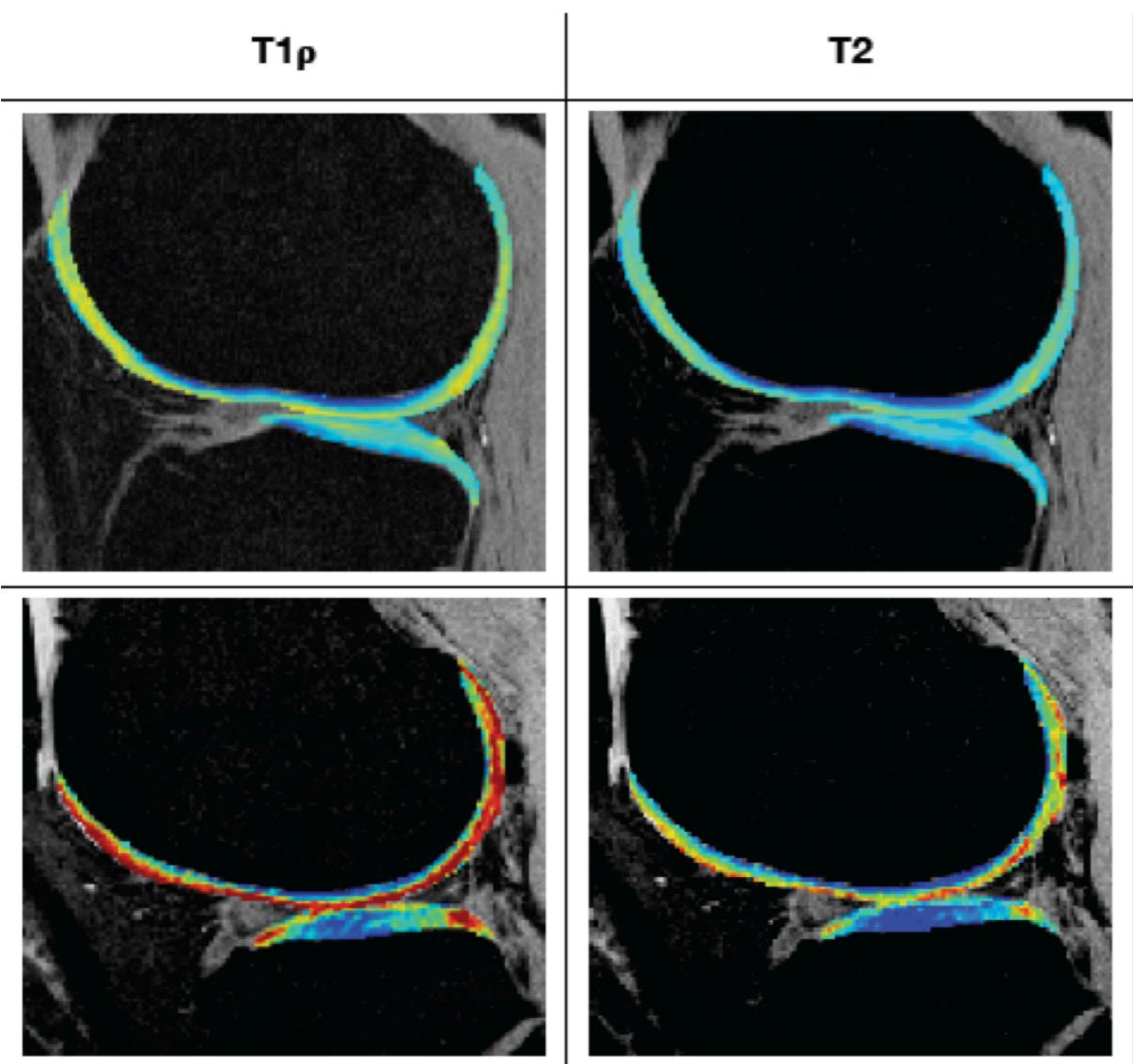


Biochemical - Combination

- Diffusion weighted imaging (DWI)



T2 mapping



Post operative imaging

- Defect fill
- Integration into border zone
- Surface
- Structure
- Signal Intensity
- Subchondral lamina
- Subchondral bone
- Adhesions
- Effusion

Variables (Points for scoring)

1. Degree of defect repair and filling of the defect
 - Complete (20)
 - Hypertrophy (15)
 - Incomplete
 - >50% of the adjacent cartilage (10)
 - <50% of the adjacent cartilage (5)
 - Subchondral bone exposed (0)
2. Integration to border zone
 - Complete (15)
 - Incomplete
 - Demarcating border visible (split-like) (10)
 - Defect visible <50% of the length (5)
 - Defect visible >50% of the length (0)
3. Surface of the repair tissue
 - Surface intact (10)
 - Surface damaged <50% of depth (5)
 - Surface damaged >50% of depth (0)
4. Structure of the repair tissue
 - Homogeneous (5)
 - Inhomogeneous (0)
5. Signal intensity of the repair tissue
 - Normal (identical to adjacent cartilage) (30)
 - Nearly normal (slight areas of signal alteration) (15)
 - Abnormal (large areas of signal alteration) (0)
6. Subchondral lamina
 - Intact (5)
 - Not intact (0)
7. Subchondral bone
 - Intact (5)
 - Not intact (0)
8. Adhesions
 - No (5)
 - Yes (0)
9. Effusion
 - No (5)
 - Yes (0)



New MOCART score

Variables	i) Standard 2D	ii) 3D-True-FISP	iii) 3D-PD-SPACE
1. Defect fill (degree of defect repair and filling of the defect in relation to the adjacent cartilage)			
<input type="checkbox"/> 0%	0 (0)	0 (0)	0 (0)
<input type="checkbox"/> 0-25%	0 (0)	0 (0)	0 (0)
<input type="checkbox"/> 25-50%	0 (0)	0 (0)	0 (0)
<input type="checkbox"/> 50-75%	9 (16)	4 (8.7)	6 (8.3)
<input type="checkbox"/> 75-100%	11 (18.3)	13 (21.7)	12 (20)
<input type="checkbox"/> 100%	28 (48.7)	29 (48.3)	28 (48.7)
<input type="checkbox"/> 100-125%	7 (11.7)	11 (18.3)	11 (18.3)
<input type="checkbox"/> 125-150%	5 (8.3)	3 (5)	3 (5)
<input type="checkbox"/> 150-200%	0 (0)	0 (0)	0 (0)
<input type="checkbox"/> >200%	0 (0)	0 (0)	0 (0)
Localization			
<input type="checkbox"/> Whole area of cartilage repair <input type="checkbox"/> > 50% <input type="checkbox"/> < 50%			
<input type="checkbox"/> Central <input type="checkbox"/> Peripheral <input type="checkbox"/> Weight-bearing <input type="checkbox"/> Non weight-bearing			
2. Cartilage Interface (integration with adjacent cartilage to border zone in two planes)			
Sagittal (Femur, Patella, Trochlea, Tibia)			
<input type="checkbox"/> Complete	41 (68.3)	40 (66.7)	30 (50)
<input type="checkbox"/> Demarcating border visible (split-like)	12 (20)	13 (21.7)	23 (38.3)
<input type="checkbox"/> Defect visible <50%	4 (8.7)	5 (8.3)	6 (10)
<input type="checkbox"/> Defect visible >50%	3 (5)	2 (3.3)	1 (1.7)
Coronal (Femur, Tibia); Axial (Patella, Trochlea)			
<input type="checkbox"/> Complete	38 (63.3)	34 (56.7)	
<input type="checkbox"/> Demarcating border visible (split-like)	18 (30)	21 (36.0)	
<input type="checkbox"/> Defect visible <50%	4 (8.7)	6 (8.3)	
<input type="checkbox"/> Defect visible >50%	0 (0)	0 (0)	
Localization			
<input type="checkbox"/> Whole area of cartilage repair <input type="checkbox"/> > 50% <input type="checkbox"/> < 50%			
<input type="checkbox"/> Weight-bearing <input type="checkbox"/> Non weight-bearing			
3. Bone interface (integration of the transplant to the subchondral bone; integration of a possible periosteal flap)			
<input type="checkbox"/> Complete	63 (88.3)	64 (90)	62 (86.7)
<input type="checkbox"/> Partial delamination	7 (11.7)	6 (10)	8 (13.3)
<input type="checkbox"/> Complete delamination	0 (0)	0 (0)	0 (0)
<input type="checkbox"/> Delamination	0 (0)	0 (0)	0 (0)
Localization			
<input type="checkbox"/> Weight-bearing <input type="checkbox"/> Non-weight-bearing			
4. Surface (constitution of the surface of the repair tissue)			
<input type="checkbox"/> Surface intact	31 (51.7)	24 (40)	26 (43.3)
<input type="checkbox"/> Surface damaged <60% of depth	19 (31.7)	24 (40)	22 (36.7)
<input type="checkbox"/> Surface damaged >60% of depth	6 (10)	9 (15)	7 (11.7)
<input type="checkbox"/> Adhesions	4 (8.7)	3 (5)	6 (8.3)
Localization			
<input type="checkbox"/> Whole area of cartilage repair <input type="checkbox"/> > 50% <input type="checkbox"/> < 50%			
<input type="checkbox"/> Central <input type="checkbox"/> Peripheral <input type="checkbox"/> Weight-bearing <input type="checkbox"/> Non weight-bearing			
5. Structure (constitution of the repair tissue)			
<input type="checkbox"/> Homogeneous	22 (46)	16 (26)	12 (18.7)
<input type="checkbox"/> Inhomogeneous or cleft formation	38 (66)	46 (76)	48 (83.3)
Localization			
<input type="checkbox"/> Whole area of cartilage repair <input type="checkbox"/> > 50% <input type="checkbox"/> < 50%			
<input type="checkbox"/> Central <input type="checkbox"/> Peripheral <input type="checkbox"/> Weight-bearing <input type="checkbox"/> Non weight-bearing			
6. Signal intensity (Intensity of MR signal in of the repair tissue in comparison to the adjacent cartilage: normal = identical to adjacent cartilage; nearly normal = slight areas of signal alterations; abnormal = large areas of signal alteration)			
<input type="checkbox"/> Normal	29 (48.3)	24 (40)	27 (45)
<input type="checkbox"/> Nearly normal	25 (41.7)	32 (53.3)	32 (53.3)
<input type="checkbox"/> Abnormal	6 (10)	3 (8.7)	1 (1.7)
Localization			
<input type="checkbox"/> Central <input type="checkbox"/> Peripheral <input type="checkbox"/> Weight-bearing <input type="checkbox"/> Non weight-bearing			
7. Subchondral lamina (Constitution of the subchondral lamina)			
<input type="checkbox"/> Intact	33 (56)	36 (60)	29 (48.3)
<input type="checkbox"/> Not intact	27 (46)	24 (40)	31 (51.7)
Localization			
<input type="checkbox"/> Whole area of cartilage repair <input type="checkbox"/> > 50% <input type="checkbox"/> < 50%			
<input type="checkbox"/> Central <input type="checkbox"/> Peripheral <input type="checkbox"/> Weight-bearing <input type="checkbox"/> Non weight-bearing			

Variables	i) Standard 2D	ii) 3D-True-FISP	iii) 3D-PD-SPACE
8. Chondral Osteophytes (Osteophytes within the cartilage repair area)			
<input type="checkbox"/> Absent	37 (61.7)	31 (51.7)	31 (51.7)
<input type="checkbox"/> Osteophytes < 60% of repair tissue	16 (28.7)	14 (23.3)	17 (28.3)
<input type="checkbox"/> Osteophytes > 60% of repair tissue	7 (11.7)	16 (26.0)	12 (20)
Localization			
Size: —mm (plane: —) x — mm (plane: —)			
<input type="checkbox"/> Central <input type="checkbox"/> Peripheral <input type="checkbox"/> Weight-bearing <input type="checkbox"/> Non weight-bearing			
9. Bone marrow edema (Maximum size and localization in relation to the cartilage repair tissue and other alterations assessed in the 3D MOCART score).			
<input type="checkbox"/> Absent	14 (23.3)	33 (56)	15 (26)
<input type="checkbox"/> Small (< 1cm)	14 (23.3)	15 (26)	13 (21.7)
<input type="checkbox"/> Medium (< 2cm)	20 (33.3)	8 (13.3)	20 (32.3)
<input type="checkbox"/> Large (< 4cm)	9 (15)	4 (8.7)	10 (18.7)
<input type="checkbox"/> Diffuse	3 (6)	0 (0)	2 (3.3)
Localization			
Size: —mm (plane: —) x — mm (plane: —)			
<input type="checkbox"/> Central <input type="checkbox"/> Peripheral <input type="checkbox"/> Weight-bearing <input type="checkbox"/> Non weight-bearing			
<input type="checkbox"/> Relation to other alterations within this score of variable No. —			
10. Subchondral bone (Constitution of the subchondral bone)			
<input type="checkbox"/> Intact	31 (33)	34 (56.7)	39 (66)
<input type="checkbox"/> Granulation tissue	18 (30)	26 (33.3)	18 (30)
<input type="checkbox"/> Cyst	4 (8.7)	4 (8.7)	3 (6)
Localization			
<input type="checkbox"/> Whole area of cartilage repair <input type="checkbox"/> > 50% <input type="checkbox"/> < 50%			
<input type="checkbox"/> Central <input type="checkbox"/> Peripheral <input type="checkbox"/> Weight-bearing <input type="checkbox"/> Non weight-bearing			
11. Effusion (Approx. size of joint effusion visualized in all planes)			
<input type="checkbox"/> Absent	17 (28.3)	10 (16.7)	11 (18.3)
<input type="checkbox"/> Small	26 (43.3)	31 (51.7)	29 (48.3)
<input type="checkbox"/> Medium	14 (23.3)	16 (26.7)	17 (28.3)
<input type="checkbox"/> Large	3 (6)	3 (6)	3 (6)

<input type="checkbox"/> Central <input type="checkbox"/> Peripheral <input type="checkbox"/> Weight-bearing <input type="checkbox"/> Non weight-bearing			
Localization			
<input type="checkbox"/> Whole area of cartilage repair <input type="checkbox"/> > 50% <input type="checkbox"/> < 50%			
<input type="checkbox"/> Central <input type="checkbox"/> Peripheral <input type="checkbox"/> Weight-bearing <input type="checkbox"/> Non weight-bearing			
7. Subchondral lamina (Constitution of the subchondral lamina)			
<input type="checkbox"/> Intact	33 (56)	36 (60)	29 (48.3)
<input type="checkbox"/> Not intact	27 (46)	24 (40)	31 (51.7)
Localization			
<input type="checkbox"/> Whole area of cartilage repair <input type="checkbox"/> > 50% <input type="checkbox"/> < 50%			
<input type="checkbox"/> Central <input type="checkbox"/> Peripheral <input type="checkbox"/> Weight-bearing <input type="checkbox"/> Non weight-bearing			

References

- Oei, E. H., Tiel, J. V., Robinson, W. H., & Gold, G. E. (2014). Quantitative Radiologic Imaging Techniques for Articular Cartilage Composition: Toward Early Diagnosis and Development of Disease-Modifying Therapeutics for Osteoarthritis. *Arthritis Care & Research*, 66(8), 1129-1141.
- Link, T. M. (2011). MRI of Cartilage: Standard Techniques. *Cartilage Imaging*, 49-66.