



7th Advanced Course on Knee Surgery - 2018:

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## *“Imaging of cartilage lesions and after cartilage repair”*

Presenter: Anders Troelsen, MD, ph.d., dr.med., Professor



Clinical Orthopaedic Research  
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## *Imaging in cartilage lesions*

- Conventional x-ray
- MRI
- MR- Arthrography
- CT- Arthrography



*...Can the surgeon rely on these imaging modalities...?*

By Thienpont, Knee, 2014

# Imaging in cartilage lesions

- Conventional x-ray
  - Limited diagnostic value
  - Assessment of: Alignment, intra- and extra-articular deformity
  - Gross assessment of bony trauma to the knee



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# Imaging in cartilage lesions

- MRI
  - Strengths:
    - Widely accessible and used for intraarticular pathologies
  - Limitations:
    - At assessment of superficial alterations
    - Artifacts when truncation
  - Sensitivity: 25-65 %
  - Specificity: 50-98 %



## MR and CT Arthrography of the Knee

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Semin Musculoskelet Radiol 2012;16:57-68.

By Thienpont, Knee, 2014

# Imaging in cartilage lesions

- MR - Arthrography
  - Limitation:
    - Less accessible and invasive
  - Strengths:
    - Contrast insinuates between cartilage and other structures
  - Sensitivity: 75-93 %
  - Specificity: 98-100 %

## MR and CT Arthrography of the Knee

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## *Sensitivity and specificity*

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- Sensitivity= Detection of true positives
  - Sensitivity ↑ False negatives ↓
- Specificity= Detection of true negatives
  - Specificity ↑ False positives ↓

# Imaging in cartilage lesions

- CT - Arthrography
  - Limitation:
    - Less accessible, invasive and radiation to the patient
  - Strengths:
    - Contrast insinuates between cartilage and other structures
  - Sensitivity: MR < CT-A ≠ MR-A
  - Specificity: MR < CT-A ≠ MR-A

## MR and CT Arthrography of the Knee

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By Thienpont, Knee, 2014

# Imaging in cartilage lesions

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KNEE

## Accuracy of magnetic resonance imaging, magnetic resonance arthrography and computed tomography for the detection of chondral lesions of the knee

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### Abstract

**Purpose** To assess the diagnostic test accuracy of magnetic resonance imaging (MRI), magnetic resonance arthrography (MRA) and computed tomography arthrography (CTA) for the detection of chondral lesions of the patellofemoral and tibiofemoral joints.

**Methods** A review of published and unpublished literature sources was conducted on 22nd September 2011. All studies assessing the diagnostic test accuracy (sensitivity/specificity) of MRI or MRA or CTA for the assessment of adults with chondral (cartilage) lesions of the knee (tibiofemoral/patellofemoral joints) with surgical comparison (arthroscopic or open) as the reference test were included. Data were analysed through meta-analysis.

**Results** Twenty-seven studies assessing 2,592 knees from 2,500 patients were included. The findings indicated that whilst presenting a high specificity (0.95–0.99), the sensitivity of MRA, MRI and CTA ranged from 0.70 to 0.80. MRA was superior to MRI and CTA for the detection of

patellofemoral joint chondral lesions and that higher field-strength MRI scanner and grade four lesions were more accurately detected compared with lower field-strength and grade one lesions. There appeared no substantial difference in diagnostic accuracy between the interpretation from musculoskeletal and general radiologists when undertaking an MRI review of tibiofemoral and patellofemoral chondral lesions.

**Conclusions** Specialist radiological imaging is specific for cartilage disease in the knee but has poorer sensitivity to determine the therapeutic options in this population. Due to this limitation, there remains little indication to replace the 'gold-standard' arthroscopic investigation with MRI, MRA or CTA for the assessment of adults with chondral lesions of the knee.

**Level of evidence** II.

**Keywords** Cartilage defect · MRI · MRA · CTA · Arthroscopy · Sensitivity · Specificity



By Thienpont, Knee, 2014



# Imaging in cartilage lesions

- Conclusions:
  - Your choice will depend on your musculoskeletal imaging setup
  - Arthrography seem ideal for diagnosing cartilage lesions in the ideal world
  - You need to be aware of limitations in diagnosing cartilage lesions
  - Are the literature results transferable to your setup?



By Thienpont, Knee, 2014

# *Imaging after cartilage repair*

- MRI is considered the gold-standard
- Combination of morphologic and compositional imaging techniques
- MOCART – grading system for postoperative scoring of repaired cartilage

Review Article

## **Understanding Magnetic Resonance Imaging of Knee Cartilage Repair: A Focus on Clinical Relevance**

**Daichi Hayashi<sup>1,2</sup>, Xinning Li<sup>3</sup>, Akira M. Murakami<sup>1</sup>,  
Frank W. Roemer<sup>1,4</sup>, Siegfried Trattnig<sup>5</sup>, and Ali Guermazi<sup>1</sup>**

CARTILAGE  
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Radiology

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### **State of the Art:** MR Imaging after Knee Cartilage Repair Surgery<sup>1</sup>

Cartilage injuries are common, especially in athletes. Because these injuries frequently affect young patients, and they have the potential to progress to osteoarthritis, treatment to alleviate symptoms and delay joint degeneration is warranted. A number of surgical techniques are available to treat focal chondral defects, including marrow stimulation, osteochondral auto- and allografting, and autologous chondrocyte implantation. Although arthroscopy

# Imaging after cartilage repair

Hayashi et al.

3

**Table 1.** Summary of MOCART Scoring System for Cartilage Repair Tissue.

Features Evaluated	Scores
Defect fill (degree of defect repair and filling of the defect in relation to the adjacent cartilage)	0%; 0% to 25%; 25% to 50%; 50% to 75%; 75% to 100%; 100%; 100% to 125%; 125% to 150%; 150% to 200%; >200%
Cartilage interface (integration with adjacent cartilage to border zone in two planes)	Scored using sagittal (femur, patella, trochlea, tibia), coronal (femur, tibia), and axial (patella, trochlea) planes. Complete; demarcating border visible (split-like); defect visible <50%; defect visible >50%
Bone interface (integration of the transplant to the subchondral bone; integration of a possible periosteal flap)	Complete; partial delamination; complete delamination; delamination
Surface (constitution of the surface of the repair tissue)	Surface intact; surface damaged <50% of depth; surface damaged >50% of depth; adhesions
Structure (constitution of the repair tissue)	Homogeneous; inhomogeneous or cleft formation
Signal intensity (intensity of MR signal in 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)	Normal; nearly normal; abnormal
Subchondral lamina (constitution of the subchondral lamina)	Intact; not intact
Chondral osteophytes (osteophytes within the cartilage repair area)	Absent; osteophytes <50% of repair tissue; osteophytes >50% of repair tissue
Bone marrow edema (maximum size and localization in relation to the cartilage repair tissue and other alterations assessed in the 3D MOCART score)	Absent; small (<1 cm); medium (<2 cm); large (<4 cm); diffuse
Subchondral bone (constitution of the subchondral bone)	Intact; granulation tissue; cyst
Effusion (approximately size of joint effusion visualized in all planes)	Absent; small; medium; large

# *Imaging after cartilage repair - conclusion*

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- The correlation between MRI and clinical outcome remains undetermined

## **Is Magnetic Resonance Imaging Reliable in Predicting Clinical Outcome After Articular Cartilage Repair of the Knee?** CME

### **A Systematic Review and Meta-analysis**

Tommy S. de Windt,\* MD, Goetz H. Welsch,<sup>†‡</sup> MD, Mats Brittberg,<sup>§</sup> MD, PhD,  
Lucienne A. Vonk,\* PhD, Stefan Marlovits,<sup>||</sup> MD, MBA, Siegfried Trattnig,<sup>‡</sup> MD,  
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*Investigation performed at the University Medical Center Utrecht, Utrecht, the Netherlands*

## **Correlation Between Magnetic Resonance Imaging and Clinical Outcomes After Cartilage Repair Surgery in the Knee** CME

### **A Systematic Review and Meta-analysis**

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Matthew J. Matava,\* MD, Rick W. Wright,\* MD, and Robert H. Brophy,<sup>\*‡</sup> MD  
*Investigation performed at the Department of Orthopaedic Surgery,  
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**Conclusion:** The MRI findings do correlate with clinical outcomes after cartilage repair surgery in the knee, although the specific parameters that correlate best vary by the type of procedure performed. No current MRI classification system has been shown to correlate with clinical outcomes after all types of cartilage repair surgery.