

## MRI evaluation of the polyethylene tibial insert in total knee arthroplasty

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### Purpose

The purpose of this educational exhibit is to demonstrate the expected MRI appearance of the polyethylene tibial insert in different designs of total knee arthroplasty (TKA) in order to provide a normative atlas of the MRI appearance of the polyethylene tibial insert. Another aim is to discuss complications related to the polyethylene tibial insert which can be visualized with MRI.

### Outline of content

#### Introduction

The polyethylene tibial insert in total knee arthroplasty has been conventionally assessed with weightbearing radiographs although analysis is influenced by patient positioning and direction of the x-ray beam.<sup>1</sup> Ultrasound has also been described to measure the thickness of the polyethylene tibial insert, although evaluation is limited to the peripheral portion.<sup>2</sup>

#### MRI scanning considerations

Traditionally, MRI has been limited in evaluating the total knee arthroplasty due to significant susceptibility artifact associated with metal prostheses. More recent developments in techniques for metal artifact reduction including the multiacquisition variable-resonance image combination (MAVRIC) sequence can significantly improve visualization of the polyethylene/metal and metal/bone interfaces as well as the periprosthetic soft tissues.<sup>3</sup>

#### Knee arthroplasty design and polyethylene tibial insert appearance

The different MRI appearances of the polyethylene tibial insert will be demonstrated and correlated with gross photographs of the corresponding retrieved prostheses of the following designs:

- Posterior cruciate sparing and posterior cruciate retaining
- Mobile-bearing
- Semi-constrained and constrained

#### Complications of the polyethylene tibial insert

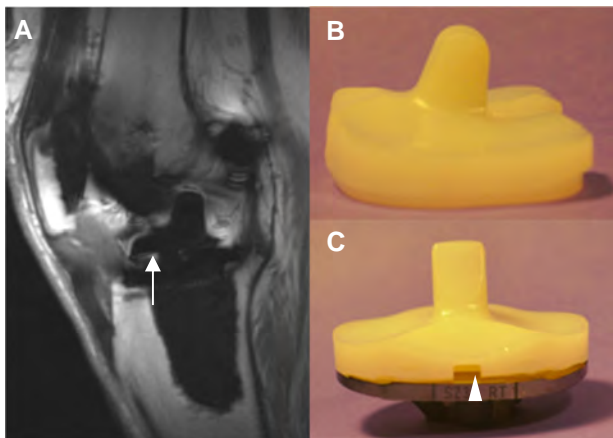
- Polyethylene wear resulting in cracking, delamination and gross deformation
- Fracture of the polyethylene tibial insert
- Dissociation of the polyethylene tibial insert or locking pin

### Summary

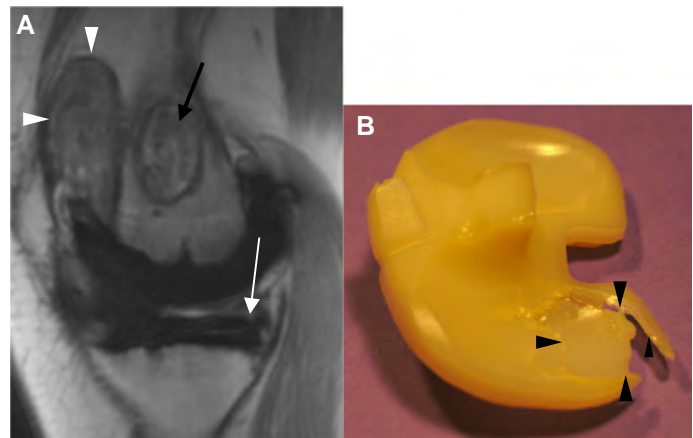
The expected MRI appearance of the polyethylene tibial insert in total knee arthroplasty varies by device design. MRI is useful in evaluating the polyethylene tibial insert and can detect associated complications.

### References

1. Collier MB, Jewett BA, Engh CA. Clinical assessment of tibial polyethylene thickness: comparison of radiographic measurements with as-implanted and as-retrieved thicknesses. *The Journal of Arthroplasty* 2003; 18:860-866.
2. Sofka CM, Adler RS, Laskin R. Sonography of polyethylene liners used in total knee arthroplasty. *AJR* 2003; 180:1437-1441.
3. Hayter CL, Koff MF, Shah P, et al. MRI after arthroplasty: comparison of MAVRIC and conventional fast spin-echo techniques. 2011; 197:W405-411.



**Figure 1.** (A) Sagittal MAVRIC FSE MR image in a patient with a Zimmer NexGen® LPS arthroplasty who subsequently underwent revision TKA. The morphology of the polyethylene tibial insert on MRI (A) corresponds to the photographic appearance (B,C) of the retrieved prosthesis. The apparent defect seen anteriorly (arrow) in the polyethylene tibial insert is an expected MRI finding, corresponding to the groove seen on the retrieved specimen (arrowhead).



**Figure 2.** (A) Sagittal MAVRIC FSE MR image in a patient with TKA demonstrates features of polymeric wear. There is bulky polymeric synovitis (white arrowheads) and osteolysis in the distal femur (black arrow). Contour irregularity of the polyethylene tibial insert posteromedially indicates cracking (white arrow). (B) Photograph of the polyethylene tibial insert following revision TKA 3 months later demonstrates gross cracking of the polyethylene (black arrowheads).