When Good Cartilage Goes Bad

"These images provide us with quantitative information about the cartilage ultrastructure. In this case (Case 1), it may aid in timing patellar realignment procedures."

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Orthopedic Surgeon
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"The quantitative T2 mapping has allowed us to discern cartilage breakdown prior to alteration in cartilage thickness. Note the blister formation over the lateral facet, where the cartilage appears relatively normal on the FSE sequence."

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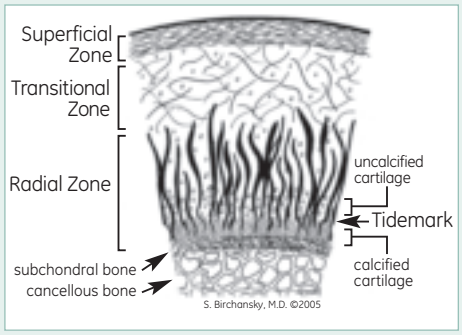
Articular Cartilage Ultrastructure

Components of Articular Cartilage Extracellular Matrix:

1. Proteoglycan
2. Collagen

Characteristics of Normal Collagen Orientation:

1. Superficial zone (<10%): parallel to surface (beyond resolution of clinical MRI)
2. Transitional zone (20-30%): more random collagen orientation – less angular dependence and longer T2 relaxation times
3. Deep radial zone (40-60%): collagen oriented perpendicular to subchondral zone – strong angular dependence: vertical striations evident and short T2 relaxation times



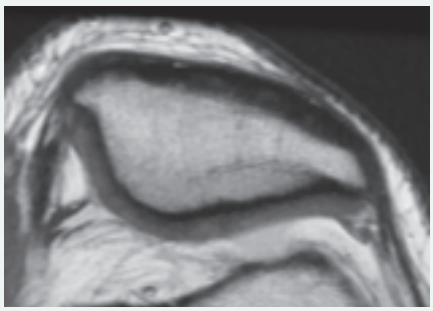
MR Musculoskeletal Imaging

The suite of musculoskeletal imaging solutions from GE Healthcare includes high-resolution imaging capabilities and clinical applications that aim to provide the physician with the appropriate tools to increase diagnostic confidence. One such application, CartiGram™, is a non-invasive imaging method that is ideal for the early evaluation and assessment of cartilage breakdown, particularly to assess articular cartilage integrity. It allows better visualization of collagen fiber network loss or degradation that translates into focal T2 increase. CartiGram provides the radiologist with increased diagnostic confidence and the orthopedic surgeon with the information needed to determine course of treatment, possibly to optimize the timing of a surgical procedure. It also helps with monitoring the effectiveness of treatment non-invasively, potentially eliminating a "second-look" biopsy.

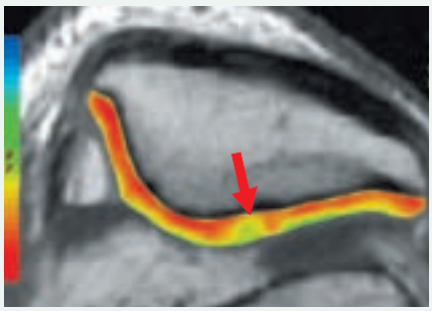
As the collagen component of articular cartilage breaks down, water in the cartilage becomes more mobile and results in a prolongation of T2 relaxation times. CartiGram (T2 relaxation time mapping) is a validated, non-invasive tool to visualize changes in the composition of cartilage, in some cases before changes in thickness can be seen.

Case 1

31-year-old man with chronic patellofemoral pain and normal radiographs.



Axial cartilage sensitive FSE demonstrates uniform thickness of cartilage.



CartiGram image demonstrates prolongation of T2 values focally over the lateral facet (arrow), indicating abnormal collagen orientation.

Clinical Utility of CartiGram T2 Mapping

Early detection of cartilage degeneration before the onset of physical symptoms can potentially offer more treatment options for the patient, particularly for those afflicted with osteoarthritis. The application is also useful to assess surgical outcomes by providing a measure of tissue characterization of the repaired tissue. ■