3D imaging of the knee takes a step forward

Fast 3D TSE sequence provides higher resolution knee imaging at MR Institut, Zurich
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“The high resolution and the ability to reformat the 3D data help us assess the cruciate ligaments much more effectively.”
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The MR Institut (Zurich, Switzerland), a private clinic within the Schulthess Clinic, is dedicated to orthopedics, rheumatology and the musculoskeletal system, focusing on joint and spine work. The MR Institut uses an Achieva 3.0T TX and is getting referrals from Schulthess clinic and from other facilities as well.

In his busy practice, Dominik Huber, MD, radiologist at MR Institut, competes with a large university hospital and a private hospital in the area. Dr. Huber recently implemented a fast 3D scan for his orthopedic patients. “We are introducing 3D imaging in MSK, currently focusing on the knee and shoulder joint,” says Dr. Huber. “We plan to expand 3D imaging to all major joints, such as the elbow, wrist, hip and ankle.”

3D TSE provides higher resolution and reformatting in any plane
Dr. Huber’s 3D TSE knee sequence is used with the 8-channel SENSE Knee coil and lasts on average about six minutes. This is longer than a single routine 2D sequence, but it has the potential to replace three individual 2D scans. One 2D scan only provides images in one plane, while one 3D scan provides both higher spatial resolution and the possibility to reformat into any desired orientation.

Dr. Huber says his 3D TSE sequences are characterized by high spatial resolution (usually 0.6 x 0.6 x 0.6 mm), which is a particular advantage when assessing the cartilage surfaces and smaller joint structures. In addition, the 3D dataset can be reformatted in any given plane. “The standard planes are reconstructed by the technologist on the console. On a separate workstation I then do the reporting, analysis and further reformatting that is needed to view the plane that is most appropriate to the joint and to the problem of the patient. This dynamic reformatting is done much like the analysis of large CT data sets and is the most important advantage of using the 3D technique: you don’t need to acquire as many planes separately and if you would like to tilt the image plane a little, you can really optimize that without another acquisition.”

Cartilage, ACL, meniscus scans benefit from 3D TSE
In knee imaging Dr. Huber recognizes three particular areas where these fast 3D sequences are an advantage. “First of all, in cartilage imaging the higher spatial resolution of 3D sequences allows me to see more subtle lesions much more effectively, especially when differentiating the two main bundles of the anterior cruciate ligament (ACL), as these can be assessed separately. When examining the meniscus, we particularly see the reformatting being advantageous for visualizing radial and complex meniscal tears.”

3D TSE knee sequence enhances sports medicine imaging
“We currently use the 3D TSE sequence in roughly 25% of our cases,” says Dr. Huber, “mainly in younger individuals who may have a sports injury or other smaller injury. Patients are expected to lie still during the complete scan, because if motion occurs, the 6-minute scan is lost. We see 3D techniques being used more and more in orthopedics, and we plan to begin using it for other joints besides knee and shoulder, because it can increase the value of the exam.”

Osteochondral lesion (2D vs. 3D acquisition)
72-year-old male with medial knee pain, 6 weeks after falling down. The 2D image shows a poorly defined cartilage lesion with a small area of subchondral marrow edema. The extent of the full thickness cartilage defect is definitely better appreciated on the 3D image due to its higher spatial resolution (0.6 x 0.6 x 0.6 mm vs. 3 x 0.4 x 0.6 mm).
Old tear of posterolateral bundle of ACL

22-year-old male athlete with a sensation of slight instability on exertion and a history of a skiing injury in the past. The ACL (anterior cruciate ligament) appears to be in continuity on the primary sagittal image. However, two separate reconstructions (in the plane of the ACL and perpendicular to it) show only the anteromedial bundle of the ACL. The torn posterolateral bundle of the ACL is not visualized.

Currently, Dr Huber adds two to three routine sequences to the exam, such as a basic 2D T1-weighted sequence, because detection of certain bone marrow changes and fracture lines can be easier on the conventional images. “However,” he says, “we hope to reach a situation where the 3D scan is so robust that it can be the only scan needed for a complete, high quality exam that can help increase our productivity.”

**Achieva 3.0T TX provides exceptional image quality**
The MR Institut has been using its Achieva 3.0T system for two years, and recently upgraded to Achieva 3.0T TX with MultiTransmit technology. MultiTransmit reduces dielectric shading by using multiple RF sources to adapt the RF signal to the individual patient, to obtain more uniform, consistent images.

“In my view, MultiTransmit makes a big difference in our spine and pelvic/hip exams,” says Dr. Huber. “We’ve seen big improvements in the signal-to-noise ratio and in the uniformity of our images for a given imaging time since we began using MultiTransmit six months ago.”

Dr. Huber says 3.0T is becoming the standard for orthopedic imaging, whereby the significant gain in signal-to-noise ratio can be used for either increasing spatial resolution or decreasing imaging time for enhanced productivity. “I don’t think many people prefer buying a 1.5T anymore. Going to 3.0T was a big improvement for us. I even think it will become the standard for all imaging, not just MSK.”

“Meniscal cyst

36-year-old male runner with increasing pain posteromedially. There is an extensive horizontal tear of the medial meniscus with an associated meniscal cyst. The full extent of the cyst and its relationship to the posterior horn of the affected meniscus is particularly well seen on the reconstruction in the axial meniscal plane.

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