



Musculoskeletal MRI Clinical Cases with Signa HD 1.5T and CartiGram

Laveran Hospital (Marseilles, France) is a 200-bed military hospital that consists of a large population of young patients with sports-related injuries. Since the installation of the new GE Signa® HD 1.5T with a Signa HD Knee Array, the image quality has dramatically increased, giving the radiologists even more diagnostic confidence. High-Definition (HD) MR enables the radiologist to better analyze the morphology of various joint structures, whereas the CartiGram™ T2 study assists in the early evaluation of cartilage diseases and provides the orthopedic surgeon with the information needed to determine an appropriate course of treatment.

Knee

The Signa HD Knee Array features an innovative hybrid technology along with an ergonomic design that together provide patient comfort. These features include:

- A split-top opening enables the coil to pivot and slide laterally on its base. The handle bar locks the top and secures the bottom on the base.
- PURE coil signal intensity correction is based on coil intensity profile calibration and requires no additional scan or processing time.
- Quadrature Birdcage is used for RF power transmission and as the receive coil during the Prescan and PURE calibration. Key feature is a “twisted” birdcage for a more uniform RF deposition within the excitation volume.
- Phased Array elements (8) are used for signal reception and when tapered to the knee anatomy provides exceptional signal-to-noise performance.

Technology Leadership

The hybrid technology of the transmit and receive coil brings outstanding chemical fat saturation across the entire imaging volume. In addition, the transmit and receive operation offers two key advantages:

- Reduced specific absorption rate (SAR) or RF power, enabling higher throughput for more slices per TR;
- No wraparound from the other knee or popliteal flow artifacts from swapping phase and frequency.

According to Professor J.F. Briant, Head of the Radiology Department, Laveran Hospital, "Thanks to the Signa HD Knee Coil, the image quality of our musculoskeletal examinations has improved considerably.

The HD Knee Array provides enough signal-to-noise ratio (SNR) to allow us to acquire very thin slices with high resolution while maintaining high contrast. These two image quality criteria provide a better morphological analysis and overall signal in each of the joint structures: the menisci, ligaments, cartilage, sub-chondral bone and soft tissue."

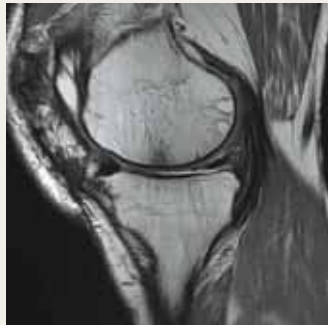
Case 1: High-resolution Imaging with Signa HD

40-year old male suffering from knee pain after medical history of algodystrophy secondary to a synovectomy.

Small area of sub-chondral necrosis of the medial femoral condyle



Coronal T1
416x320 matrix
3mm thickness, 16 slices
3min 00s scan time

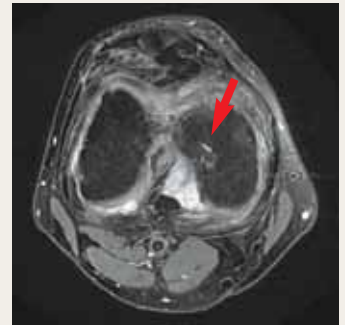


Sagittal PD
512x384 matrix
3mm thickness, 24 slices
3min 29s scan time

Small area of sub-chondral cystic necrosis



Coronal PD and Fat Sat
512x320 matrix
3mm thickness, 20 slices
3min 51s scan time



Axial PD and Fat Sat
512x320 matrix
2.6mm thickness, 20 slices
3min 35s scan time

Linear intra-menisal hypersignal: meniscopathy without fissure



Sagittal PD
512x384 matrix
3mm thickness, 24 slices
3min 29s scan time



Coronal PD and Fat Sat
512x320 matrix
3mm thickness, 20 slices
3min 51s scan time

Fatty focal areas following algodystrophy



Coronal T1
416x320 matrix
3mm thickness, 16 slices
3min 00s scan time



Sagittal PD
512x384 matrix
3mm thickness, 24 slices
3min 29s scan time

CartiGram

CartiGram is a non-invasive imaging method to assess articular cartilage integrity. It allows clinicians to better see collagen fiber network loss or degradation that translates into focal T2 increase.

CartiGram is based on a multi-echo pulse sequence derived from the existing FSE-XL that can create up to 8 echoes per single acquisition. Typically, not more than eight echoes are acquired, due to the cartilage short T2 relaxation times. CartiGram then calculates a mono-exponential pixel-by-pixel fit from the real signal decay curve. By providing information needed to help determine the appropriate course of treatment, CartiGram can reduce unnecessary arthroscopy and provide the required images to monitor the effectiveness of treatment noninvasively, eliminating the need for a "second-look" biopsy.

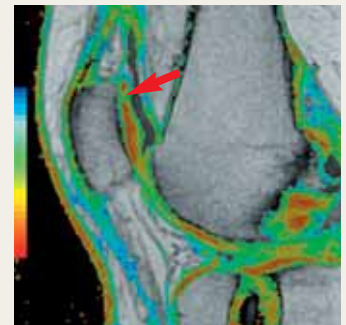
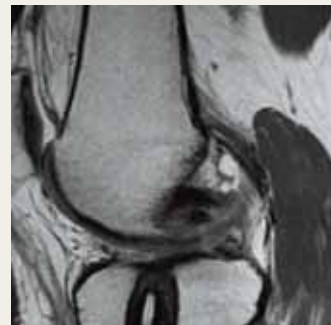
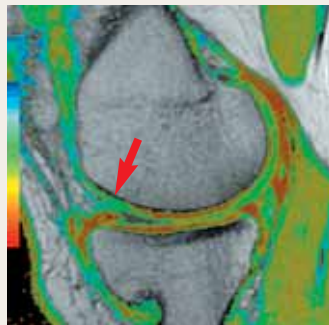


"The new Signa HD Knee Array allows us to produce, in clinical routine, high-quality examinations of the knee. The access to the exploration of the cartilage, thanks to the T2-Mapping sequence, offers a new perspective to diagnose and treat chondropaties at an early stage," said Prof. Briant.

CartiGram is an optional feature available only on the Signa HDx platform. The following clinical case was acquired with a prototype version tested by Hospital Laveran. ■

Cartilage thinning of the anterior section of the medial femoral condyle (arrow), also presenting signal discrepancies in favor of oedema

Focal strain area in the supero-medial portion of the patellar cartilage (arrow)

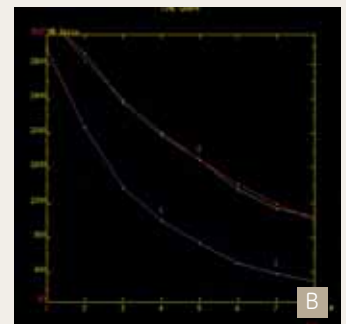
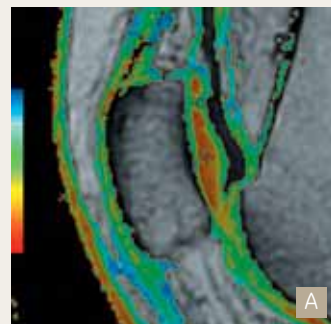


Sagittal PD FSE
512x384 matrix
2.4mm thickness, 24 slices
3min 29s scan time

Sagittal T2 Mapping
256x224 matrix
3mm thickness, 8 echoes, 13 slices
6min 01s scan time

Case 2: Cartilage Imaging and CartiGram

24-year old female competition volleyball player, presenting with pain in flexion following ACL-PCL ligament surgery.



Colored map (A) showing T2s from 20ms in red to 80ms in blue, with calculated T2 values from ROIs. ROI #2 green curve (B) shows the 8-echo signal pattern and the red curve shows the calculated monoexponential fit.