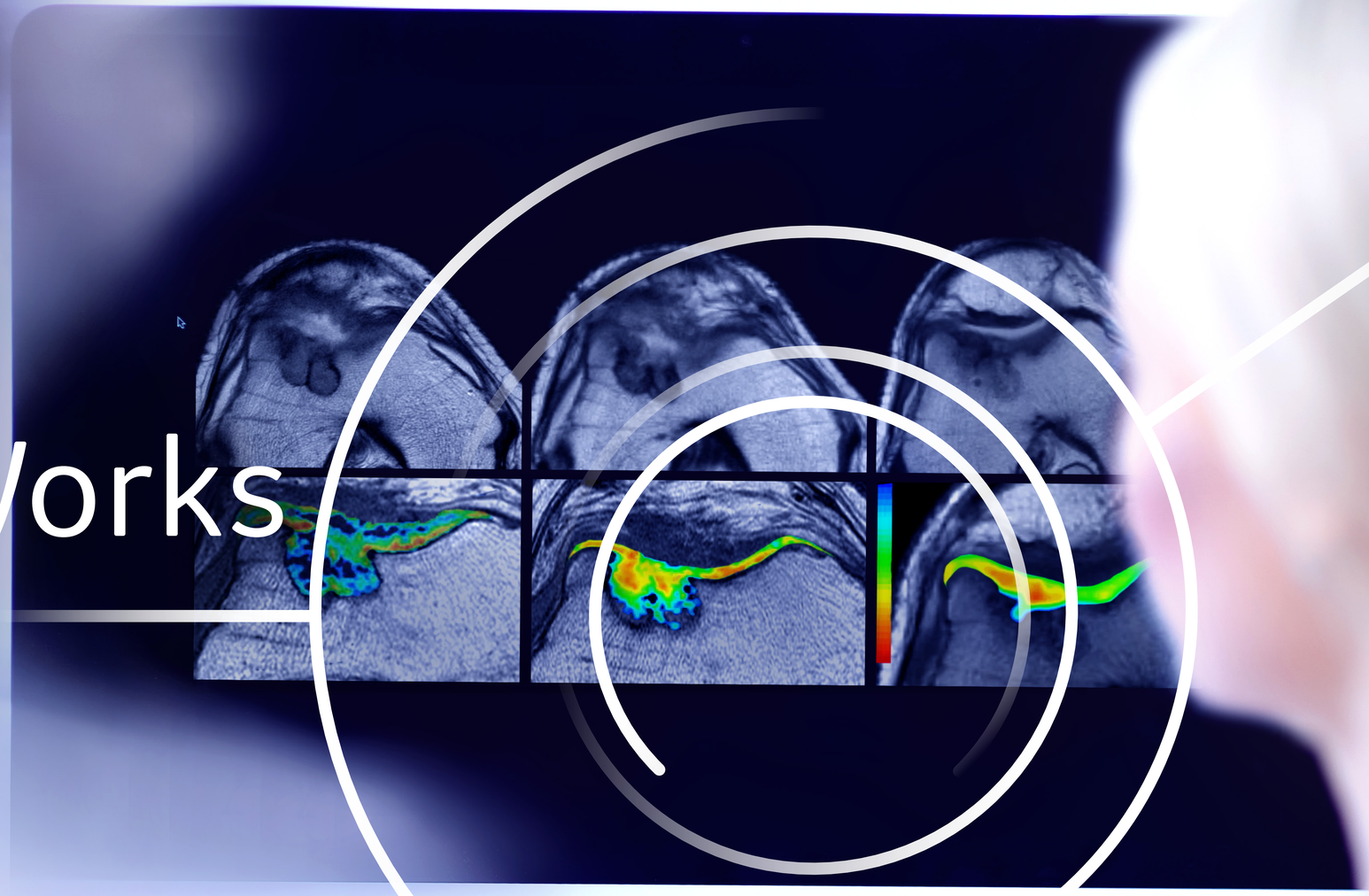
GE Healthcare
Tomorrow Today

OrthoWorks



SIGNA™Works
Fueling the future of MR

SIGNA™Works

The new standard is extraordinary

Our new SIGNA™Works productivity platform redefines productivity across the breadth of our core imaging techniques. It takes full advantage of Total Digital Imaging (TDI), further advancing diagnostics and quickening throughput, while improving patient outcomes and your ROI. It is upgradeable and customizable with additional applications to suit your growing practice.

Standard Applications

Energize your clinical capabilities with all the tools you need to complete an exam. Imaging solutions cover a variety of contrasts, 2D and 3D volumetric data and motion correction capabilities.

find out more

Innovative Applications

Expand your expertise to the next level, to deliver improved image quality, higher efficiency and a more streamlined workflow, so you perform better than ever before.

find out more

Not all Elective Applications come standard on every system. Please contact your GE Representative for the most current information.

SIGNA™Works

The new standard is extraordinary

- **Standard Applications**
- Innovative Applications

BodyWorks

One of the fastest growing areas in MR, BodyWorks allows you to image abdominal and pelvic anatomy with user flexibility to adapt to different patient types.

CVWorks

Gain crucial insights into vascular structure and flow dynamics and access morphology, flow, function and tissue viability with CVWorks.

NeuroWorks

This one-stop solution enables you to image brain, spine, vascular and peripheral nerve anatomy with exceptional tissue contrast.

OncoWorks

Delivers robust tissue contrast, motion-insensitive, high temporal and spatial resolution imaging techniques that capture anatomical and morphological data for oncological assessment.

OrthoWorks

This extensive library of musculoskeletal imaging techniques enables you to image bone, joint and soft tissue with remarkable tissue contrast.

PaedWorks

Delivers distinctive child-centered imaging techniques that provide ease of use for the user and clinical excellence for your smallest, most fragile patients.

SIGNA™Works

The new standard is extraordinary

Standard Applications

▶ **Innovative Applications**

HyperWorks

HyperWorks means hyper scanning with astonishing imaging and impressive speed. It includes HyperSense, which can deliver higher spatial resolution images or reduced scan times.

ImageWorks

ImageWorks boosts your overall MR performance. READYView visualization and MAGiC one-and-done scanning help ensure consistent and clear results.

SilentWorks

SilentWorks is GE's most advanced noise reducing technology. Traditional exams can be extremely loud. SilentWorks brings the sound level down to ambient noise.

ViosWorks

ViosWorks reduces the complexity and cost of cardiac imaging. For the first time, all 7 dimensions of information can be captured in a cardiovascular scan in 10 minutes or less.

OrthoWorks

The OrthoWorks package is an extensive library of musculoskeletal imaging techniques that provide dynamic imaging of bone, joint and soft tissue with remarkable tissue contrast.

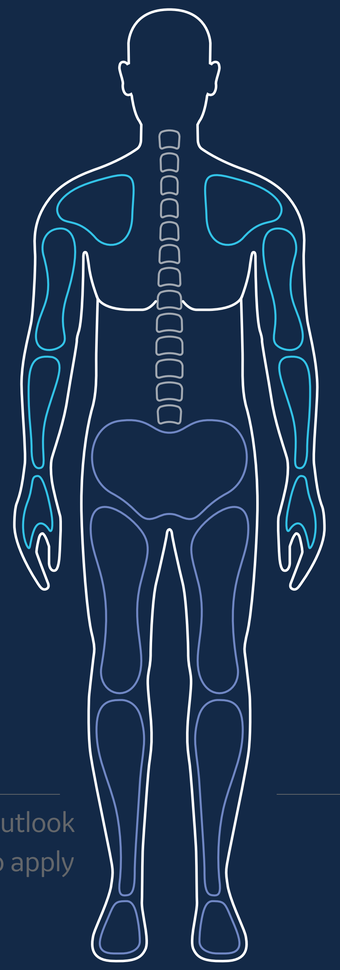
- Standard Applications
- Elective Applications
- Innovative Applications

Lower and upper extremity scans as a proportion of all MR procedures

24%

Spine scans as a proportion of all MR procedures

24%*



Increase in MR procedure volume from 2013 to 2016

+33% Upper extremities

+28% Lower extremities

Source: IMV 2016 MR Market Outlook

* Spine as a category could also apply to neurology

Not all Elective Applications come standard on every system. Please contact your GE Representative for the most current information.

OrthoWorks

Standard Applications

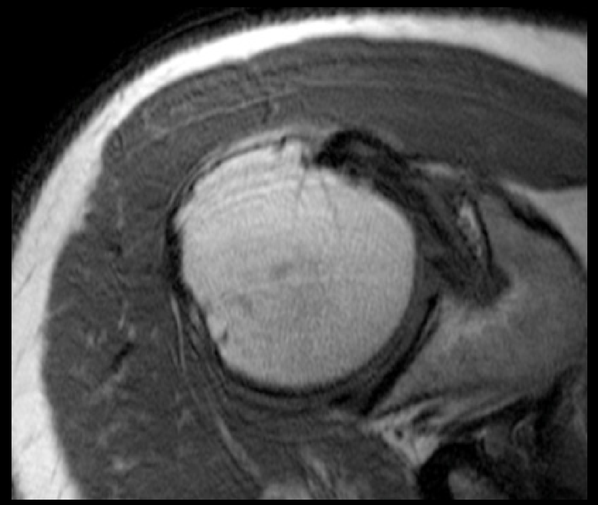
PROPELLER

PROPELLER Multi-Blade (MB) is a multi-shot approach that preserves tissue contrast regardless of weighting while also reducing motion artifacts and providing a more signal-rich image. Additionally, this technique allows for all contrasts for 2D FSE: T1, T2, STIR and PD weightings.

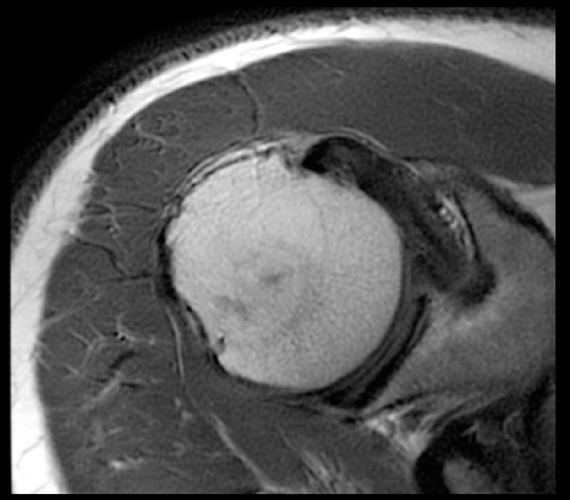
Clinical benefits:

- Delivers motion-artifact-free diagnostic images for voluntary and involuntary patient motion
- Increases productivity and decreases the number of repeated scans
- Enables sedation-free scanning and increases patient tolerance

Standard FSE



PROPELLER FSE



OrthoWorks

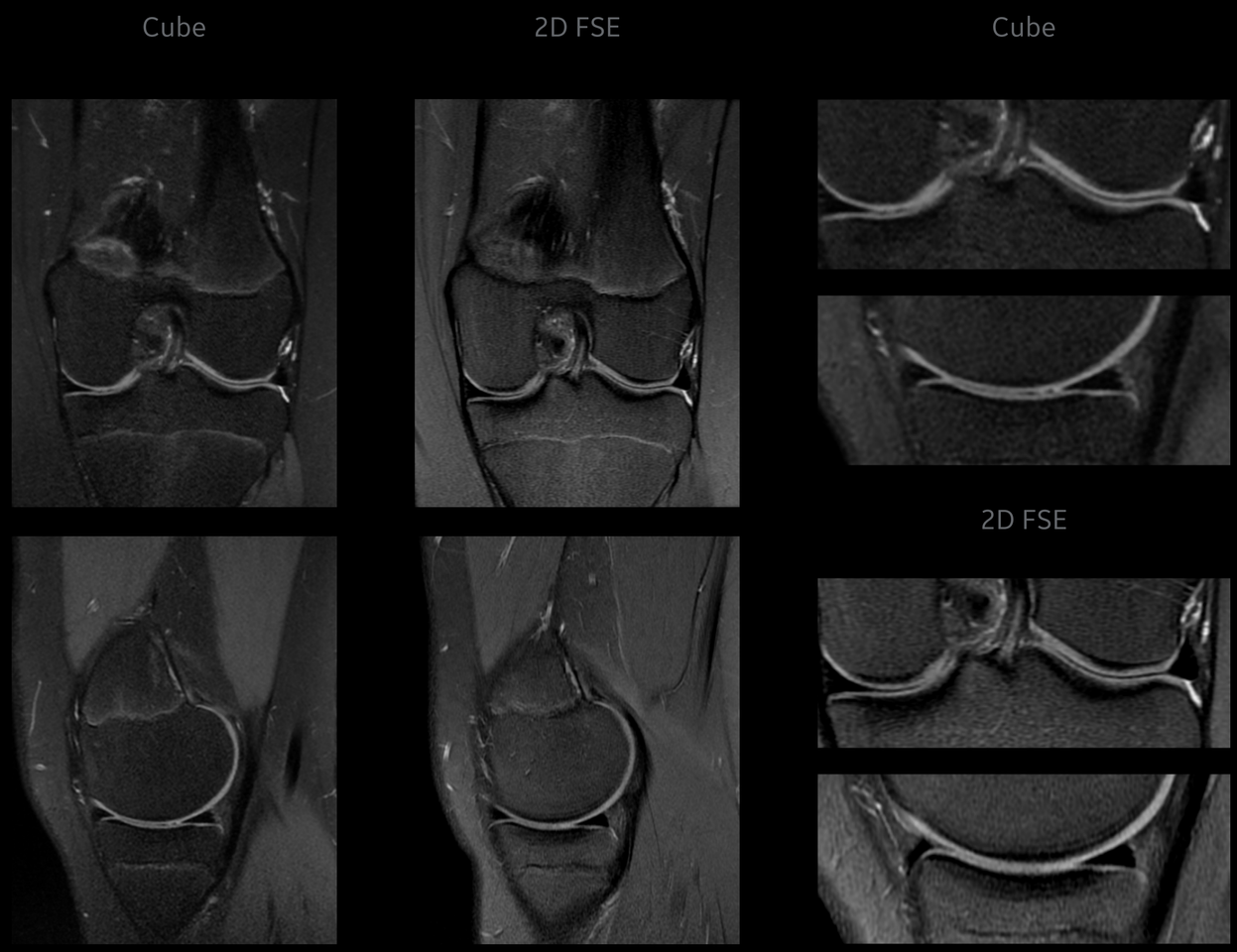
Standard Applications

Cube

Cube is our 3D volumetric imaging technique that can easily be reformatted into any plane. The SNR-rich submillimeter slices can provide partial volume averaging effect which helps to visualize even small and subtle abnormalities.

Clinical benefits:

- Scan once, then reformat to any plane with high sub-millimeter resolution
- Combines with ARC acceleration to reduce scan times
- Spatial anatomical localization for abnormalities
- Higher slice resolution compared to 2D imaging
- Can decrease flow artifacts



OrthoWorks
Standard Applications

Cube

34cm FOV, 1.2mm slice thickness 4:18 min

OrthoWorks

Standard Applications

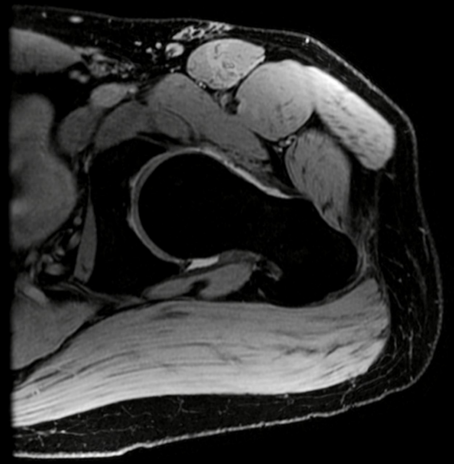
MERGE

Multi-Echo Recalled Gradient Echo (MERGE) uses multiple TE's to generate superior contrast and visualization of the different layers of cartilage in MSK imaging and better definition of gray/white matter in the spine. It can be acquired in 2D or in 3D with excellent spatial resolution, includes water excitation for elimination of fat, and maintains ligament visualization while adding soft tissue contrast.

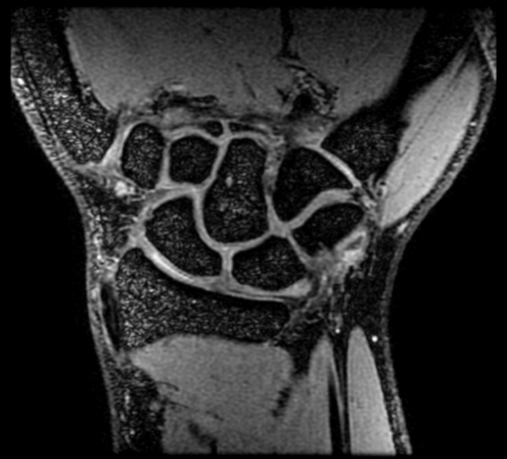
Clinical benefits:

- Distinguishes femoral and acetabular cartilage in the hip
- Helps visualize scaphoid fractures and delineation of ligaments in the wrist

3D MERGE



3D MERGE



3D GRE

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Standard Applications

2D FSE

FSE is a standard imaging technique that accelerates scan time based on Echo Train Length. It also produces sharp and crisp images with familiar contrasts, including PD, T1, T2 and STIR weightings. ARC and ASSET can be used to further accelerate scan times.

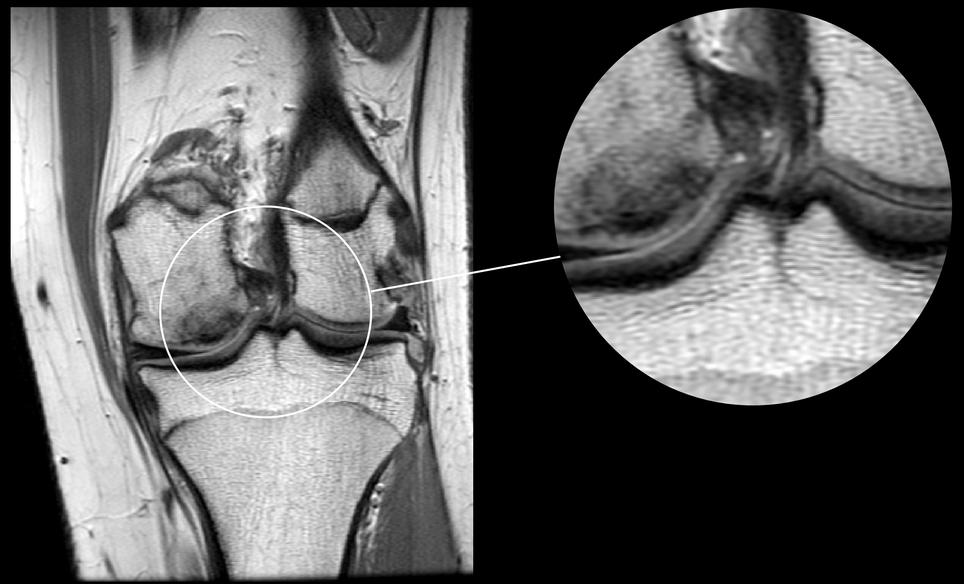
Clinical benefits:

- Fast, high resolution images with sharp edge detail
- Gold standard for MSK imaging
- Compatible with Flex for areas that are difficult to FatSat, such as ankles, toes and fingers

Osteochondritis dissecans

PD FatSat Coronal 0.4 x 0.6 x 2mm
3:22 min

PD Coronal 0.3 x 0.6 x 2mm
2:46 min



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Elective Applications

FSE Flex

Fast Spin Echo (FSE) Flex uses a 2-point Dixon technique that provides homogenous fat separation with water, fat, in-phase and out-of-phase images in a single scan. It provides robust imaging where chemical FatSat can fail, even in difficult-to-scan anatomies such as the feet, spine, hips, neck, hands and fingers.

Clinical benefits:

- Acquires multiple contrasts in a single scan, reducing need for multiple acquisitions
- Compatible with 2D and 3D imaging, which is helpful in challenging off-isocenter anatomies or larger fields of view
- Combines with ARC acceleration to reduce scan times

case study A | case study B

Hamstring Tear
PD FSE Flex Coronal and Sagittal, 400 x 400, 3mm slice 4:16 min

Not all Elective Applications come standard on every system. Please contact your GE Representative for the most current information.

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Elective Applications

Case Study: Assessing Axillary Lesion with FSE Flex

Clinical solutions

System: Discovery™ MR750w GEM

Protocols used

Axial T2 FSE Flex, Axial FOCUS DWI, Coronal T2 FSE Flex

Patient history

A 90-year-old patient with a known squamous cell carcinoma in the axilla was examined.

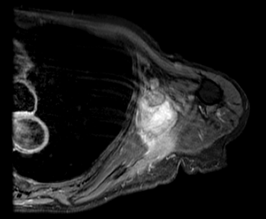
Procedure

FSE Flex and FOCUS DWI were used through the area of interest. Post contrast images included FSE Flex and 3D Turbo LAVA. Data was post-processed with READYView.

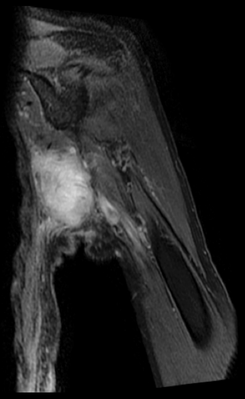
MR findings

With a previous diagnosis of squamous cell carcinoma, the lesion in the axilla could be a metastatic lesion from this or a new cancer. The results from the MR scan changed the course of treatment to determine the appropriate therapy for an axilla lesion.

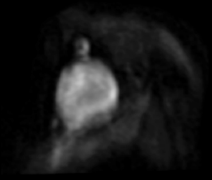
Axial T2 FSE Flex



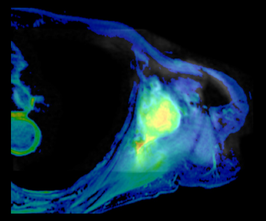
Coronal T2 FSE Flex



Axial FOCUS DWI



Fusion of FOCUS DWI to FSE Flex



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OrthoWorks
Elective Applications

Case Study: Imaging the Hand with FSE Flex

Clinical solutions

System: SIGNA™ Pioneer 3.0T
Coil: GEM Flex Small Coil

Protocols used

Coronal T1, Coronal STIR, Sagittal T2,
Axial PD FatSat, Axial PD Flex,
Axial T1 Flex (pre and post),
Coronal T1 Flex (pre and post)

Patient history

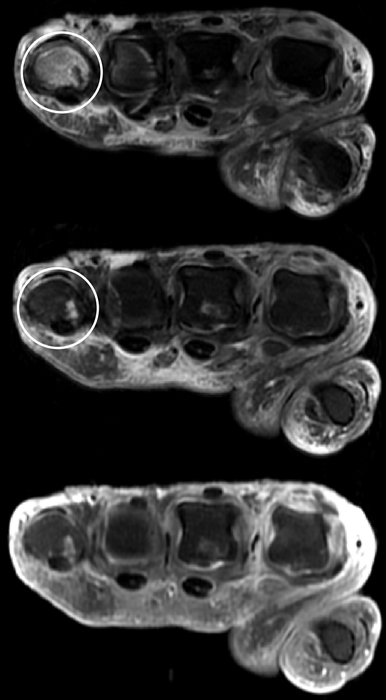
A 78-year-old patient presented with pain and swelling in their hand following a scratch to the forearm. Patient had an embedded piece of steel in the affected hand from 30 years prior. Metal artifact was not able to be removed.

Procedure

Using FSE Flex greatly enhanced diagnostic confidence due to poor saturation caused by the steel artifact, and also saved time.

MR findings

The specific source of infection was not determined but would have been deemed inconclusive if we were unable to obtain homogeneous fat saturation. Diagnostic confidence is greatly improved in the presence of tissue susceptibility.



Axial PD FatSat

Axial PD Flex

Axial T1 Flex Post

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Not all Elective Applications come standard on every system. Please contact your GE Representative for the most current information.

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Elective Applications

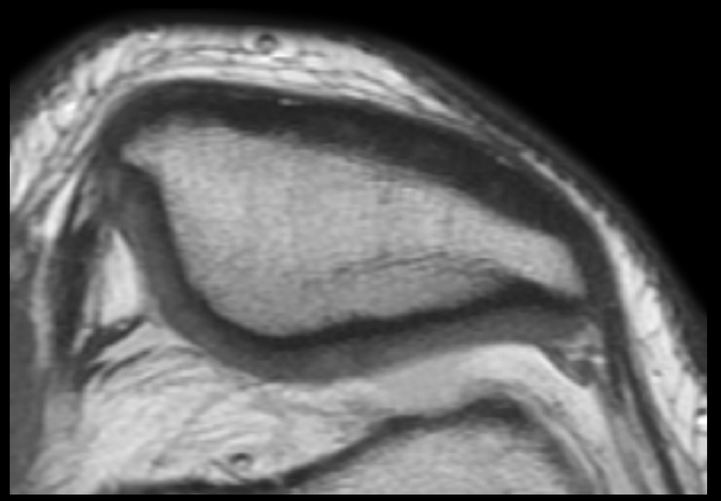
CartiGram

A non-invasive imaging technique designed to quantitatively assess cartilage degeneration.

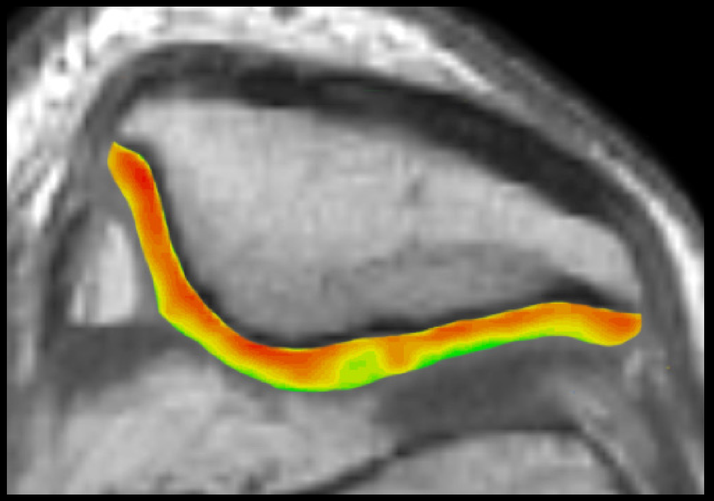
Clinical benefits:

- Ideal for early detection of cartilage collagen breakdown
- Effective for evaluation and staging of osteoarthritis
- Useful for post-therapy assessment

2D PD FSE



CartiGram

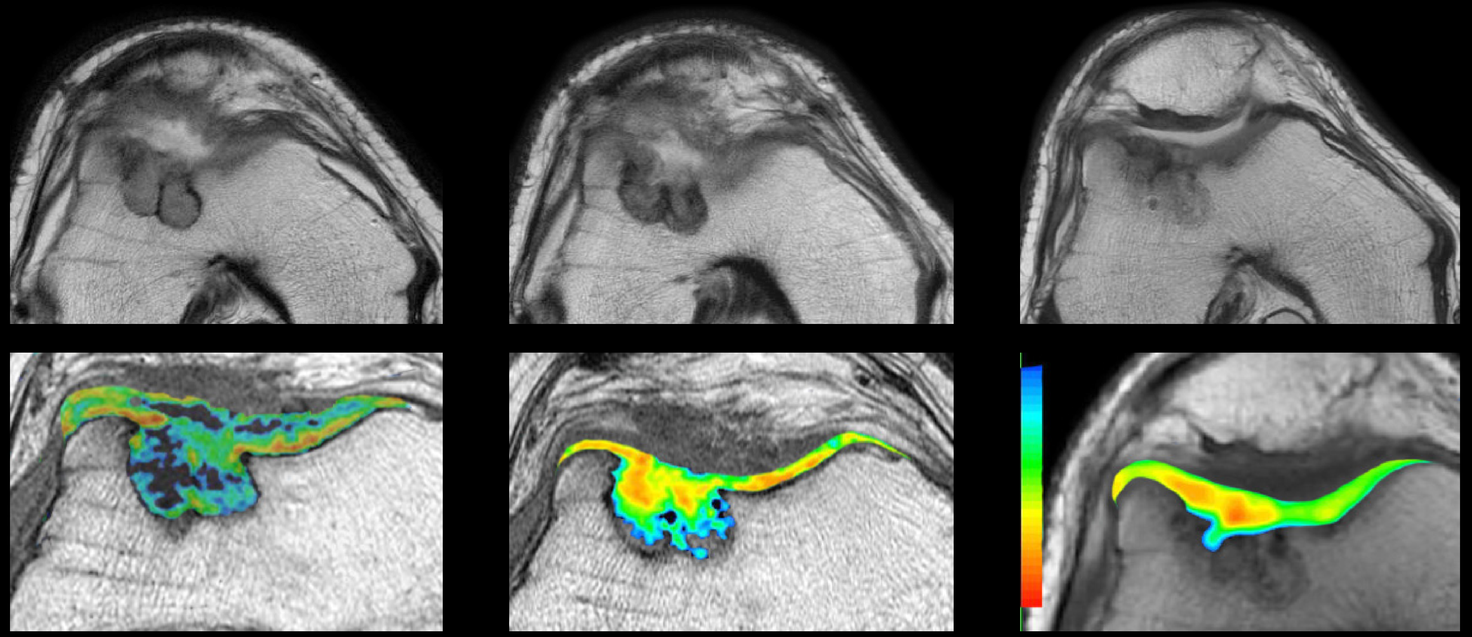


OrthoWorks
Elective Applications

CartiGram

Late teen with biphasic scaffold plugs into trochlea
T2 Map helps to demonstrate progressive organization of repaired tissue

8 months post-op | 13 months post-op | 27 months post-op



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OrthoWorks
Elective Applications

MAVRIC SL

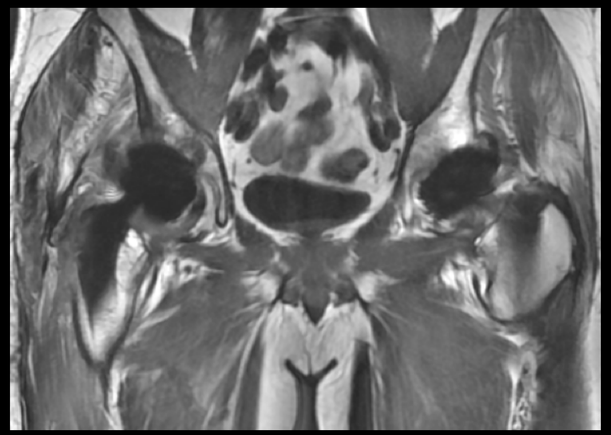
Multi-acquisition with Variable Resonance Image Combination SeLective (MAVRIC SL) is an advanced technique designed to greatly reduce artifacts while imaging soft tissue and bone near MR conditional metallic devices. It also acquires different offsets to remove metal implant distortions.

Clinical benefits:

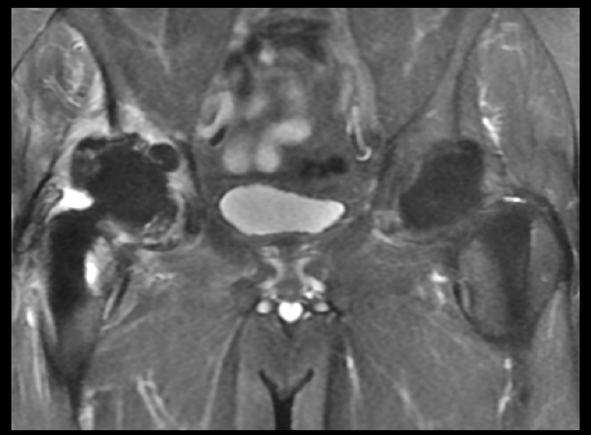
- Evaluates arthroplasty complications
- Acquires several 3D FSE images to produce a single composite image
- Visualizes fluid near an implant

case study A | case study B

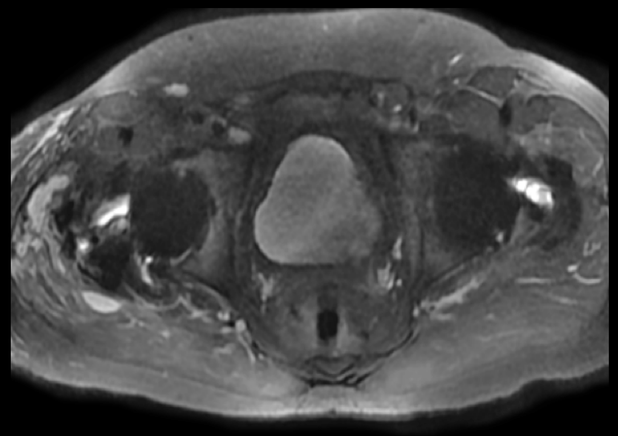
T1 MAVRIC SL



STIR MAVRIC SL



STIR MAVRIC SL



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OrthoWorks
Elective Applications

Case Study: Imaging Hip Replacement with MAVRIC SL

Protocols used

Coronal T1 MAVRIC SL, Coronal STIR MAVRIC SL, Axial STIR MAVRIC SL

Patient history

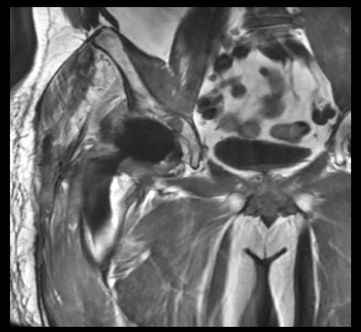
A patient presented with pain and an infection in the pelvic region.

MR findings

MAVRIC SL sequences clearly demonstrated inflammatory changes surrounding the right hip replacement and a moderate effusion in the right hip. The right prosthesis was protruding outside the right femoral stem and there was an infection in the right hip joint.

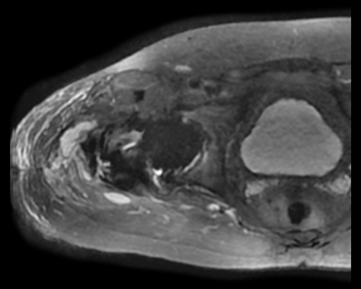
MAVRIC SL helped to determine that an orthopedic surgeon, not a vascular surgeon, was need for hip revision surgery.

Coronal T1 MAVRIC SL



Coronal STIR MAVRIC SL

Axial STIR MAVRIC SL



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OrthoWorks
Elective Applications

Case Study: Assessing Metal Particle Disease with MAVRIC SL

Clinical solutions

System: Optima™ MR450w

Protocols used

Axial PD MAVRIC, Axial STIR MAVRIC, Coronal T1 MAVRIC, Coronal STIR MAVRIC

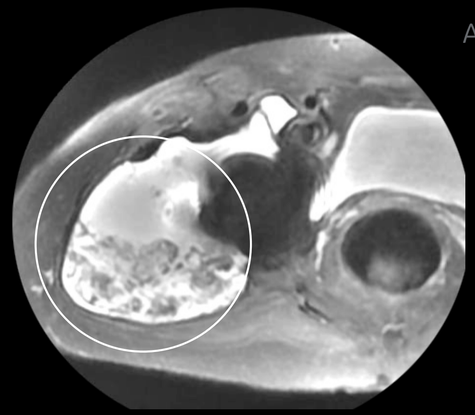
Patient history

An elderly patient presented with swelling and pain. Damage was indicated to the metal prosthesis.

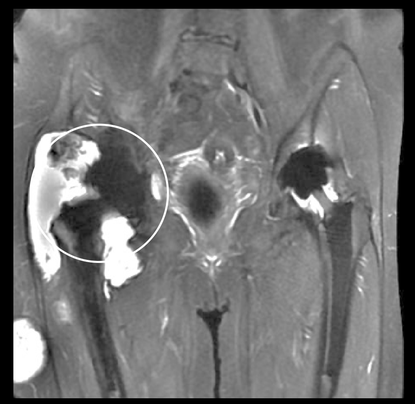
MR findings

A large collection of fluid was seen around the arthroplasty, which is an adverse local tissue reaction from a failed implant. Debris, believed to be metal deposits from the prosthesis, was shown floating in the fluid. This is due to re-absorption of metal on metal hip replacements.

Coronal T1 MAVRIC



Axial STIR MAVRIC



Coronal STIR MAVRIC

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Not all Elective Applications come standard on every system. Please contact your GE Representative for the most current information.

OrthoWorks
Innovative Applications

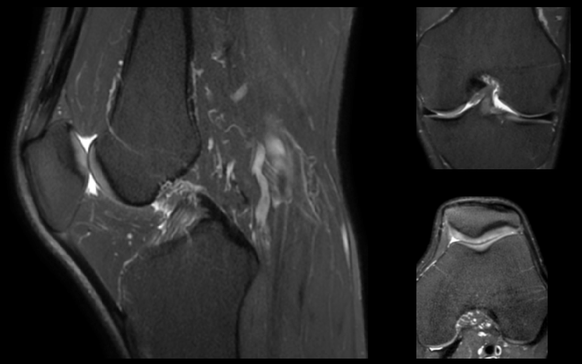
HyperSense

HyperSense is an acceleration technique based on sparse data sampling and iterative reconstruction, that delivers higher image resolution or reduced scan time, without the typical penalties of conventional parallel imaging. It is combined with ARC acceleration to maintain high SNR with shorter acquisition times.

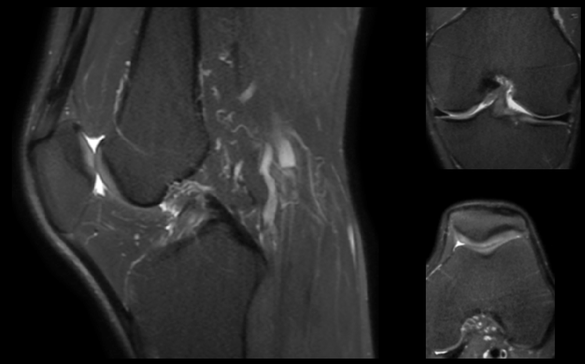
Clinical benefits:

- Lowers scan time, without reducing SNR
- Achieve outstanding resolution in the same amount of time
- Provides faster 3D imaging acquisitions

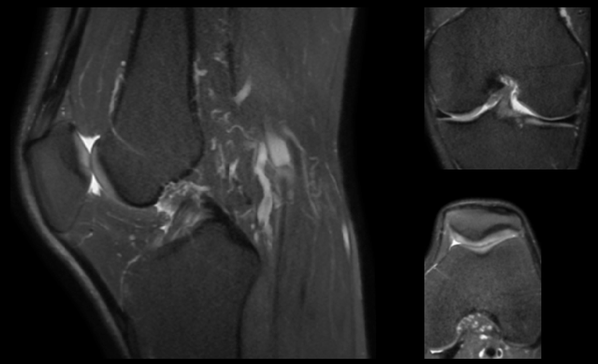
Original scan without HyperSense
Sagittal Cube PD FS, 0.6mm^3
6:03 min



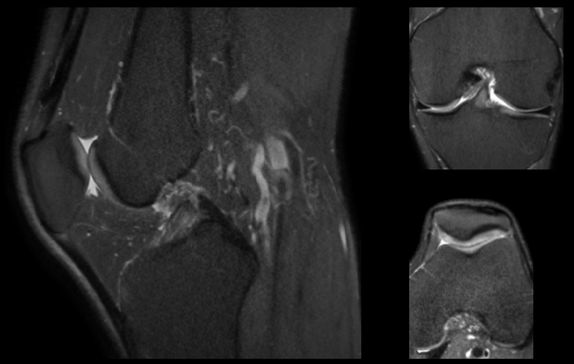
With HyperSense for reduced scan time
Sagittal Cube PD FS, 0.6mm^3
HyperSense factor = 2 3:03 min



With HyperSense for improved spatial resolution
Sagittal Cube PD FS, **0.5mm^3**
HyperSense factor = 2 4:06 min



With HyperSense for improved spatial resolution
Sagittal Cube PD FS, **0.4mm^3**
HyperSense factor = 2 5:52 min



OrthoWorks
Innovative Applications

HyperCube

HyperCube reduces scan time and limits artifacts such as motion and aliasing by reducing the phase FOV. It can be applied with or without fat suppression and significantly lowers imaging time without sacrificing contrast quality. It focuses on the area of interest, can be used on the entire body and is compatible with HyperSense.

Clinical benefits:

- Lowers scan time without SNR loss, reducing the potential for patient motion and repeats
- Eliminates time-consuming parameters
- Provides high-resolution small FOV imaging
- Helps with large FOV robust fat suppression when combined with FSE Flex

HyperCube with HyperSense 2:36 min

Sagittal

Multi-planar reformats

Images courtesy of: Centre Cardiologique du Nord, St. Denis, France; Keio University, Japan; Morriston Hospital, Swansea, UK; Hospital for Special Surgery, New York; Epworth Medical Imaging Geelong, Victoria, Australia; Fairfax MRI Center, Fairfax, VA, US; Queen Silvia, Gothenburg, Sweden; Novant Health Maplewood Family Medicine, Winston-Salem, NC, US

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