Research Leads to Discovery

An Interview with Garry Gold, MD, Associate Professor of Radiology, Stanford University and Thomas Grist, MD, Professor and Chair, Department of Radiology, John Jewell Professor of Radiology and Medical Physics, University of Wisconsin, Madison

GE Healthcare recently sat down with several leading researchers to gauge the impact of the Discovery MR750 on their institution's MR research. Following is an excerpt from our conversation with Garry Gold, MD, associate professor of radiology at Stanford University, and Thomas Grist, MD, professor and chair, the Department of Radiology at the University of Wisconsin, Madison, as they share their insights on MRI in research

Dr. Garry Gold

How is the Discovery MR750 helping to address your institution's mission and vision?

The Stanford University Department of Radiology is committed to improving patient care through imaging, either by improved diagnostics, therapeutic guidance or by research and education. I think MRI is the best, most flexible imaging modality – an extraordinarily useful clinical tool which we use every day to improve patient care. MRI generates the soft tissue contrast in images we need to make the diagnoses that are important to our clinical colleagues. MRI also enables us to push the boundaries with research, either through functional imaging, molecular imaging, or of multi-nuclear imaging. All of these could be important to improving diagnosis and ultimately patient outcomes.

The Discovery MR750 enables us to take applications that we've worked on in the laboratory for the past few years and directly apply them to improve patient care.

What new applications are you utilizing with the Discovery MR750?

We use Cube for 3D fast spin echo imaging in every day patient studies, which enables us to push the boundaries with isotropic MRI. As technology advances in musculoskeletal MRI, we are in a transition from 2D imaging with slice gaps to 3D imaging with isotropic resolution. Cube enables us to acquire isotropic data on every patient to diagnose problems in the musculoskeletal system that were simply not visible before. With isotropic 0.6 mm acquisitions in the knee, we can reformat the data in any plane and see small cartilage defects or surface abnormalities. And that really excites our clinical orthopedic colleagues, who tell me these MR images look like pathologic sections.

IDEAL fat-water separation really enables us to do things in musculoskeletal MRI that we couldn't do before with conventional fat saturation. Primarily, it improves the quality of our water-only images around field inhomogeneity. This has revolutionized our imaging in the neck and cervical spine, and in patients who have metallic implants. IDEAL gives us the potential to do T1 weighted fat-suppressed post contrast imaging around metal, which was not available before.

In many of our clinical musculoskeletal protocols, we want high resolution-gradient echo images to clearly view the articular cartilage. We prefer gradient echo techniques that give us bright synovial fluid next to the cartilage to outline superficial defects. MERGE is a multi echo approach that provides cartilage-to-fluid contrast that highlights small surface defects in the articular cartilage or ligament tears. I find MERGE particularly useful in high resolution imaging in the shoulder and the wrist.

Dr. Garry Gold

Garry E. Gold, MD, is an associate professor of radiology and an associate professor (by courtesy) of bioengineering and orthopaedic surgery at Stanford University School of Medicine. Dr. Gold received a bachelors and masters in electrical engineering prior to obtaining his doctor of medicine degree at Stanford. He completed his internal medicine residency at Kaiser Medical Center (Santa Clara, CA) and his radiology residency at Stanford University Medical Center. Dr. Gold has received numerous honors, including the SCBT/MR Lauterbur Award for best MRI paper three times, the ARRS President's Award twice, and most recently the SCBT/MR Cum Laude Award. Dr. Gold has authored or co-authored numerous peer-reviewed journal articles and is an active member in the ISMRM, RSNA, ARRS, SCMR, ARRS and ISS.

One of the most exciting developments on the Discovery MR750 is the implementation of ARC. ARC enables us to use parallel imaging routinely without having to worry about calibration scans or artifacts. We have implemented ARC in many of our routine protocols simply to speed up image acquisition, and it is also critical for isotropic imaging with 3D FSE Cube. Using ARC, I have developed a rapid joint protocols that enable us to save a tremendous amount of time on routine imaging.

What are you able to do with the Discovery MR750 that you couldn't do before?

The Discovery MR750 enables us to image at a higher resolution than we could obtain previously. The system's high SNR, multi-channel coils, parallel imaging, and isotropic imaging enables us to acquire data that we haven't seen before. With isotropic imaging, we can acquire data that has the same resolution in any direction and much like a multi-detector CT, we can reformat that in any plane or in arbitrary planes to look for small surface defects in the cartilage, small meniscus tears, or ligament pathology.

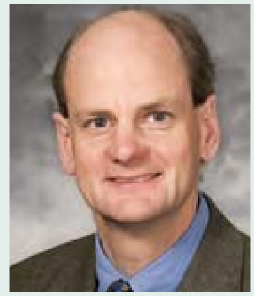
We can use IDEAL fat-water separation to do fat suppressed contrast enhanced imaging around metal in orthopedic patients who present with metallic hardware. We can use CartiGram, an implemented method of T2 mapping on the MR750 that enables us to evaluate the collagen matrix in the articular cartilage. This is really a form of molecular imaging that we can do on a day-to-day basis. I believe the MR750 has really pushed the boundaries in terms of what we can see in the articular cartilage, such as the acetabular cartilage, which is difficult to see on lower field systems.

Dr. Thomas Grist

How is the Discovery MR750 helping to address your institution's mission and vision?

Our mission in the Department of Radiology, University of Wisconsin-Madison is to advance human health through innovation and imaging. Our approach to innovation extends across all three of our activites, including research, clinical care, and education. MR imaging is very important to our mission of improving human health, for research in MRI can be rapidly translated into clinical practice to improve care of our patients. MR is developing as an extremely powerful tool to improve patient care, by virtue of the fact that it has tremendous image contrast and spatial resolution, better tissue characterization and provides images for structural and functional evaluation.

With MR, we're developing new contrast mechanisms and new imaging methods with our colleagues in medical physics, bioengineering and radiology, that we expect to translate into clinical practice through a partnership with GE Healthcare. Primary areas of interest are cardiovascular imaging, advanced brain imaging, new techniques for anatomic and functional imaging of articular cartilage, and tissue structure and function.



Dr. Thomas Grist

Thomas M. Grist, MD, FACR, received his undergraduate degree in biomedical engineering from Marquette University (Milwaukee, WI), and his doctor of medicine degree from the Medical College of Wisconsin (Milwaukee, WI). He completed his radiology residency at Duke University in Durham, NC and joined the faculty of the Department of Radiology at the University of Wisconsin in Madison, WI. He is currently the John H. Juhl Professor of Radiology, Medical Physics and Bioengineering and Chairman of the Department of Radiology. Dr. Grist has lectured extensively both nationally and internationally. He is author/co-author of four books, 15 book chapters and 134 peer-reviewed publications. He is an active member in many professional organizations including ISMRM, RSNA, SCBT/MR, and he is a Fellow of the American Heart Association, ISMRM, and American College of Radiology. His research has resulted in 12 patents.

What new applications are you utilizing with the Discovery MR750?

The Discovery MR750 provides a platform of technology that really allows us to acquire high-quality images more rapidly with excellent signal to noise ratio (SNR). It also provides an engine to reconstruct those images rapidly.

There are host of new applications on the Discovery MR750, and I think they're all predicated on improvements in gradient performance, parallel imaging, RF chain, reconstruction engine, and the 32 channels. This platform allows us to use new functional MR imaging (fMRI) techniques to continuously acquire data over a longer period of time with rapid reconstruction of the data and without any limitations in terms of gradient heating.

For the first time, I've been really impressed with imaging cardiac structure and function at 3.0T; in the past, the difference between 1.5T and 3.0T wasn't so evident. Now with Discovery MR750, we see some spectacular images for cardiovascular imaging at 3.0T. For example, by using the new ARC parallel imaging and a time resolved MRA sequence, we can create the data in a very short period of time and use the rapid reconstruction engine to make the data clinically useful. We are obtaining time resolved, 4D cine imaging of the cardiac and vascular structures and can reconstruct those images as rapidly as we can acquire them.

We've also seen significant improvements in abdominal imaging, abdominal imaging with excellent spatial resolution and control of the respiratory artifacts that previously plagued this type of image acquisition. Improved coils and, specifically, better fat suppression techniques allow us to reliably create uniform images and deal with variability in the fat signal. As a result, I think we'll see a continued growth of new applications for body MR imaging.

What are you able to do with the Discovery MR750 that you couldn't do before?

We've seen a tremendous improvement in the overall image quality with improved SNR and contrast-to-noise ratio as well as better fat suppression throughout our images. That translates into more reliable, nearly artifact-free images, which I believe is a major outcome. We have also observed more rapid throughput of our patients in many cases due to the integrated display system in the magnet room, the new table positioning hardware and software, and the rapid image reconstruction.

There is improved RF monitoring so we're not running into limits in terms of body specific absorption rate for RF power. This allows us to push the envelope more than we did in the past and create better images. I've specifically seen this with dynamic imaging, or any sort of time resolved imaging, as well as diffusion imaging.

The improved uniformity of RF excitation and duty cycle of the gradients allows us to conduct long series of exams that we couldn't do previously. We are acquiring high-quality abdominal images with reduced sensitivity to motion at 3.0T with substantially improved uniformity, and as a result we're comfortable shifting abdominal cases to 3.0T. Likewise, we previously performed cardiac imaging only at 1.5T. The demand for Discovery MR750 3.0T continues to rise for existing applications like neuro and musculoskeletal, but the real growth will be in body, cardiovascular, and breast imaging. ■