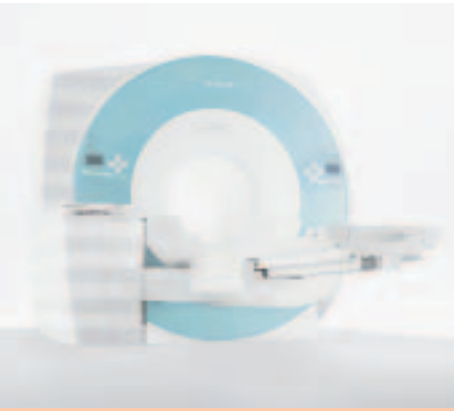
Introducing MAGNETOM Trio: Tim Takes the Revolution to 3T

Siemens' new clinically proven 3T MRI system, MAGNETOM Trio, came to the patients' bedside on both sides of the Atlantic by the end of April. In terms of speed, clarity, and versatility, the combined power of 3 Tesla plus Tim sets a new benchmark for diagnostic imaging.

By Karen Dente



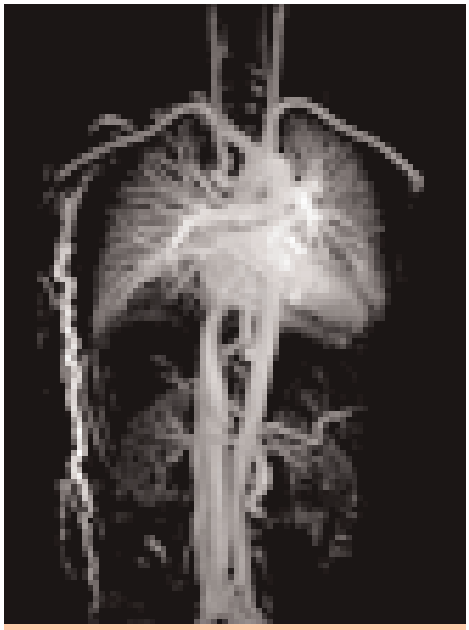
MAGNETOM TRIO is the first 3 Tesla system with Total imaging matrix (Tim) technology.

With Tim®, current limitations of 3-Tesla MRI are a thing of the past. Two medical facilities worldwide offer the combined benefits of this high field strength MRI system and the power of Tim (Total imaging matrix) technology for patients today. They are the New York University Medical Center, USA, and the University of Tübingen, Germany. Vivian Lee, M.D., Ph.D., professor of radiology at New York University, and Heinz-Peter Schlemmer, M.D., associate professor of radiology at the Tübingen University Hospital, spoke to Siemens about the potential applications of this new system for daily clinical routine, based on exciting diagnostic advances.

"The high field strength of the 3T system represents a new frontier in clinical MRI imaging," says Lee. The 3T field strength takes the previous Siemens unit with Tim, the MAGNETOM Avanto®, a 1.5-Tesla system, to a new level. The standard of MRI systems so far has been a magnetic strength of 1.5 Tesla. The MAGNETOM Trio® is the first unit capable of 3T whole-body MRI available with Tim. With the inclusion of Tim's innovative radiofrequency (RF) system and matrix coil concept, it represents the future of MR with even greater resolution and better image quality in less time. According to Lee, the potential advantages include better imaging, faster imaging, and the use of technology such as MR spectroscopy to measure the fine biochemical makeup of different tissue.

Unmatched PAT Performance

MAGNETOM Trio with Tim is the first integrated 3T system with all built-in parts that fully offers uncompromised parallel imaging. With



ULTRAFAST 50-cm FoV MR angiography at 3 Tesla: 4 seconds per volume with Tim's multichannel technology and parallel imaging capabilities.

its unmatched PAT (parallel acquisition techniques) factors, MAGNETOM Trio redefines ultrafast MRI. Beyond the highly innovative RF system and matrix coil design of up to 102 seamlessly integrated matrix coil elements read in up to 32 independent RF channels, the MAGNETOM Trio offers integrated PAT (iPAT), the industry's only complete high-speed parallel imaging package with both GRAPPA (k-space-based) and mSENSE (image-based) techniques. It is parallel in all directions, head to toe, front to back, and side to side. "It allows use of a new approach using parallel imaging, which takes advantage of the 32 channels to do faster imaging," says Lee. Scans that used to take one hour can be completed in just five minutes due to accelerations up to PAT 16. Effortless workflow automation achieved by iPAT translates into increased throughput and reduced scanning times for patients; i. e. a whole CNS obtainable with no coil reconfiguration or a renal angiogram in just a few seconds.

Increased Performance With Tim

"The Tim technology is a huge advance for 3 Tesla. Siemens introduced Tim two years ago at 1.5 Tesla. Having this technology at 3T now is really a radical improvement," says Lee. She points out that the Tim technology exploits the full capabilities of 3T for the first time. MAGNETOM Trio with Tim accelerates patient setup, scan times, and examinations. With MAGNETOM Trio, scan times are cut in half, which benefits physicians and patients.
Lee adds that the biggest improvement is probably seen in the exquisite quality of the images with Tim and 3T. "MAGNETOM Trio with Tim offers the great advantage in that it has a huge line of coils – multichannel compatible coils resulting in excellent images," she says. Tim technology is already proven at 1.5T, and now, with MAGNETOM Trio, Siemens is moving to the introduction of the first 32-channel 3T system, allowing use of more sophisticated coils (named matrix coils) that receive weaker signals from the body in order to generate even better images.
Dr. Lee's clinical research focus is on vascular and cardiac imaging. "I basically scan everything between the neck and the pelvis, and one real advantage to this technology is doing multistation images," she says. MAGNETOM Trio with Tim provides a 50-cm field of view, which permits scanning of the whole torso in one exam, covering large anatomical areas. "Now you can also plug in lots of different coils at once, and then the table moves so you can do whole-body imaging," Lee explains. MAGNETOM Trio allows multistation imaging, such as the chest, abdomen, and pelvis, in one setting. "In the past, that might have been two separate studies," Lee says. "You were doing the chest and upper abdomen in one day, or one exam, and then the lower part of the abdomen and pelvis in another." Now patients need to be positioned only once for multistation studies, which translates into increased patient comfort, a big plus for elderly and frail patients.
Dr. Schlemmer agrees, the faster scanning times of the MAGNETOM Trio with Tim and

»The amazing spatial and temporal resolution offered by 3T can have a big potential in neuro-radiologic imaging.«

Heinz-Peter Schlemmer, M.D., Tübingen University Hospital, Tübingen, Germany

HEINZ-PETER SCHLEMMER, M.D., associate professor of radiology at the Tübingen University Hospital, Tübingen, Germany, sees a big potential benefit in fast, high-resolution imaging of the musculoskeletal system.

increased performance translate into greater convenience for patients and higher throughput for the practicing physician. He sees a main application in the realm of orthopedics. "You can perform a routine knee protocol in less than two minutes," says Schlemmer.

Best Clinical Practice at 3T

Applications that until recently were only possible in the realm of research are now being translated into daily clinical routine. From a clinical point of view, the areas that are being talked about are whole-body angiography, allowing the physician to look at the blood vessels in the entire body, according to Lee. "Patients can come in with carotid symptoms like stroke, or leg symptoms, but may have atherosclerotic disease in the whole body," she states. The MAGNETOM Trio with Tim is the first 3T system to support parallel imaging for peripheral angiography. With its 36-element peripheral angio matrix coil, physicians can easily perform an ultra-fast whole-leg high-resolution MRA. Schlemmer sees a big potential benefit in imaging cardiac infarct tissue. "Making use of the higher SNR shortens the scanning time, allowing imaging of all phases of heart movement in a single breath," says Schlemmer. Additionally, the improved contrast offered by these images translates into higher diagnostic confidence when assessing areas of cardiac infarction, he explains. He believes that this helps in tailoring a more individually adapted therapy for patients with cardiac problems, and enables a more precise prognosis.

Schlemmer sees another main application for the clinical routine in the musculoskeletal areas involving smaller fields of view, in particular for examinations of knee and hand joints. "Changes in the TFCC (triangular fibrocartilage complex), a cartilage found between the ulna and the distal hand bones, can be seen with exceptional precision," says Schlemmer, adding, "Higher field strength permits earlier diagnosis of slight changes

MOVING TO 3 TESLA is a radical improvement," says Vivian Lee, M.D., Ph.D., professor of radiology at the New York University Medical Center.

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Vivian Lee, M.D., Ph.D.,
New York
University Medical Center, NY

in the cartilage tissue, which results in a reduction of further invasive diagnostic and therapeutic procedures, such as knee arthroscopies." With the 3T system, invasive procedures will only need to be performed when indicated.

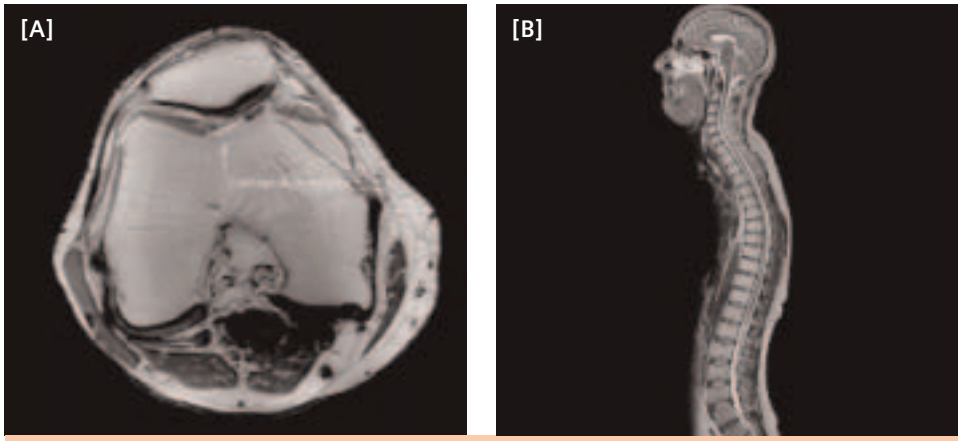
The Value Added by 3T with Tim

MR spectroscopy is better at higher field strength, and both Lee and Schlemmer see potential areas of application in prostate cancer and the study of the brain. A striking feature of MAGNETOM Trio with Tim is the brilliant resolution of most microscopic pathologies. "Regular MRIs don't allow you to differentiate between benign and malignant tumors. High field spectroscopy allows you to get fine biochemical information, adding another dimension to diagnostic imaging," says Lee. In prostate cancer, the 3T can aid in localizing cancer better and lead to more precisely guided biopsies of actual tumor tissue. People with elevated PSA levels are often subjected to random biopsies that don't always result in effective sampling of cancerous tissue.

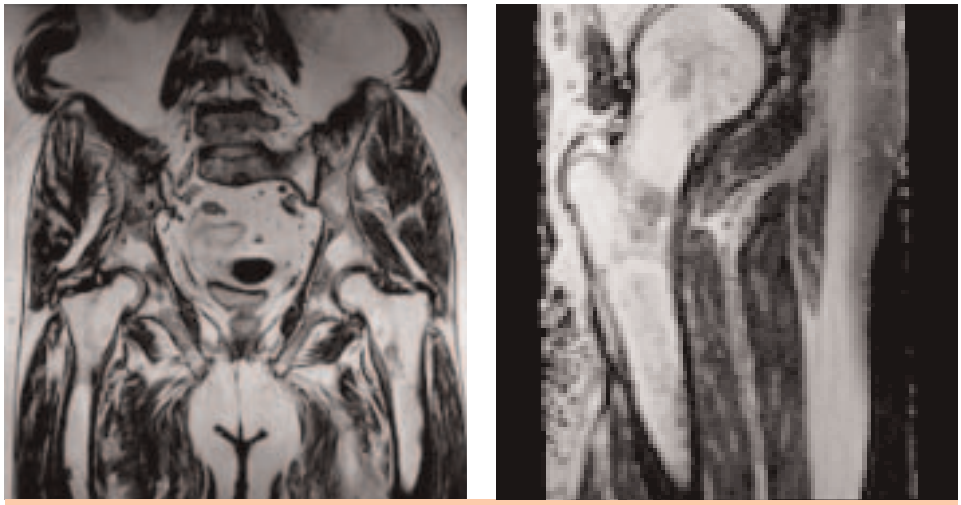
"The amazing spatial resolution with exquisite details offered by 3T can help to plan complex neurosurgical procedures," says Schlemmer. MAGNETOM Trio enables routine visualization of cranial arterioles at 200 micrometer resolution with exceptional visualization of cortical layers in the brain.

Lee sees a third potential area of application in skeletal or bone disease, such as leukemia, where a lot of different bones can be affected. "It has not really been feasible to do whole-body imaging so far," she explains. MAGNETOM Trio with Tim might be applied similarly to what is being done with PET scanning in cancer patients to look for metastases where you don't suspect them.

Lee and Schlemmer both think that the 1.5-Tesla system, the MAGNETOM Avanto – the forerunner to the higher-field-strength



[A] ULTRAFAST (< 1:40 min) submillimeter evaluation of arthritis at 3 Tesla with Tim's multichannel technology and parallel imaging capabilities.
[B] ENTIRE CENTRAL nervous system acquisition: efficient workflow with 3 Tesla and Tim without patient repositioning. *(Images courtesy of New York University, New York, NY)*



3D HIP AND RECONSTRUCTIONS with the 1-mm isotropic SPACE technique at 3 Tesla with Tim technology. *(Images courtesy of Uniklinik Tübingen, Germany)*

MAGNETOM Trio with Tim is already an amazing system. Now that the 3-Tesla unit has proven itself in clinical research, with Tim technology, they anticipate no problems with its integration into clinical routine. Schlemmer notes that the interfaces of the MAGNETOM systems are very user-friendly. "The great benefit of the MAGNETOM Trio is that it uses the same software we have been used to using," he says. Schlemmer and Lee foresee the new unit being immediately put into application in the clinical areas of neurology, cardiology, and orthopedics.

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