Epworth Geelong Takes MR Imaging to a New Level of Excellence with SIGNA Architect

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When Epworth Medical Imaging and partner Sonic Healthcare opened its first imaging center, Epworth Freemasons, in 2013, the vision was to offer patients access to world-leading technology in CT, MR, X-ray, 3D mammography, angiography, nuclear medicine, bone mineral density, and body composition scans.

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Pramit Phal, MBBS, FRANZCR, neuroradiologist and the Clinical Director for Epworth Medical Imaging and an Associate Professor at the University of Melbourne.
“We were opening a new hospital in a new market, and having a point of differentiation was critical for success,” adds Chris Kokkinos, B.App.Sc., Pg.Cert. (MRI), MRI Manager at Epworth Medical Imaging. SIGNA Architect, with a 128-channel RF chain, Total Digital Imaging (TDI), Orchestra reconstruction platform, and the SIGNA™Works productivity platform, would be that key point of differentiation in MR imaging for this site.

There was just one problem: SIGNA Architect would not be commercially available in time for the center’s opening in July 2016. However, GE Healthcare had a solution: the company’s SIGNA™ Lift program would enable existing Discovery™ MR750w sites to upgrade to SIGNA Architect once it became available. GE Healthcare installed the Discovery MR750w so that it was up and running in time for Epworth Medical Imaging’s opening in Geelong, and then upgraded to SIGNA Architect once it became available.

During the first week of December 2016, the site’s existing Discovery MR750w was upgraded to SIGNA Architect, making it one of the first five global installations for this advanced and intuitive scanner.

“With this improved platform and multi-channel system, we are able to better image areas that are traditionally difficult—for example, in the thoracic spine, where there are issues with phase artifacts or flow and poor signal within the cord; and the brain, in areas of air bone or bone brain interface where we can get signal distortions,” says Associate Professor Phal. “The technology behind this platform is improving the imaging we can provide, and we’re seeing that in MSK, neuro, and body imaging. As a clinician, this system just increases your confidence immensely.”

### A scanner for research and clinical practice

Combining clinical practice and research with SIGNA Architect was a key goal for Epworth Medical Imaging. According to Paul Smith, MBBS, B.Arts B.Sci (Hons), FRANZCR, Clinical Director for services located at Epworth Geelong, the center has an agreement with Deakin University School of Medicine for medical student rotations and medical imaging (technologists) student hands-on teaching.
highlighted the anatomy, including the way the tendrils in the ACL run for ultrastructural integrity, it would be nice to see with multi-directional DTI and high-resolution imaging, where we can drill down more tightly and look at the individual bundles,” Dr. Smith explains.

And in the clinical setting, Associate Professor Phal is hopeful that multi-directional diffusion tensor imaging (DTI) can enable the capture of more information without significant time penalty.

“Deakin is excited to have an imaging department like Epworth Medical Imaging in close proximity with the latest and greatest technology, such as SIGNA Architect,” Dr. Smith says. There are several research projects already in the pipeline between the two organizations, he adds. Some of those research opportunities relate to MR musculoskeletal (MSK). Geelong, a sport-centric city near the coast, is also home to the second oldest club in the Australian Football League.

An area of research that Dr. Smith is exploring is the longevity of ACL grafts. Recent research suggests that ACL reconstruction is not adequate intervention to prevent knee osteoarthritis.1

“If clinicians can understand the viability of the graft, over time, they may be more likely to refer (the appropriate) patient for a graft. Tensor imaging offers the potential to analyze the integrity of ACL grafts. While the Discovery MR750w nicely

Figure 2. MRA using HyperSense and the TDI 48-channel Head Coil. (A, C) Original protocol in 4:39 min. (B, D) HyperSense Factor 2 in 3:36 min. Note the scan reduction time, higher resolution, and depiction of small vessels (blue arrows) with HyperSense.

Figure 3. HyperCube with HyperSense and Flex delivers uniform fat suppression in all areas. HyperCube supports thin slice 3D imaging, in this case 1.2/0.6mm overlap. Acquisition time was 3:50 min.
Leadership in MSK applications

“With the newer technology, including multi-slice acquisitions and the option to acquire a high number of diffusion tensor directions in a clinically feasible scan time, we have the ability to excel in sports medicine. That was one of the appeals,” says Kokkinos.

Having a scanner with the potential to acquire high-quality knee exams is critical to building this area of the practice, says Dr. Smith. “We can do these in as little as 20 minutes, and that is really important for us,” he adds.

With this time saving, Epworth Medical Imaging can now accept up to five urgent sports injury exams on a Monday morning when previously they were limited to no more than two or three. “That ability to increase space in the scanners is crucial to having our practice become a leader in the market for MSK imaging. Also, the diffusion tensor imaging (DTI) in MSK is getting the sports medicine doctors very excited here. The more excited they get, the more they want to get involved with us and are passionate about using our center.”

FSE Flex is another new sequence that is fantastic for spine imaging, says Brad Kennedy, B App Sc (Med Rad), PG Dip (MRI), Senior MRI radiographer. It is excellent at suppressing fat, as he learned when comparing FSE Flex to a conventional FatSat technique in a post-contrast spine protocol on patients with screws in their lumbar vertebrae.
“With FSE Flex, we could see behind the vertebral bodies into the spinal canal,” Kennedy explains. “The image quality is far superior and our radiologists have a much clearer picture to find out what is happening with these patients.”

Dr. Smith agrees, “The improved signal, particularly in the plus-sized patient, is tremendous from a diagnostic perspective. Previously, we were getting a lot of signal from the subcutaneous fat; now we are getting signal of the spine and spinal cord. It was always difficult to figure out if the post-surgical patient had new or evolving symptoms. Now with the new platform, I am more confident in my reading and diagnosis of the cause for the patient’s condition.”

When using HyperCube and HyperSense in cervical spine imaging, Dr. Smith is able to visualize the nerve roots of the cervical spine. It’s a sequence that noticeably improved after the upgrade to SIGNA Architect and one that the team hopes to use more often.

Even without the new high channel coils available on SIGNA Architect, spine imaging is significantly better thanks to the digitized 128-channel RF chain that reduces noise and improves SNR. “Prior to the upgrade, we were struggling to get enough signal to enable higher resolution,” adds Kokkinos. “The new digital architecture has allowed us to improve our image quality significantly.”

This is true even in larger-sized patients where the spine may be further from the coil, making it difficult to get enough signal. Kennedy says there is appreciably more signal and he has increased the matrix on all spine protocols while decreasing the slice thickness thanks to the additional SNR.
Neuro MR with the 48-channel Head Coil

Epworth Medical Imaging’s site in Geelong is one of the first sites worldwide to implement GE Healthcare’s new TDI 48-channel Head Coil into clinical practice. “The new 48-channel Head Coil has made a huge difference in our image quality and ability to improve spatial resolution of our images,” Kokkinos says.

Kennedy says the TDI 48-channel Head Coil design is very comfortable for patients and a lot more open than prior head coils—and that can help reduce claustrophobia. As important, the addition of a spacer means the new head coil fits 99% of the patient population and virtually any head size, including most Australian football players. The coil is one of the technological advancements that has resulted from the GE NFL Head Health Initiative (see page 25).

“The spacer doesn’t impact image quality at all; it is the same if the spacer is used or not,” Kennedy says. He has used high channel neuro coils at other facilities where he has worked, and most tend to have signal drop out in the middle of the brain… but not this one.

“The 48-channel Head Coil is a really good coil in terms of signal intensity and uniformity across the whole area of the brain,” Kennedy adds. “We’ve picked up a significant amount of extra signal. For example, we previously had to run FiESTA for high resolution T2 images through the optic and the other fine nerves that come out of the brain stem. Now, I’ve gone to HyperCube with HyperSense, and the images are a lot less prone to artifact and are much clearer with higher resolution in the same amount of time. This is a great coil and we are really happy to use it.”

\( \text{\footnotesize Results may vary with Dixon-based fat/water separation approaches. For most reliable and consistent artifact reduction in the vicinity of metal implants, MAVRIC SL is the preferred acquisition approach. MR Safe or MR Conditional labeling of the depicted implant could not be confirmed in this situation. Patients with implants should only be scanned in accordance with the implants' MR Safe or MR Conditional labeling guidelines.} \)
HyperCube helps reduce scan time or decrease the field of view (FOV) for higher image spatial resolution. At Epworth Medical Imaging, the team is utilizing HyperCube and HyperSense to reduce the FOV from 22cm to 20cm while using a 512 matrix for amazingly high spatial resolution in neuro MRA exams. With HyperSense, the MRA scan only takes four minutes and there is excellent contrast between the background suppression and the blood vessels, Kennedy adds.

**Growth in body imaging**

In body MR imaging, Dr. Smith sees a difference in the reduction of artifacts, particularly in MR cholangiopancreatography (MRCP) exams. “We can get streaming as the bile flows down the ducts, which we can only see with SIGNA Architect and HyperSense. That gives us a lot of confidence in calling a subtle biliary calculus as a real finding. Obviously, that is very important to our referring clinicians for their patient management.”

Another impressive application is Synthetic DWI in the prostate with the ability to extrapolate high b-values, which Dr. Smith calls “exciting.” While the practice hasn’t yet built a strong referral base for prostate MR imaging, they expect SIGNA Architect and SIGNA™Works will help them grow their imaging services.

**Realizing what MR can be**

The homogeneity of the magnet has benefited nearly every exam and now, with SIGNA Architect the team can scan large FOVs without distortion issues. Kokkinos says frequency selective fat saturation (chem-sat) can be routinely used to deliver homogeneous fat suppression in off-center imaging situations, such as ‘by the side’ wrist imaging, or when scanning using large FOVs in the abdomen and pelvis. And, he can still use chem-sat in the spine, when desired, as well as cover more area in the z-direction.

For the team at Epworth Geelong, as useful as the expanded clinical sequences are, it’s the productivity enhancements with SIGNA™Works, the patient comfort, and the high image quality that are the key benefits.

Associate Professor Phal says, “All our expectations have been met—installation, clinical applications, support, and research.”

Adds Dr. Smith, “Definitely, my expectations have not only been met, the SIGNA Architect has exceeded them.”

**Reference**


**Pramit Phal, MBBS, FRANZCR,** is a neuroradiologist, the Clinical Director of Epworth Medical Imaging, and an Associate Professor at the University of Melbourne. Associate Professor Phal graduated from the University of Melbourne, completed specialization in radiology at The Austin Hospital in Melbourne, and undertook additional fellowship training at Oregon Health and Science University in Portland, Oregon. Associate Professor Phal has a keen interest in radiology education, has published extensively in his areas of interest and has been the recipient of several research grants from the NHMRC and RANZCR.

**Paul Smith, MBBS, B.Arts B.Sci (Hons), FRANZCR,** is the Clinical Director for Epworth Geelong. Dr. Smith trained at the Austin Hospital in Melbourne, where he completed general intervention, body and neuroradiology fellowships and also at Memorial Sloan Kettering Cancer Center, New York in body and musculoskeletal imaging. Dr. Smith completed his MR Musculoskeletal Fellow training at Regional Imaging, which featured a heavy sports medicine focus and a high case load of MR.

**Chris Kokkinos, B.App.Sc., Pg.Cert. (MRI),** is the MRI manager at Epworth Medical Imaging in Melbourne Australia, where he oversees the MR services across all sites of the organization. Chris graduated from the RMIT University of Melbourne with a Bachelor of Applied Science (Medical Imaging) and has worked as an MR radiographer for 20 years. Beginning in April 2017, Chris will commence in the role of President-Elect of the Society for MR Radiographers and Technologists (SMRT), a section of the International Society for Magnetic Resonance in Medicine (ISMRM).

**Brad Kennedy, B App Sc (Med Radi), PG Dip (MRI),** is the Senior MR radiographer at Epworth Geelong. He graduated from RMIT University in Melbourne with a Bachelor of Applied Science (Medical Radiations). Brad has also earned his A.I.R. MRI Level 1 accreditation and a graduate diploma (MRI) from Charles Sturt University. He is a member of SMRT.

**Epworth Medical Imaging** is a premium imaging service in Melbourne, Australia located across five Epworth HealthCare sites: Epworth Richmond, Epworth Freemasons Medical Centre, Epworth Freemasons, Epworth Geelong, and Epworth Camberwell.