SmartExam helps to banish most repeat knee studies at Desert Medical Imaging

Total scan automation boosts efficiency, reproducibility

John F. Feller M.D.

The exceptional intelligence of SmartExam's anatomy recognition software has rendered knee scout and pulse sequence retakes virtually non-existent at Desert Medical Imaging (DMI, Indian Wells, Calif., USA), one of the first users of the Panorama HFO system. After just a few months of use, SmartExam has provided nearly flawless study reproducibility and major increases in operational efficiency via seamless scan automation. Desert Medical, the first clinical Panorama HFO site to validate SmartExam for the knee, also has enjoyed much improved proton density (PD) weighted imaging of the knee with asymmetric TSE, a new functionality that provides time-efficient PD imaging with high image quality.

Any strategy that may increase scanning efficiency is welcome at Desert Medical Imaging, as the Indian Wells, Calif. center strives to counterbalance the financial impact of the U.S. Deficit Reduction Act. While the impact of government regulations on imaging economics isn't isolated to the United States, the changes for American imaging centers have been drastic, according to DMI's medical director, John F. Feller, M.D.

"Panorama HFO and SmartExam helped us decrease scan slots to 30 minutes and increase throughput from 15 to 20-25 exams per day."

"We're facing a 25 percent reduction in revenues from Medicare, which represents 40 percent of our payor mix," he notes. "That translates into a 10-15 percent reduction in total revenues. We needed to increase efficiency. Switching from a low field open system to the high field open Panorama and implementing SmartExam for first brain and then knee studies, contributed to our ability to decrease scan slots from 45 minutes to 30 minutes and increase our throughput from about 15 exams per day to 20 to 25 per day."

New SmartExam Knee streamlines studies

By February 2007, Desert Medical had used SmartExam Knee – which plans examinations through 3D recognition of key bony anatomy (tibia, patella, femur) in both right and left knees – in over 100 examinations. During the previous two months, DMI clinicians had proven SmartExam Brain's clinical utility in more than 200 brain studies.

The first step was to help SmartExam "learn" how to plan knee studies, which was conducted by allowing SmartExam to develop plans under technologist supervision and correction. Remarkably, this teaching period comprised just 15 knee cases – and after a total of 30 knee cases, SmartExam had reached "mature" status for knee imaging.

"During that time, only two cases required significant technologist intervention," Dr. Feller recalls. "One was for a very large patient whose knee we had to scan with another coil, and in the other case, SmartExam had difficulty planning because the technologist had externally over-rotated the knee and SmartExam couldn't recognize the orientation."

Similar to SmartExam Brain, using SmartExam Knee has resulted in operational efficiency gains, he observes. "In addition to decreasing the duration of the scan slot from 45 minutes to 30 minutes, there have been obvious decreases in the number of repeat survey scans and repeat pulse sequences among our less experienced technologists," he says.

Technologists reap more time for other tasks

No longer burdened by scan planning duties, Desert Medical's technologists report that they now have time to engage in more rewarding tasks, including 3D processing, PACS processing and developing ExamCard protocols.

Gaining so much extra technologist spare time is not too surprising when comparing the number of discrete steps involved in a typical MRI scan from planning to end of acquisition. For a knee study alone, Dr. Feller calculated that 32 separate mouse clicks are required to manually perform the examination, as compared to just two with SmartExam.

"It's very unusual to find a process for which you can so drastically reduce the number of steps without compromising quality," Dr. Feller observes. "In many ways, manual MRI scan planning involves many mindless clicking and dragging tasks, but SmartExam helps replace mundane activities with tasks that require higher order decision-making on the technologist's part."

Asymmetric TSE improves proton density weighted imaging

An ingenious Philips-exclusive strategy that uses asymmetric profile ordering to fill k-space has reduced both proton density (PD) Turbo Spin Echo (TSE) blurring and PD TSE acquisition time. The emergence of asymmetric TSE (a-TSE) was good news for Dr. Feller, who counts on proton density TSE sequences for musculoskeletal imaging.

"For years, pulse programmers have devised many fancy k-space trajectories for things like cardiac imaging and contrast-enhanced MRI, but no one paid any attention to musculoskeletal imaging, for which proton density TSE is the workhorse sequence," Dr. Feller says. "Regrettably, PD TSE is susceptible to image blurring if your echo spacing is large (>120 ms), where shot length = TSE factor (TF) x echo spacing (ES). Historically, the ES depends on the TE you selected. For example, if you select a TE of 20 ms, then the ES also is, automatically, 20 ms, which tends to result in blurry images at reasonable TSE factors. The lower the ES, the less blurring. Generally, for orthopedic work, you want

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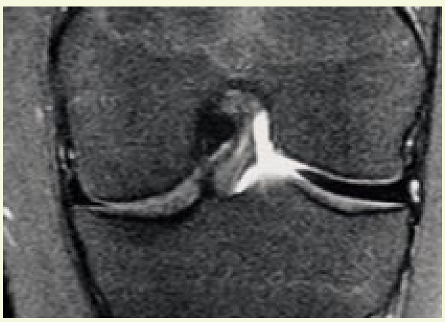
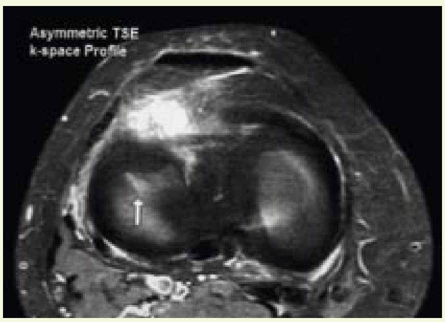
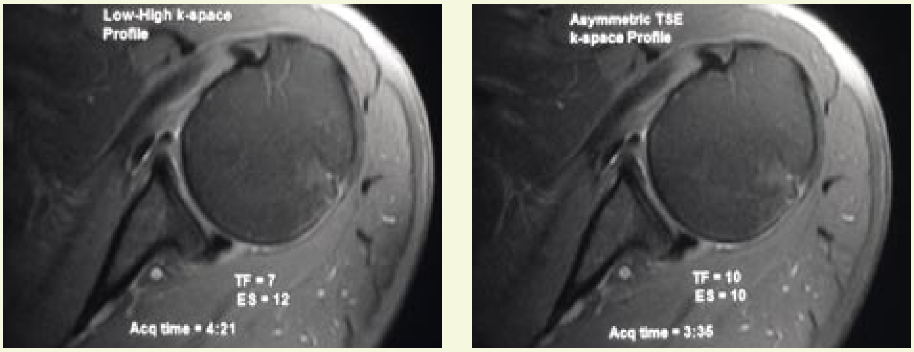



SmartExam automatically planned, scanned and reconstructed these Panorama HFO knee images.

SmartExam improves workflow, efficiency, image quality reproducibility and throughput. It is especially effective for boosting throughput with less experienced technologists, because it reduces repeats of surveys and other scans.



Comparison of low-high profile order and asymmetric TSE in the shoulder demonstrates that a-TSE reduces PD TSE blurring and acquisition time.

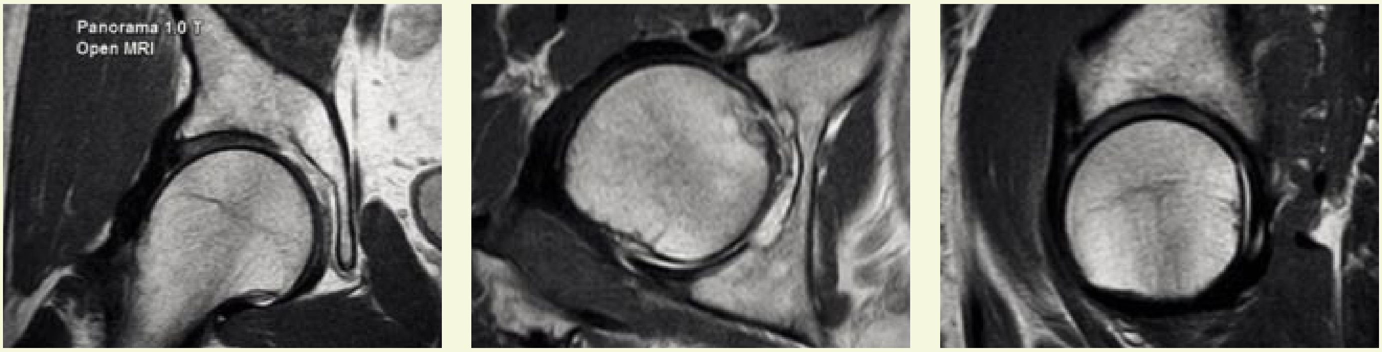
Comparison of low-high profile order and asymmetric TSE in the knee demonstrates that a-TSE reduces PD TSE blurring and acquisition time.

an ES of between 8 and 12 ms, and a shot length of ≤120 ms.

"Asymmetric TSE allows independent selection of TE, TF and ES," continues Dr. Feller, who has used a-TSE since October 2006. "So, I can pick a TE of 18 ms, for example, and an ES of 10 ms to avoid blurring. Then I know empirically – from having tested many different shot lengths – that my TF needs to be low enough to keep the shot length less than or equal to 120 ms. Accordingly, with my ES of 10 ms, I will select a TF of 10 to 12. Previously, using a TF of more than 8 would increase blurring. But with a-TSE, I get the best of both worlds – reduced blurring and reduced acquisition time."

Desert Medical Imaging, Palm Springs, Calif., USA.

At DMI, use of a-TSE has improved PD TSE knee studies, particularly imaging of subtle meniscal tears and chondral defects. Before availability of a-TSE, obtaining optimum image quality meant settling for a longer than desirable acquisition time due to the necessity to keep the TF at 8 or less. "Plus, you might be stuck with a TE that you don't especially like," Dr. Feller adds. "For example, if you wanted a higher TE, say 30 ms, to nicely visualize the articular cartilage, then the ES would also have to be 30 ms, thereby contributing to image blurring. With a-TSE, we can pick 30 ms as our TE, pick an ES of 10 ms and still get good cartilage contrast-to-noise ratio with



Asymmetric TSE in the hip.

no blurring at reasonable acquisition times. It's very nice to have these parameters independently selectable now."

As a bonus, a-TSE also can be used for T2- and T1-weighted TSE sequences to reduce acquisition time. In fact, DMI has documented a-TSE scan time reductions for many applications. (see table)

"Although a-TSE was first used in orthopedic imaging, it ends up being exceptional for TSE imaging in other anatomies, because it can reduce acquisition times," he says. "I'm very pleased. It's nice to see that Philips people worked hard to develop a method that directly addresses the problems with orthopedic imaging and actually spun off scan time reduction benefits for other TSE applications."

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Summary of scan time reductions (min:sec) with asymmetric TSE

	T1 TSE	Ax PD TSE	Sag PD TSE	Cor T1 TSE	Cor PD TSE
Shoulder		1:45	1:21	1:05	1:17
Wrist	0.34	0:39	1:00		1:20
Hip		1:14	1:02		1:16
Knee		0:08	1:23	0:45	1:32
Ankle		0:07	0:01		1:16