



## **Native TEQ Ultrasound Technology: An Evaluation of the Clinical and Ergonomic Benefits When Using Control-Free Optimization**

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# Native TEQ Ultrasound Technology: An Evaluation of the Clinical and Ergonomic Benefits When Using Control-Free Optimization

## Introduction

Work-related musculoskeletal disorders (WRMSD) are increasingly being recognized as a serious problem in the ultrasound industry workforce. Growing patient loads and the length of time a sonographer has been in the profession add to the incidence of problems. New automated ultrasound image optimization methods may help address some of the causes contributing to WRMSD.

## Quantifying the problem

Approximately 80 percent of sonographers studied in the American, Canadian and Australian surveys were found to be scanning in pain or discomfort, with nearly one-fourth having to leave the profession entirely.

As a result, the economic consequences are enormous. One study (Sound Ergonomics 11/04) estimates the total medical costs for one shoulder injury, worker's compensation, replacement staff and loss of revenues to average \$1,377,500. Following is a break out of estimated costs:

- Medical bills for average shoulder injury \$20,000 per year
- Worker's compensation \$29,000
- Replacement staff \$148,000
- Provide control-free image optimization to decrease the number of keystrokes, resulting in less repetitive motion for the hand and wrist
- Enable shortened exam times. Ultrasound exams should be efficient and diagnostic, which not only benefits the patient, but also decreases the risk of WRMSD
- Reduce physical strain. For the technically difficult-to-image patient, it is often necessary to apply more exertional force to the transducer in order to create an acceptable image. This can lead to WRMSD but, in conjunction with newer techniques such as

harmonic imaging, control-free image optimisation tools are a powerful adjunct resulting in less pressure and strain on the sonographers hand and shoulder.

## Evaluation of Native TEQ Ultrasound Technology

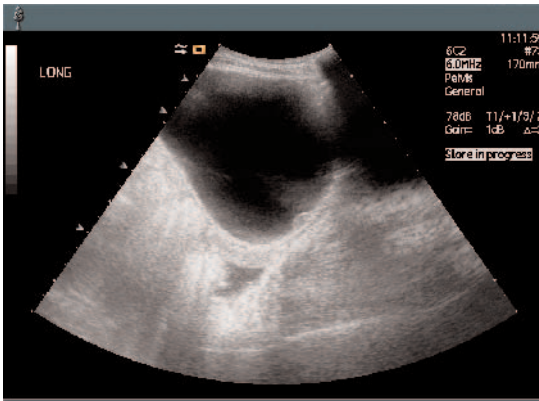
The ultrasound department at Great Ormond Street Hospital is very focused on reducing, and if possible eliminating, WRMSDs. The department undertakes the full range of general paediatric ultrasound examinations from intracranial, abdominal, hip and musculoskeletal, to renal transplant and Doppler examinations of peripheral vessels. Patient ages range from neonates to adolescents. In addition, the department has a wide range of ultrasound practitioners, from specialist radiologists in training to experienced sonographers and paediatric radiologists. In a study, operators were observed using state-of-the-art equipment (ACUSON Sequoia™ ultrasound platform) with and without the use of Native™ TEQ ultrasound technology, (the control-free image optimization technology from Siemens Ultrasound). A range of examinations were included in variable ambient conditions, such as portable exams in the intensive care units and examinations in the ultrasound department. Both experienced and inexperienced radiologists and sonographers were included in the evaluation.

In one small study we found that without utilising Native TEQ™ ultrasound technology, keystroke activity was highest in the less experienced sonographers, unfamiliar and inexperienced on the equipment but increased in all groups with the length and difficulty of the examination. Doppler examinations and uncooperative patients further increased the keystroke activity as did poor lighting, such as in the ICU.

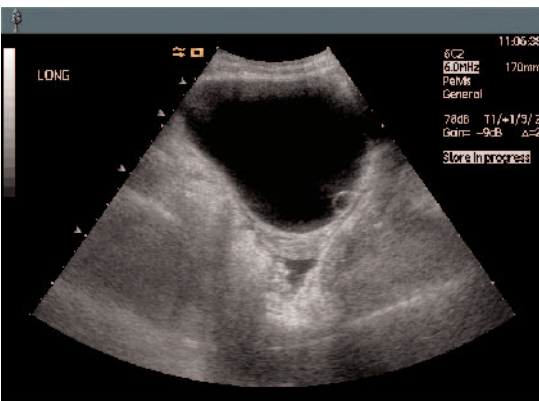


## Findings

Importantly for today's climate, control-free image optimisation was found to be a powerful tool that resulted in less keystroke activity as well as in less pressure and strain on the sonographer's back, hand and shoulder during the course of an ultrasound examination.



*This transverse image of a full bladder was taken without the use of Native TEQ technology. Notice the reverberation artefact obscuring the very prominent ureteric insertion into the bladder. Also it is very difficult to clearly identify the small uterus in front of the fluid in the Pouch of Douglas.*

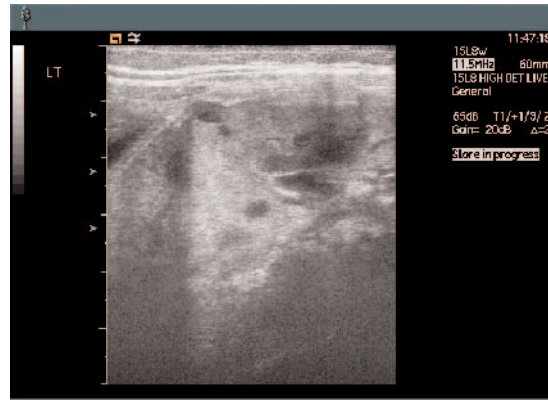


*Without further manual optimization, Native TEQ technology optimized the image throughout the field of view – in particular structures behind the bladder and the side walls of the pelvis. The ureteric insertion is much more easily identified and the uterus can clearly be seen in front of the fluid in the Pouch of Douglas.*

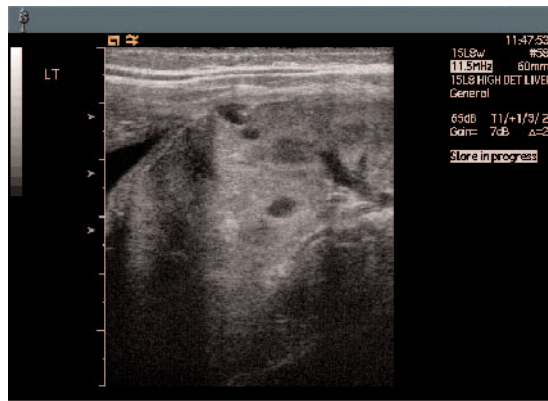


In the individual evaluation of Native TEQ technology some of the trainee radiologists/sonographers reported a decrease in examination time of up to 20%. Perhaps more importantly they felt that by using the Native TEQ technology their confidence in making a diagnosis was increased, because they knew the image was optimised continuously throughout the ultrasound examination. This was particularly evident when subtle changes were being evaluated such as a heterogeneous liver or confusing fluid filled structures such as bowel. Also in patients who were technically difficult with a large body habitus, they felt reassured knowing the image and thus their diagnostic ability was optimised at all times. It is well recognised that poor imaging technique and technically challenging patients in ultrasound are often the cause of a mistaken or even non diagnosis.

The Native TEQ technology was also found particularly useful when scanning conditions were not optimum such as on the wards. One operator even reported that when performing a head scan on the Intensive care he could safely hold the life support tubing in one hand whilst scanning with the other in the knowledge that the image was being continually optimised and would be constantly updated with no keyboard activity required. Another reported that in awkward bedside positions he was able to concentrate his activity on getting the probe in a good position rather than his keyboard activity, thus optimising his body posture and reducing the likelihood of WRMSDs.



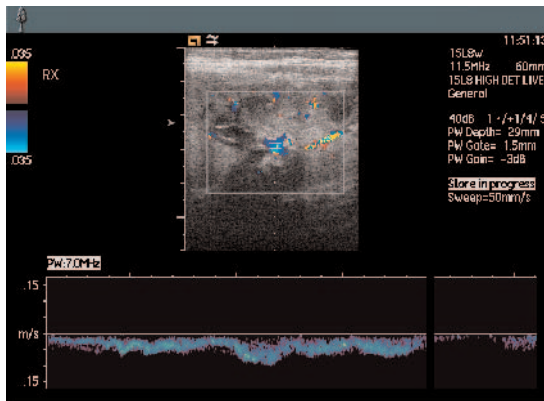
*This image of a transplant kidney was taken without the use of Native TEQ technology.*



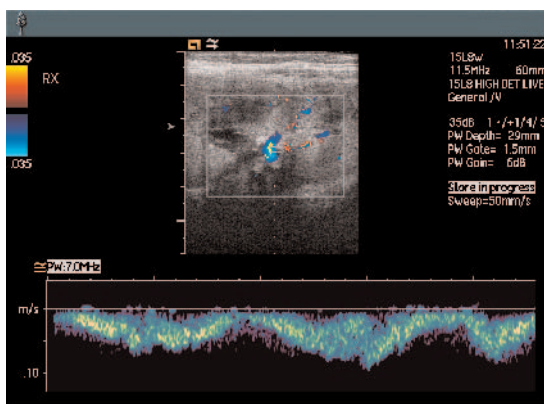
*The same patient scanned at the same time in the same conditions with the use of Native TEQ technology demonstrating the improved quality image. Notice in particular the better definition of the small cortical cysts.*

Of particular note and of particular benefit to all sonographers was the improved confidence in making a diagnosis and the resultant shorter scan times when

Doppler TEQ technology was used in conjunction with Native TEQ technology in performing Doppler examinations. With a simple press of a button the Doppler image and parameters were optimised.



*This image of a transplant kidney was taken without the use of Native TEQ technology.*



*With the Doppler TEQ technology switched on the spectral Doppler trace is optimised saving time with key board activity. With restless and difficult patients the time saving and improved confidence levels were particularly notable.*

Native TEQ technology was probably not helpful or necessary to use in every single ultrasound examination. Settings must be carefully monitored so that low level echoes are not excluded from fluidfilled structures such as pleural effusions for example. Native TEQ technology was of most use in the technically challenging patients for the experienced as well as the inexperienced sonographer. Indeed, as

the staff became familiar with the technology their usage and reliance on this facility increased.

Native TEQ technology provided consistency of image quality while the resultant reduction in keystroke activity meant a shorter exam time and significantly less repetitive arm and hand movements for the sonographer. Importantly, it also reduced the need for exertional force on the transducer that is often required to obtain the optimum image quality in technically difficult exams.

## Conclusions

Overall, the clinical and ergonomic benefits of Native TEQ technology include:

- A significant reduction in time and repetitive movements spent on keyboard activity during scanning
- Improvement in overall diagnostic confidence
- In technically difficult patients the control-free image optimization saves time as well as reducing the amount of physical pressure required to obtain a diagnostic image
- In Doppler examinations it is particularly useful when Doppler TEQ technology is used alongside Native TEQ technology to improve exam time and clinical confidence

Additionally, we found that often the quality of ultrasound imaging is related to the experience and expertise of the sonographer. By using an effective control-free image optimization technology, the overall quality of the image improves regardless of the operator, therefore reducing intra- and inter-operator variability, while improving overall diagnostic ability.

Such a technology allows for less time in training the sonographer and makes it much easier for the sonographer to learn. Additionally, it provides the sonographer with the luxury of time to concentrate on making the diagnosis rather than producing a diagnostic image.

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