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Techniques to Reduce the Impact of Patient and Probe Motion

Supporting greater ultrasound imaging consistency across clinicians, higher quality images, and more efficient workflow.

White Paper | 2015

Overview

The implications of patient and probe motion in ultrasound, whether in emergency cases or general imaging, are significant. Image quality is a foremost concern, since even modest amounts of motion may be sufficient to reduce clinical confidence, perhaps resulting in longer examination times, repeat imaging, or inconclusive diagnosis—all or any of which can impact departmental efficiency and patient and referring physician satisfaction.

High-performance ultrasound systems use sophisticated algorithms that make use of temporal information to improve image quality and blood flow detection. Such technologies, however, are highly sensitive to motion. Based on the type of motion, clinicians often try several different workarounds:

- To accommodate for patient respiratory motion, sonographers often ask patients to hold their breath, which may not be practical for pediatric and/or very ill patients.
- Due to involuntary cardiac motion, the clinician may choose to angle or reposition the probe to a different scan window further away from the heart to avoid flash artifacts from cardiac motion. Such a window may not be optimal for diagnosis. Alternatively, the clinician may manually reduce the color Doppler sensitivity to a level to avoid flash artifacts, and risk not detecting the blood flow of interest.
- During initial scanning assessment clinicians constantly reposition the transducer to different anatomy windows, in search of targets, causing temporal artifacts to occur. As a result, the clinician will either move very slowly or manually to reduce system sensitivity while searching. Then, manually restore system sensitivity when the search is complete.

In each of these cases, workflow is disrupted, and efficiency is reduced. In other cases, the clinician might temporarily or permanently preset the system to reduce or disable the image enhancing technologies in order to avoid motion artifacts, thereby reducing image performance and clinical confidence.

These challenges can be overcome with intelligent, integrated technologies that enable automatic correction for patient or probe motion. Offered exclusively on the ACUSON P500™ ultrasound system FROSK edition, Dynamic Persistence and Auto Flash Artifact Suppression allow for higher quality images without additional workflow steps—ultimately improving imaging consistency. Further, faster quality imaging can support higher levels of clinical confidence, faster triage in the ER, and better departmental and organizational efficiency.

Benefits of Dynamic Persistence

A unique technology in the ultrasound industry, Dynamic Persistence works with Auto Flash Artifact Suppression to detect patient and probe movements that impact image quality. Associated with B-mode and color Doppler, Dynamic Persistence prevents ghosting when patient or probe motion is detected, enhances color sensitivity, and reduces B-mode noise when no motion is detected.

How Dynamic Persistence Works

When the system detects motion, it gradually—and automatically—reduces persistence, which limits smearing or ghosting of images. When the motion stops, the system automatically restores itself to conventional image processing, which maintains the original image integrity. In this way, sonographers achieve the highest possible levels of image quality without additional steps, thus saving time and increasing efficiency.

Benefits of Auto Flash Artifact Suppression

Auto Flash Artifact Suppression eliminates the clinicians continual need to adjust sensitivity settings by automatically maintaining the best color sensitivity when little motion is detected. As motion increases, the degree of suppression automatically increases proportionally, to provide an artifact-free image.

Figure 1. Conventional color Doppler image with small motion, using high-sensitivity settings.

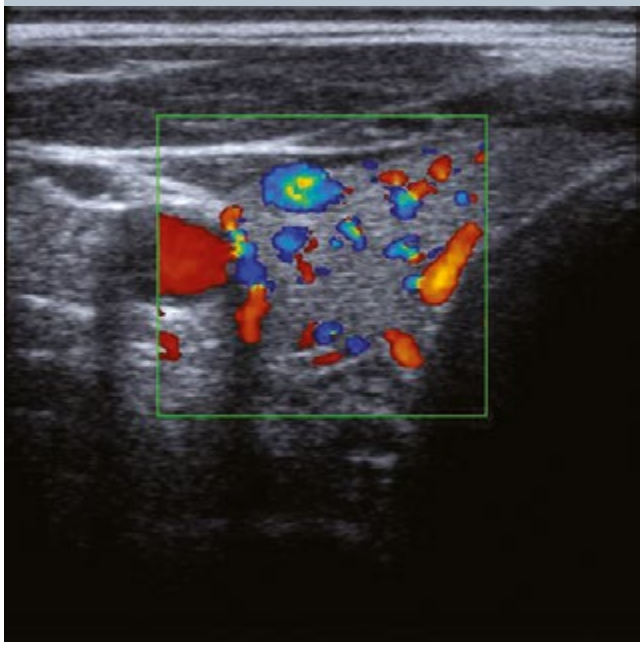
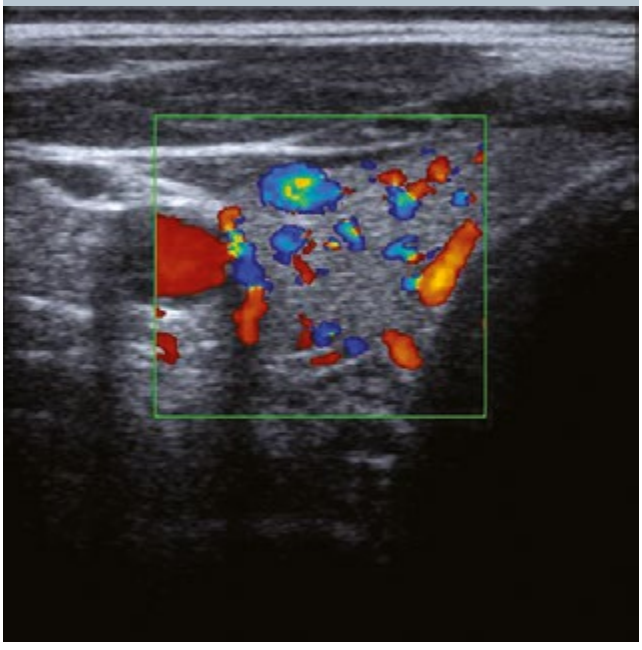


Figure 2. Color Doppler image with small motion, maintaining the high sensitivity as conventional color Doppler.



Auto Flash Artifact Suppression is a Siemens proprietary, industry-first technology that detects and prevents artifacts associated with probe and patient motion and enhances color imaging sensitivity when no motion is detected. It is integrated into the platform architecture of the ACUSON P500 FROSK and, as such, can support higher image quality and greater diagnostic certainty without adding steps to the clinician's workflow.

How Auto Flash Artifact Suppression Works

Auto Flash Artifact Suppression technology enables the use of very low filter settings without showing motion artifacts in color Doppler.

Figure 1 vs. Figure 2: High-sensitivity color Doppler Image of the same scan comparison between conventional (1) and the ACUSON P500 FROSK (2), when motion is small or negligible. Notice that sensitivity to blood flow is almost identical.

Figure 3 vs. Figure 4: Color Doppler image of the same scan comparison between conventional (3) and the ACUSON P500 FROSK (4), when the sonographer is surveying the thyroid, i.e., high motion. Notice both ghosting and false flow artifacts are virtually eliminated in the ACUSON P500 FROSK, leaving true blood flow and hence significantly improving clinical confidence.

False flow due to motion.

Ghosting due to persistence.

Figure 3. Conventional color Doppler Image with motion artifacts.

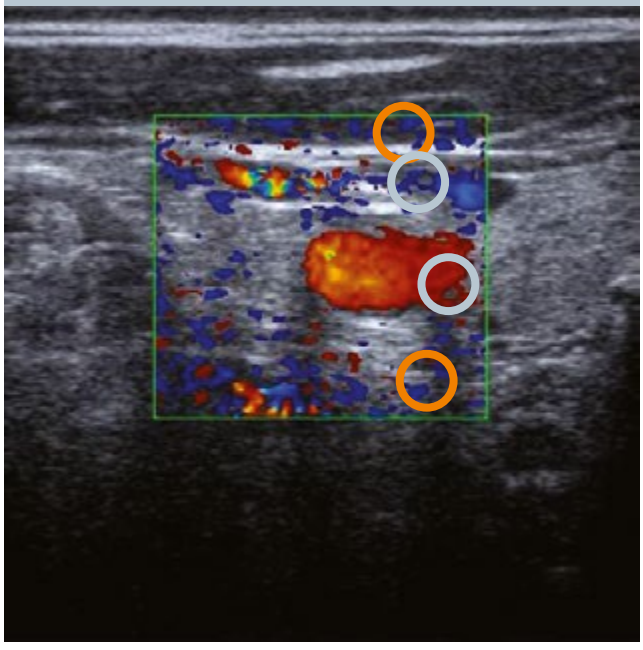
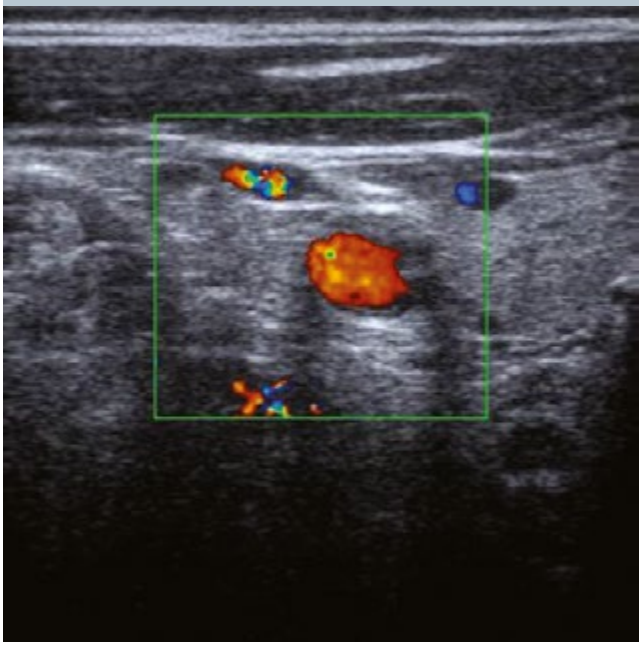


Figure 4. Color Doppler image with Dynamic Persistence and Auto Flash Suppression.



Author and References

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Case Report
Kanal K, Bhargava P, Vaidya S, Dighe M. Ultrasound Artifacts Classification, Applied Physics with Illustrations, and Imaging Appearances. Ultrasound Quarterly. 2014 June;30(2):145-157.

Standalone clinical images may have been cropped to better visualize pathology.

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