

How breast radiologists can work more efficiently

Display technology transforming breast imaging workflow



The field of breast imaging is often described as a challenging environment, especially since radiologists are required to view more and different types of imaging modalities. Different sets of images have their own specific display specifications and requirements, compelling radiologists to use multiple workstations. This has an impact on radiologists' efficiency. In this ebook, we'll discuss the challenges in breast imaging and how new display technologies can tackle these, improving reading comfort and performance.

Challenge 1: multimodality reading

Today, breast radiologists read more than just mammography images. Especially for patients who are at high risk for developing breast cancer or patients with dense breast tissue (where mammograms will miss more than 50% of the cancers present¹), the use of breast ultrasound, breast MRI or 3D mammography can improve detection.

Dr Laszlo Tabar, Professor Emeritus of Radiology, University of Uppsala School of Medicine, Sweden, confirms the importance of using additional screening methods besides mammography. "There is currently not a single imaging method that can image all the normal or abnormal breast lesions equally well. This complex problem can be overcome by using the 'multimodality approach', especially when the breast tissue is 'dense.'" It's no surprise that 51% of US breast imaging specialists also read breast MRI and 55% read breast ultrasound as part of their daily workflow².

However, reading multiple modalities is not as easy as it looks. Mammography requires the highest-resolution and brightest grayscale whereas breast MRI and ultrasound are presented in color. In reality, this means radiologists will often switch workstations, moving from a grayscale to a color display and back, in order to read these supporting modalities.

In addition, breast tomosynthesis and MRI images are viewed in a cine sequence. Adapting to moving 3D images, a sequence of keyframes, and ultrasound video poses additional challenges. All of these factors drive the need for a different kind of display system, one that combines grayscale, color, and moving images onto a single screen so radiologists can compare multiple imaging modalities on a single workstation.

Challenge 2: compliance with new guidelines

Industry organizations around the world have defined standards and guidelines for mammography imaging to ensure the quality of mammogram screenings. The FDA (US), EUREF (Europe), the Central Committee on Quality Control of Mammographic Screening (Japan) and the ACR-AAPM-SIIM Practice Guideline for Determinants of Image Quality in Digital Mammography (US) all recommend the use of high-bright displays with a minimum spatial resolution of 5 megapixels.

However, as mammography practice evolves, new guidelines and requirements are being established. This is mainly driven by the evolution of digital equipment as well as emerging modalities. For example, the matrix resolution of acquired breast images is growing. To cater to this evolution, a higher resolution screen size is recommended, allowing radiologists to view images at 1:1 without excessive scrolling or mouse clicks.

At the same time, new imaging modalities require additional guidelines. For example, the rise of moving images introduces the need to eliminate motion blur when scrolling through images. And the increasing use of color images requires color calibration and stabilization, similar to the DICOM standard for grayscales, in order to render them in a diagnostically meaningful way. It means that, when presenting all imaging modalities on one screen, DICOM compliance should be preserved, color should stay calibrated over time, and 3D (moving) images should be blur-free.

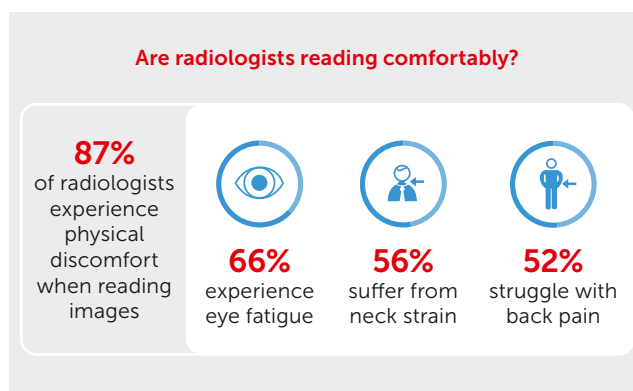
Challenge 3: reading comfort

The use of multiple displays – 85% of radiologists use three or more – causes increased head and neck movements. At the same time, eye strain remains a cause for concern. No fewer than 87% of radiologists experience routine physical discomfort while reading images, such as eye fatigue (66%), neck strain (56%) and back pain (52%).²

Considering all of the inherent stressors that negatively impact a radiologist's ability to work comfortably, there is an urgent need to improve the ergonomics of diagnostic imaging displays. A workstation setup that takes ergonomics as well as productivity into account consists of a single diagnostic display that supports viewing of every type of imaging modality – eliminating the need for multiple displays.

At the same time, extensive panning and zooming, continuous rearranging of images, and physically taxing mouse clicks can lead to repetitive motion disorders like carpal tunnel syndrome. Presenting radiologists with life-size images – which require minimal panning and zooming and less windowing and leveling to get the best image for analysis – is key to an ergonomic viewing experience.

In addition, an easy-to-adjust stand (83%), better ambient room lighting (81%), reduced screen glare (72%), and keyboard task lighting (69%) are also believed to make a radiologist's workday much more comfortable and efficient.²



1. <http://densebreast-info.org/>

2. What makes a good read? Challenges and opportunities in radiology today. The MarkeTech Group, 2014

Display best practices to improve breast imaging workflow

1. Unifying workflow

A Fusion display, such as Barco's Coronis Uniti®, supports this new multimodality workflow. Designed to support every type of image, it enables viewing of multimodality breast images on a single screen, in 2D or 3D, static or moving, grayscale or color. And it eliminates the need to change workstations to complete patient studies, improving overall operational efficiency.

2. Increasing detection

Display luminance has a positive impact on the detectability of breast microcalcifications. Calibrated luminance levels of 1000 cd/m² lead to an increased detection probability of breast microcalcifications compared to calibrated luminance levels of 500 cd/m².³

Coronis Uniti features luminance levels of 2000 cd/m². In addition, we developed I-Luminate™ technology, a unique system to boost display luminance, to improve detection of fine details in breast images. With I-Luminate, small and low contrast details are easier to see, dense breast tissue is sharper, and near skin-line details are much brighter.

3. Ensuring quality

As the use of color in breast imaging continues to evolve, going beyond simple annotation to depicting more complex diagnostic information, mammography displays must meet a higher standard for color inline with the standards used for medical grayscale displays. That's why we developed SteadyColor™, a more advanced calibration technology, to guarantee consistent color images in space and time. So radiologists can rely on the diagnostic value of color if present in the image.

The same is true for viewing breast tomosynthesis images, when radiologists browse through a stack of thin image slices in video or cine loop. Our RapidFrame™ technology counteracts blur or ghosting of moving images by speeding pixel refresh when scrolling through a stack of image slices. RapidFrame has been proven to increase detection by 10% when scrolling DBT images, compared to a traditional FFDM display.⁴

4. Boosting ergonomics

A large display form factor – ideally featuring a 3:2 aspect ratio to fit more of the image on the screen - ensures easy compliance to guidelines to view images at 1:1 while minimizing head and eye movement and reducing reading times.

For example, with our Coronis Uniti display, radiologists perform up to 4 fewer mouse clicks per screening. When you know that a typical radiologist reads about 40 studies per day, having more pixels at hand can substantially improve your reading comfort and productivity.

In addition to display brightness, ambient light conditions are critical to maintaining a radiologist's visual acuity. Built-in features which manage ambient light, such as Barco's SoftGlow™ to adjust wall and keyboard lighting, ensure optimal reading conditions.

The combination of the field of view and the luminance is without a doubt reducing the stress and fatigue I feel over the course of a day or a reading session. The reduction in eye fatigue is noticeable and there is an overall increased level of reading comfort due to the reduction in hand, head and eye movement. The workflow focus the user gains as a result is the key. It is human nature that when we are less tired, we are smarter.

Dr. James Ruiz, Woman's Hospital, US

3. Tom Kimpe and Albert Xthona. "Quantification of detection probability of microcalcifications at increased display luminance levels." Breast Imaging. Springer Berlin
4. Marchessoux, C., et al. (2011). Validation of a new digital breast tomosynthesis medical display. Proceedings of SPIE, 7966, 79660R

Coronis Uniti: one display, any image

With its unparalleled image quality, inventive productivity features, and commitment to ergonomics, Coronis Uniti® is Barco's latest response to some of the challenges in modern radiology: increasing image volumes, growing complexity, and ergonomic stress.



The display's large 33" form factor and 12MP resolution, combined with 1000 cd/m² of brightness, is a real game changer. Never before have radiologists had a tool that provided this much real estate with the image quality that comes as a result of the 12MP display and the boost in brightness. But it doesn't stop there. Coronis Uniti provides radiologists the ability to visualize studies in grayscale as well as color to improve reading workflow.

Coronis Uniti has been clinically validated for multi-modality breast imaging. This makes it the world's first and only diagnostic display that can be used for both PACS and multi-modality breast imaging, including breast tomosynthesis, 3D mammography, breast MRI and breast ultrasound.

The ability to display a mammogram with an identified area of concern on the same display as the corresponding US and MR certainly improves our efficiency in delivering accurate diagnosis for our patients.

Dr. Alice Rim, The Cleveland Clinic, US