How image quality and consistency impact workflow efficiency

Clinical displays for viewing patient charts and medical images present consistent quality-controlled images that are sharp and bright. This allows physicians and healthcare specialists across all departments in imaging-specific and critical care locations to see the exact same image regardless of time, environment and viewing angle. Some of the key benefits include quicker image review, improved inter-disciplinary collaboration, reduced risk of clinical errors, and leveraging of existing investments within the healthcare enterprise.

Improved inter-disciplinary collaboration

It is crucial that images be displayed consistently over time on every networked display within the enterprise. This greatly enhances collaboration between physicians and healthcare specialists, and minimizes the risk of clinical errors, especially in image-intensive departments and critical care locations. Colleagues can discuss images across multiple locations with absolute confidence that everyone is reviewing identical images.

Image consistency across monitors

Conventional computer monitors have grayscale tone characteristics that may vary, even between the same models, making them unsuitable for use in a clinical environment. The Digital Imaging and Communications in Medicine (DICOM) standard specifies a display function for grayscale and color reproduction which corresponds to the way human eyes perceive luminance. On the DICOM curve, each grayscale increment corresponds to an increment in luminance that can just be perceived by the human eye. Therefore, the diagnostic images reviewed by physicians and associated healthcare professionals will look identical to the acquired and diagnosed images in radiology only if the display is DICOM compliant. This guarantees consistent image quality throughout the digital imaging chain.

Image consistency over time

Because the brightness of conventional computer monitors changes substantially over time and at different temperatures, proper comparison of images over time is impaired. Under such conditions, the images may or may not be DICOM compliant.

In contrast, the special sensor technology in clinical displays measures – and, if necessary, corrects – the brightness of the display. Each time the display is switched on, this sensor automatically aligns the image quality to the DICOM standard.
Image consistency at different ambient lighting conditions

We have all seen how the clarity of an image changes according to the amount of ambient light in the viewing environment. The more ambient light, the more difficult it is to discern pathology in the darker areas of a medical image. Therefore, clinical displays should have ambient light presets to compensate for varying degrees of ambient light.

Image consistency over different viewing angles

When viewing images on a flat panel display, a slight shift in the viewer’s position can affect the image content substantially. Today’s LCD displays can be divided into three main categories, with three different results in color accuracy over different viewing angles:

- The most common display (and also the oldest) uses Twisted Nematic (TN) technology. These displays show the biggest color shift even at moderate angle changes. A TN-based display can usually be identified through these color distortions when the image is viewed from above or from the sides.

- Some conventional computer displays use Vertical Alignment (VA) technology – these displays show incorrect colors when viewed from off-center angles.

- In-Plane Switching (IPS) panel technology prevents color change when image content is viewed from a wide angle or when the viewer shifts position.

Intelligent and efficient IT enterprise workflow

Automated with front consistency sensor

The advent of digitized medical displays in radiology created the need for consistent calibration and quality control. Quality assurance guidelines were established to quantify and control the quality of medical displays. Over the past 5 years, QA awareness and usage have grown substantially.

Today, acceptance testing and consistency checks are crucial for keeping the quality of medical displays within the requirements of standards such as AAPM TG18 (“Assessment of Display Performance for Medical Imaging Systems” formulated by the American Association of Physicists in Medicine), DIN 6868-57 (Acceptance test for displays formulated by the German Institute for Standardization), and other regional QA guidelines.

As with all medical displays, clinical displays for reviewing images outside the radiology department should also be supported by the correct configuration and quality control software tools to ensure the entire diagnostic imaging chain – from acquisition and storage to display – is up to standard. These tools automatically control and track the display’s configuration, image quality and accuracy over time. Along with software tools to run automated quality checks, clinical displays contain an embedded front-of-screen optical sensor for luminance control and stabilization. This ensures automated, consistent image quality as specified in the standards listed above.
Centralized, intervention-free QA for enterprise imaging

Combining this automated quality control with central asset management and reporting enables a much more efficient IT workflow. IT departments can leverage the investment made in radiology and deploy it across the enterprise. Control of, and access to, complete statistics on every networked medical-grade display in the enterprise enable management to monitor display operations, generate regulatory and budget reports, and manage assets for lowest cost of ownership. Automated, online QA runs silently in the background across the enterprise and provides a window into how every display is performing at any given time. This makes frequent calibration – which is costly in terms of time and manpower – unnecessary.

Asset management tools provide a comprehensive overview of all workstations connected to the system and automatically notify the right person in case of quality issues or if an asset is removed.

Designed for image-enabled EMR

The image-enabled EMR (Electronic Medical Record) is a game-changer – providing physicians with fast, real-time access to patient images and charts through one consistent and easy-to-use interface, while leveraging current technology investments (such as centralized, intervention-free QA and calibration management) to manage all medical displays across the healthcare enterprise. As we have said, these images should be quality-controlled and calibrated to the DICOM standard to ensure consistency (regardless of time, environment or viewing angle) and efficient inter-discipline collaboration, thus reducing the risk of clinical errors.

Image-enabled EMRs suffer from screens that are overcrowded with images and data, making it difficult for physicians to see what they need to see quickly and clearly. To optimize use of image-enabled EMR, the display should have the right resolution. Medical displays that support at least FULL HD resolution (1920 x 1080 pixels) are EMR compatible. This format, combined with the image quality and consistency of a clinical display, ensures that physicians can review medical images and patient charts on a single screen more quickly and with clinical confidence.

Most EMR applications are optimized for displays with Full HD format, which ensures that all clinical data can be displayed on a single screen without scrolling.