How image quality and consistency impact workflow efficiency

Dental displays for viewing patient charts and dental images present consistent quality-controlled images that are sharp and bright. This allows dentists 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 improved patient communication.

**Improved inter-disciplinary collaboration**

It is important that images be displayed **consistently over time and across all displays**. This greatly enhances collaboration among the dental team (general dentists, endodontists, periodontists, prosthodontists, orthodontists, ...), ensures consistency of care from diagnosis to treatment, and **minimizes the risk of clinical errors**. Colleagues can discuss images across multiple locations with absolute confidence that everyone is viewing 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 dental environment. The Digital Imaging and Communications in Medicine (DICOM) standard specifies a display function for grayscale and color reproduction that are used as a standard in most dental digital X-ray equipment. Therefore, the acquired dental images will be optimal only if the display is DICOM compliant.

DICOM is an international standard that was developed to improve the communication of digital images in medical imaging. The DICOM standard:

- Ensures that a display’s presentation of grayscale matches the contrast sensitivity of the human visual system as closely as possible;
- Enables dental digital imaging equipment (e.g. intra-oral digital x-ray systems, panoramic imaging, cone beam CT, ...) and software applications and dental displays from different suppliers to ‘talk’ to each other without variation or degradation of grayscale tones.

**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 dental 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.

**Display brightness over time without sensor technology**

**Display brightness over time with sensor technology**
A front consistency sensor is basically a tiny embedded optical sensor positioned at the front of the LCD screen. Positioned in a corner of the screen (and only a few square millimeters in size), the sensor checks the screen's output without disturbing the image display. The sensor communicates its readings to the controlling electronics, which translate the readings into corrective actions that the Liquid Crystal Display performs in real-time.

Dental displays should be supported by Quality Control software tools that automatically control and track the image quality of all of the displays in the dental practice. The software communicates with the embedded front consistency sensor and monitors luminance degradation over time, indicating when a display no longer meets the quality standards.

The combination of the automated quality control with central asset management and reporting enables a much more efficient IT workflow for the dental practice.

**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. Especially in dental practices, the ambient light is different in each area of the practice. The more ambient light, the more difficult it is to discern pathology in the darker areas of a dental image. Therefore, dental displays should have ambient light presets to compensate for varying degrees of ambient light.

**Image consistency over different viewing angles**

A slight shift in a viewer’s position can affect the image content of a flat panel display substantially – and dentists working next to a patient are not always positioned to view their display at the best angle. 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. Therefore, this kind of display should never be used in a dental environment.

- Some dental 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.
**Improved user experience**

Thanks to this guaranteed image quality, the dentist is able to see issues in pristine detail and can more clearly and effectively communicate diagnosis, treatment options and outcomes to the patient. In particular, treatment plans involving dental implants can often be complex and difficult for patients to understand—and, as a result, dentists spend a significant amount of time and effort describing the treatment plan. By showing crisp, high-contrast images of the treatment plan, the dentist saves time and improves the patient’s experience as well.

Advanced 3D imaging applications designed for dentists are a game-changer—providing dentists with powerful 2D and 3D tools that improve diagnostic abilities and help them work faster and smarter, with access to patient images and charts through one consistent and easy-to-use interface, while leveraging technology to manage all dental displays employed throughout the dental practice. As we have said, these dental 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.

Many dental software applications suffer from screens that are overcrowded with images and data, making it difficult for dentists to see what they need to see quickly and clearly. To benefit optimally from the possibilities of dental software applications, the display should have the right resolution. With the increase in 3D imaging in digital dentistry, applications benefit from a larger estate as well. The best choice are dental displays that support at least Full HD resolution (1920 x 1080 pixels) and a minimum of 250 cd/m².

This widescreen format, combined with the image quality and consistency of a dental display, ensures that dentists can review dental images and patient charts on a single screen more quickly and with clinical confidence.

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