Sensor size

Digital or electronic imaging has been available for more than a decade. It is estimated that **10-20%** of dental practitioners use digital imaging technology in their dental practice. It is anticipated these numbers will steadily increase over the next five to ten years as dentistry continues to move from film based to digital imaging. **Film-based imaging** consists of x-ray interaction with electrons in the film emulsion, production of a latent image, and chemical processing that transforms the latent image into a visible one.

As such, radiographic film provides a medium for recording, displaying, and storing diagnostic information. Film-based images are described as **analog images**. Analog images are characterized by continuous shades of gray from one area to the next between the extremes of black and white. Each shade of gray has an optical density *(darkness)* related to the amount of light that can pass through the image at a specific site. **Film displays higher resolution** than digital receptors with a resolving power of about 16 lp/mm *(lines pairs/millimeter).* **However,** film is a relatively inefficient radiation detector and, thus, requires relatively high radiation exposure.The use of rectangular collimation and the highest speed film are methods that reduce radiation exposure. Chemicals are needed to process the image and are often the source of errors and retakes. The final result is a fixed image that is difficult to manipulate once captured.

Digital imaging is the result of **x-ray interaction with electrons in electronic sensor pixels** *(picture elements),* conversion of analog data to digital data, computer processing, and display of the visible image on a computer screen. Data acquired by the sensor is communicated to the computer in analog form. Computers operate on the binary number system in which two digits *(0 and 1)* are used to represent data. These two characters are called bits *(binary digit)*, and they form words eight or more bits in length called **bytes.** The total number of possible bytes for 8-bit language is 28 = 256. The **analog-to-digital converter** transforms analog data into numerical data based on the binary number system. The voltage of the output signal is measured and assigned a number from 0 *(black)* to 255 *(white)* according to the intensity of the voltage. These numerical assignments translate into **256 shades of gray.** The human eye is able to detect approximately 32 gray levels.

Direct digital imaging has distinct advantages over film in terms of exposure reduction, elimination of processing chemicals, instant or real time image production and display, image enhancement, patient education utility, and convenient storage. The actual amount of exposure reduction is dependent on a number of factors including film speed, sensor area, collimation, and retakes. The **primary disadvantages** include the rigidity and thickness of the sensor, decreased resolution, higher initial system cost, unknown sensor lifespan, and perfect semiconductor charge transfer. **Note:** Infection control presents another challenge for clinicians using direct digital imaging. CCD sensors cannot be sterilized. Care needs to be taken to properly prepare, cover, and ensure the barrier is not damaged during patient imaging procedures. Direct saliva contact with the receptor and electrical cable must be avoided to prevent crosscontamination.