DIGITAL IMAGING

Digital imaging

Photostimulable phosphor plates (PSPs)

Indirect digital

PSPs are composed of a polyester base with a phosphor layer (europium activated barium fluorohalide) on one side. After the PSP is exposed it is scanned in a reader before the image is displayed on a monitor. The phosphor layer is relatively delicate and any damage to it can degrade the image significantly.

Solid-state detectors (SSDs)

Direct digital

SSDs contain solid state materials such as amorphous silicon or amorphous selenium in their construction. The detectors contain either a charge coupled device (CCD) or complementary metal oxide semiconductor (CMOS). The intra-oral systems generally have a flexible cable connecting the detector directly to the PC, although wireless systems are available.

Photostimulable phosphor plates (PSPs)

Under a protection layer is a photo sensitive phosphor plate
The phosphor layer absorbs and stores the X ray energy
The phosphor plate is placed in processor....reader
The phosphor plate is laser scanned
The X ray energy is released as light
The light is detected by a photo multiplier
The image is divided into pixels (squares)
The photomultiplier gives them a numerical value in relation to
the intensity of the light released
The digital information is stored in the computer
The image can be manipulated and displayed

Direct Digital
CCD real time imaging

The X ray film is replaced by a CCD chip- a charge coupled
device which works like a miniature video camera
Inside the image detector the X ray photons are converted to
light
The CCD sensor picks up the light and transmits the
information to the computer
The computer converts the information to digital data...A gray
scale visual image
The display on the monitor is almost instant
The computer can manipulate the image ...Contrast, resolution
and Image enhancement
Benefits of Digital Imaging .... Radiation dose reduction for the patient as digital sensors are more sensitive to radiation than film
Eliminates darkroom errors
Radiographs degrade over time, but digital images do not
Digital images are easily reproduced. Analogue images require specialist equipment to copy and the copy images are often of an inferior quality to the original
Environmentally friendlier due to the elimination of chemical processing
Specialised software packages allow for manipulation of the digital image and for measurements to be taken accurately
CCD produce images more quickly than traditional film. CCD technology produces real time images, eliminating any form of delay between acquiring the image and deciding whether supplementary images are required
The no of phosphor screen films taken on a patient at any given time can vary the time taken to produce and capture an image
PSP sensors are film sized and are compatible with film positioning devices so can be used as per film
Eliminates the need to purchase analogue consumables such as film, chemicals etc
Space saving as no bulky additional processing facility required
Factors To Consider .... Radiation dose reduction to patient only true if the operator is capable of using the system properly; increased numbers of retakes leads to increased dose

Require GOOD technical and IT support

All staff who use it must receive adequate training in handling the sensors, variations in radiographic technique and using the computer software

Initially expensive to convert to digital imaging

CCD sensors are very expensive though can last for many years if used correctly

PSP sensors are much cheaper but are scratched relatively easily and require careful handling. Scratched sensors must be replaced

CCD sensors are much bulkier than film and have a more rigid structure. Many patients struggle to tolerate them within the mouth and they are difficult for the operator to position. They are usually unsuitable for small children

Digital sensors cannot be sterilised and so added costs such as barrier envelopes must be taken into account
INDIRECT DIGITAL SENSORS

Phosphor Plates

Surface marking

There is a topcoat on the plate that is easily marked by any form of rough handling. All staff who handle them should be aware that they must not bend or scratch them even normal handling can damage the surface

There is a type of mat that resembles bubble wrap which the plate can be placed on prior and post processing allowing the plate to be lifted off the surface without scratching over a work surface

The serial no should be taken and regular checks should be done (tiny flash exposure) to monitor marks, no step wedge. Each surgery should be responsible for their own plates.

Limiting fogging

As the plates are very sensitive to radiation even daily background radiation can base fog them. plate should be cleared on a light box every day before use for a few minutes. if done in the morning the plate should be fine till the end of the working day. Cling film can be stretched over the viewing box before placing the sensors, blue side down, onto the surface of the box to clear. This allows the cling film to be lifted off with the sensors safely inside the cling film, the sensors will not therefore be scratched when being slid or lifted off the box. Or the sensors can be cleared first thing every morning in the scanner, no exposure beforehand.

Sensor Positioning
There is a sensor waterproof cover that is gray–white coloured that can be used in the mouth rather than the black ones ...this is much more easily seen in the mouth than the black one (more the colour of a normal emulsion film packet) to enable precise positioning. When positioning the sensor in the bite block it can sometimes slide as it is not as thick as a film packet ...thicken with a white cardboard bitewing tab which will also double as a” target“ when checking the position of the sensor in the mouth before aligning with the spacer cone

Ensuring captured image stays captured

When taking the radiographs the room blinds should be closed and the lights dimmed also light boxes should not be on

When taking the sensors to the scanner after exposure they should be protected from white light

As the image is cleared in the scanner by light the plate should be kept as dark as possible when image capturing and before scanning. The exposed plate should be kept in a light tight box prior to scanning and the scanner should be positioned in a dim room away from bright lights to enable plates to be loaded without losing image quality

Exposure settings

Phosphor plates have a wide exposure latitude, this means that they can give the same result when using a number of different exposures, unlike normal emulsion films which will be too pale or too dark if the exposure is changed. Their will have to be a number of test images taken to ascertain the lowest exposure that gives an acceptable enhanced image and this will become the maximum exposure for that area