

Panoramic Radiographic Technique

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Introduction

Panoramic radiographs are commonly used images in dental practice. They depict a large part of the maxillofacial region, including the entire maxilla, mandible and dentition, on a single image. Panoramic radiographs allow visualization of regions that cannot be captured, such as the temporomandibular joints, or are difficult to image on intraoral images, such as the third molar regions. Their larger coverage is also often important in imaging pathology or trauma of the jaws and surrounding tissues, since assessment of the entire abnormality is critical for interpretation and treatment planning. An additional advantage of this technique is that it is more comfortable for patients since they do not need to open their mouth wide and no bulky instruments are placed intraorally. Although panoramic radiography covers a relatively large area, panoramic radiographs have a lower spatial resolution compared to intraoral radiographs, which makes visualization of fine detail and some dental diseases, such as caries and periodontal bone loss, difficult. Panoramic images should not be used as a substitute for intraoral radiography, or as a means of surveying the jaw for quiescent pathoses.

Production of good quality panoramic radiographs is technique sensitive and unfortunately many panoramic radiographs produced are of less than optimal quality. Understanding the principles of panoramic tomography and proper patient positioning is critical to obtaining ideal images. The steps in panoramic radiograph acquisition and the common procedural errors that may be encountered will be discussed.

Materials

- Panoramic cassette.
- Panoramic film/sensor.

- Patient positioning device such as bite stick (depends on machine design).
- Lead apron.
- Materials necessary for infection control procedures.

Film preparation

Panoramic radiographs may be obtained using conventional film or digital sensors. The principles of patient preparation and positioning are the same.

If the radiograph is to be obtained using conventional film, an extraoral film cassette with intensifying screens is loaded with a film in the darkroom. The cassette may contain markers that indicate the left or right sides of the film and a place to label or radiographically stamp patient information. The loaded cassette is inserted in the panoramic machine, making sure that the front of the cassette faces the x-ray source and that the superior edge of the cassette is at the top. The correct direction of cassette placement is usually indicated on the outside of the cassette with an arrow.

For digital panoramic radiography, sensor preparation will depend on the system employed. Storage Phosphor sensors are loaded in a panoramic cassette in a similar fashion to film. These reusable sensors must be erased prior to each exposure. A film/cassette combination is not used in charge-coupled device-type panoramic machines. Rather, the CCD sensor is a permanent component, though the operator may need to make sure the sensor is in the correct position for imaging.

Common Errors

- Forgetting to load the cassette will result in no film/sensor present to capture the image.
- Any light exposure to the undeveloped film (pre or post image acquisition) will result in undesired exposure such as in generalized film fogging or localized black regions.
- Re-using an exposed film or failing to erase a storage phosphor sensor will result in creation of a double image.
- Positioning the cassette backwards in the machine will result in no image captured on the film.
- Positioning the cassette upside down will result in the markers or radiographic stamp positioned incorrectly.

Machine Preparation

Ensure that the panoramic machine is turned on and that the rotating component of the machine, comprising the x-ray source and receptor, is returned to the start position.

Adjust the height of the machine to the approximate height of the patient.

Prepare the patient positioning device.

For digital panoramic radiography, the patient's information is entered into the appropriate database or software for image identification.

Patient preparation/positioning

1. Have the patient remove all metal from the neck up including dentures, earrings, necklaces, hairclips, eyeglasses, facial piercings, etc.

Common Errors

Forgetting to remove metallic items may result in white/radiopaque images on the film. These opaque shadows may obscure areas on the film, potentially compromising the evaluation of the structures in the region.

2. Place the lead apron on the patient. Thyroid collars are never used since they would attenuate the x-ray beam and produce a white non-exposed area on the radiograph.

3. Position the patient into the focal trough. Guide the patient into the machine, so that they are standing tall, directly in front of the patient positioning device. Many manufacturers use a bite stick as a patient positioning device. This bite stick often has notches into which the patient bites his/her maxillary and mandibular incisors. Have the patient bite into the notches, ensuring that his/her midline is centered on the stick and the midsagittal plane is straight. Some machines provide a vertical light line as a guide to accomplish this.

When the patient is fully or partially edentulous, positioning aides, such as cotton rolls and nose rests, will ensure that the patient is correctly positioned.

Instruct the patient to grasp the handles of the machine. This provides stability for the patient and helps to keep them in the correct position during the exposure.

Ensure that the patient is standing as tall as possible with his/her cervical spine fully extended. To accomplish this, place gentle upward and forward force on the back of the patient's head using your hands while the patient keeps his/her chin down and forehead forward. The height of the machine can now be adjusted more precisely so that the patient's chin is on the chin rest and the patient's ala-tragus line is approximately horizontal. A horizontal guide light may be present to assist in this positioning. An alternate guide to determine how far a patient's head should be tipped up or down is to look at the maxillary and mandibular incisors from the side of the patient and to position them so that they are, together, as vertical as possible. This positions the alveolar bone of the anterior region within the focal trough and therefore produces a clear image of this area.

While looking at the patient from the side, have the patient smile so that the maxillary canine can be seen. The anterior/posterior position of the patient is now adjusted so that the canine light line passes approximately through the maxillary canine in a vertical direction.

Ensure that the patient's shoulders are not in the path of the machine and make any necessary adjustments to create room.

Common Errors:

- If the patient is not biting in the correct position on the bite stick, then their jaw will not be aligned in the focal trough and the image will be distorted.
- Failure to position the patient so that the midsagittal plane is straight may produce an image that is asymmetrical. When the patient is positioned so that the head is rotated to the left or right, the resulting image will become distorted with magnification of one side and minification on the other side.
- If the patient and machine are positioned so that the patient is in a hunched position, the image produced will show pronounced superimposition of the cervical vertebrae over the midline area, making evaluation of structures in the area more difficult or impossible.
- Also if the patient is hunched the lead apron may become positioned within the path of the x-ray beam. This is exacerbated because the beam is directed in an upward direction from below the patient's neck. The resultant attenuation of the x-ray beam produces a white triangular artefact or "shark fin-like" structure projecting from the bottom of the film.
- Tipping the patient's chin too far up or down leads to poor image quality. With the chin up, the occlusal plane appears flattened out or "frowning" and there is superimposition of the palate over the apices of the maxillary teeth. With the chin too far down, there is an exaggerated upward curve or "smile" of the occlusal plane and the mandibular incisor region may not be seen clearly because it is out of the focal trough. Structures, such as the condyles or mental region, may also be cut off the image.
- If the patient is positioned too far forward or backwards then image distortion will result. With the patient too far forward, there is minification of the anterior teeth and with the patient too far back, magnification occurs.
- If the machine hits the patient's shoulders then it may cause the patient to move or it may stop the machine, terminating the image acquisition prematurely and resulting in a partial panoramic image.

4. Close the temple supports on the patient's head to reinforce its stability.

5. Describe to the patient what will happen during image acquisition, including that the film/x-ray source combination will rotate around his/her head, the length of time of the exposure and any sounds that they will hear. This will help ensure that the patient maintains the correct position and stays still during the exposure.

6. Instruct the patient to place his/her tongue flat onto their hard palate and to close their lips around the bite stick. Ask the patient to hold still, maintaining their position until instructed otherwise by the operator.

Common Errors:

- If the tongue is not placed on the palate, an air space exists between the dorsal surface of the tongue and the roof of the mouth. This creates an overexposed black or “burned out” region which obscures clear visualization of the apices of the maxillary teeth.
- If the lips are not closed, an overexposed black region corresponding to the open oral orifice can also obscure the crowns of the maxillary and mandibular anterior teeth.
- Movement of the patient during the exposure will produce a blurred image.

Machine preparation and exposure

1. Set the exposure parameters. Select the patient size and adjust the KVP and mA.

Common error:

Incorrectly selecting the exposure parameters may result in images that are over or underexposed.

2. Exit the operatory and activate the exposure button. An audible beep will be heard while x-rays are being emitted. Some machines require the operator to hold the exposure button for the entire duration of the exposure.

3. When the exposure is complete and the beep is no longer heard, re-enter the operatory and remove the patient and cassette from the panoramic x-ray unit. Some machines require a button to be pushed in order to return the film/x-ray source combination to its start position.

4. The film/sensor has now been exposed and is ready for processing.

Film Evaluation

Once the film has been developed, it is reviewed to ensure that it provides a quality image. Occasionally, errors in panoramic technique produce an image that is sub-optimal in quality and may require a retake of the image with appropriate adjustments. When the operator is satisfied with the quality of the image, a radiographic interpretation is completed.