Radiology

Panoramic Radiography

Panoramic imaging (also called pantomography) is a technique for producing a single tomographic image of the facial structures that includes both the maxillary and mandibular dental arches and their supporting structures.

Principles of panoramic radiography

x-ray source rotates around the patient's head and in opposite directionto the rotation of image receptor and collimator. Lead collimators in the shape of a slit, located at the x-ray source limit the central ray to a narrow vertical beam. Another collimator between the objects and the receptor reduces scattered radiation.

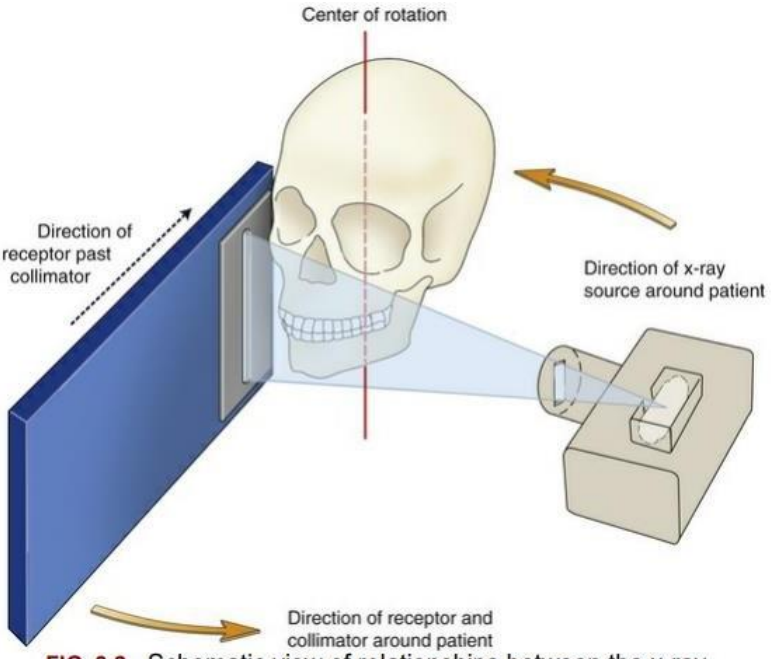


FIG. 9.2 Schematic view of relationships between the x-ray source, the patient, the secondary collimator, and image receptor.

Indications

1. Overall evaluation of dentition

2. Evaluation of intraosseous pathology such as cysts, tumors and infections.

3. Gross evaluation of tempromandiular joints

4. Evaluation of impacted teeth, dental implant, and orthodontic treatment

5. Evaluation of permanent teeth eruption and mixed dentition.

6. Dentomaxillofacial trauma such as fracture.

7. Developmental disturbances of maxillofacial skeleton.

Advantages of Panoramic radiograph

1. Broad coverage of facial bones and teeth
2. Low radiation dose
3. Ease of panoramic radiographic technique
4. Can be used in patients with trismus or in patients who cannot tolerate intraoral radiography
5. Quick and convenient radiographic technique
6. Useful visual aid in patient education and case presentation

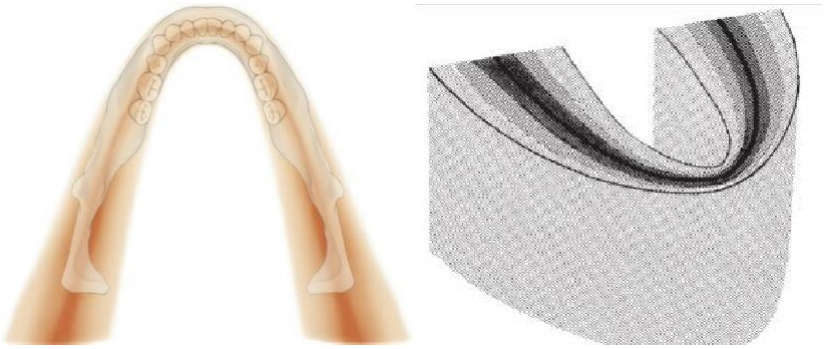
Disadvantages

1. Lower-resolution images that do not provide the fine details provided by intraoral radiographs
2. Magnification across image making linear measurements unreliable
3. superimposition of real, double, and ghost images
4. Requires accurate patient positioning to avoid positioning errors and artifacts, so it is not suitable for children under 5 years or on some disabled patients.
5. Difficult to image both jaws when patient has severe maxillomandibular discrepancy

Focal Trough (Image Layer)

is a wide, three-dimensional curved zone, where the structures lying within this layer are reasonably well defined on panoramic image. The structures seen on a

panoramic image are primarily those located within the image layer. Objects outside the image layer are blurred, magnified, or reduced in size and are sometimes distorted to the extent of not being recognizable.



Focal trough

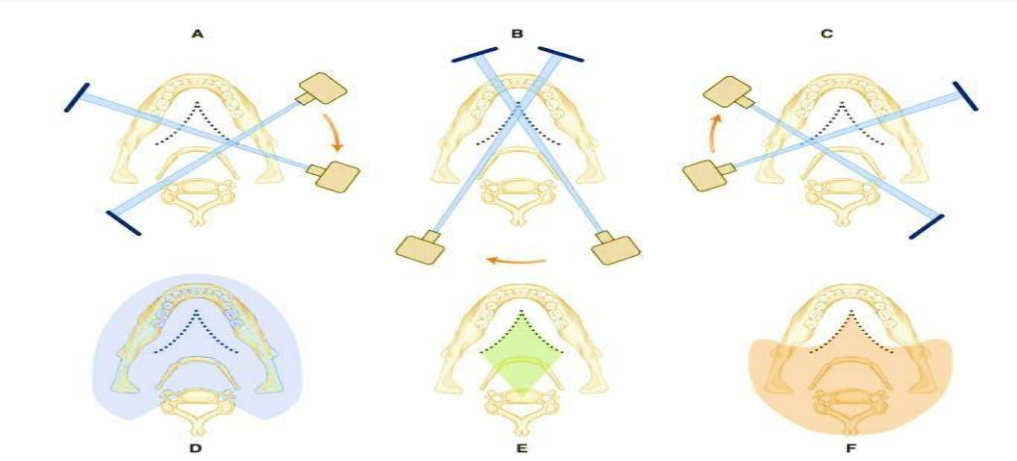
Real, Double, and Ghost images

Because of the rotation of x-ray source and receptor and depending on objects location, objects may cast three different types of images:

1. **Real images**: object that lie between the center of rotation and the receptor form a real image (all the objects within focal trough cast relatively sharp images). (figure D)

2. **Double images**: objects that lie posterior to the center of rotation and that intercepted twice by the x-ray beam form double images (figure E).

3. **Ghost images**: objects that located between the x-ray source and center of rotation, can cast ghost images. The ghost image appear on the opposite side of it's true anatomic location and at higher level. (figure F)



Technique, Patient Positioning and Head Alignment للاطلاع

This technique utilizes a narrow vertical negatively angled beam. The angle can be (−4 to −7°), so the beam exposes the patient just below the occipital bone. The beam is shaped by a lead collimator which is long, narrow slit located at the X-ray source and the image receptor (film or digital plate).

Proper patient preparation and positioning within the focal trough are essential to obtaining diagnostic panoramic radiographs.

1. Dental appliances, earrings, necklaces, hairpins, and any other metallic objects in the head and neck region should be removed.

2. Demonstrate the machine to the patient by cycling it while explaining the need to remain still during the procedure. This is particularly true for children, who may be anxious. Children should be instructed to look forward and to not follow the tube head with their eyes

3. The anteroposterior position of the patient head is achieved typically by place the incisal edges of their maxillary and mandibular incisors into a notched positioning device (the biteblock).

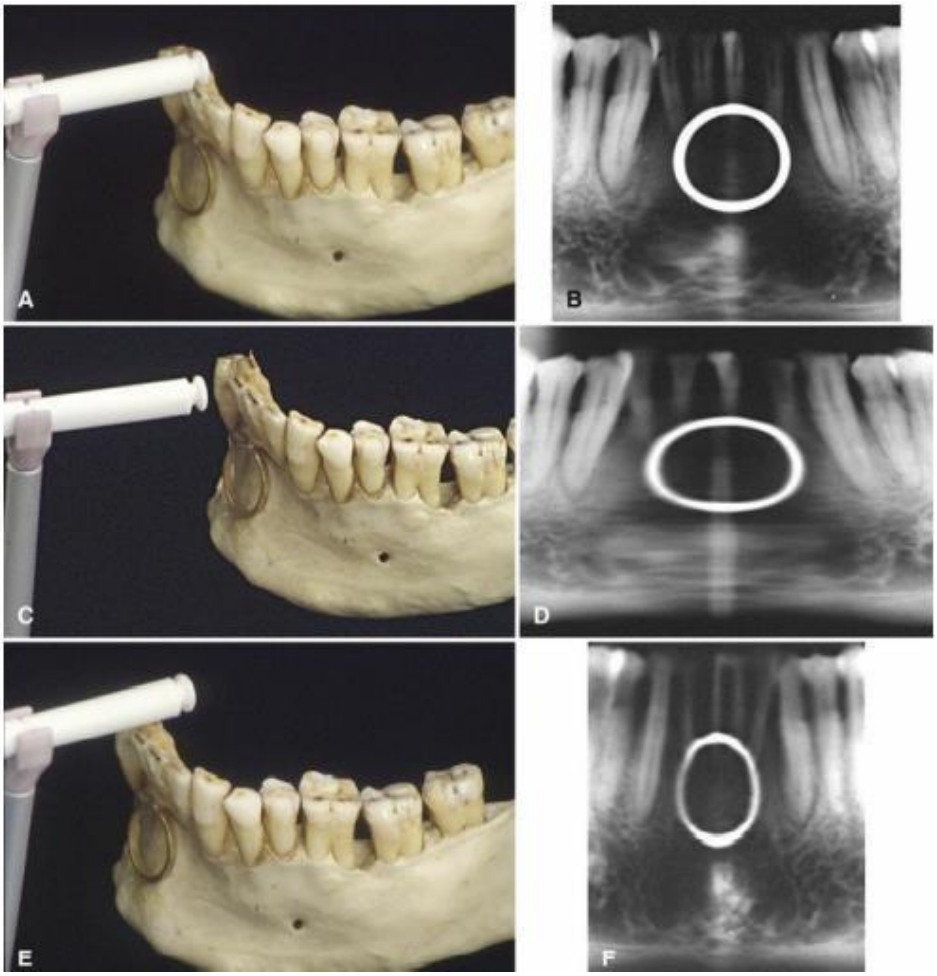
4. The midsagittal plane must be centered within the focal trough without any lateral shift in the mandible

5. The patient's chin and occlusal plane must be properly positioned to avoid distortion. The occlusal plane is aligned so that it is lower anteriorly.

6. Patients are positioned with their backs and spines as erect as possible and their necks extended.

7. من هنا للنهاية مطلوب Ask the patient to swallow and hold the tongue on the roof of the mouth. This raises the dorsum of the tongue to the hard palate, eliminating the air space and providing optimal visualization of the apices of the maxillary teeth

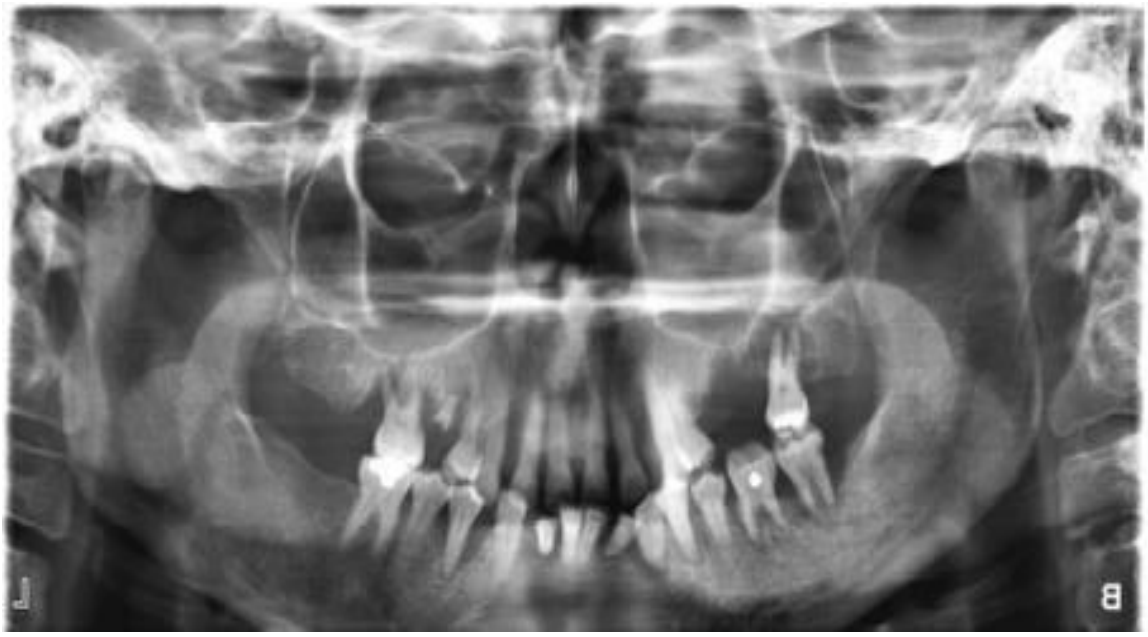
Placement of the patient either too far anterior or too far posterior relative to the focal trough results in significant dimensional **errors** in the images for example: Too far posterior results in magnified mesiodistal dimensions through theanterior sextants and resulting "fat" teeth (D). Too far anterior results in reduced mesiodistal dimensions through the anterior sextants and resulting" thin " teeth (F).



- Failure to position the midsagittal plane lead to rotation of midline results in a radiograph showing right and left sides that are unequally magnified, this positioning error will cause excessive tooth overlap in the premolar regions and results in clinicallyunacceptable images.
-

- If the chin is tipped too high, the occlusal plane on the radiograph appears flat or inverted, and the image of the mandible is distorted (A). In addition, a radiopaque shadow of the hard palate is superimposed on the roots of the maxillary teeth. While If the chin is tipped too low, the occlusal plane shows an exaggerated smile line, the teeth become distorted, the symphyseal region of the mandible may be cut off the film (B).

A

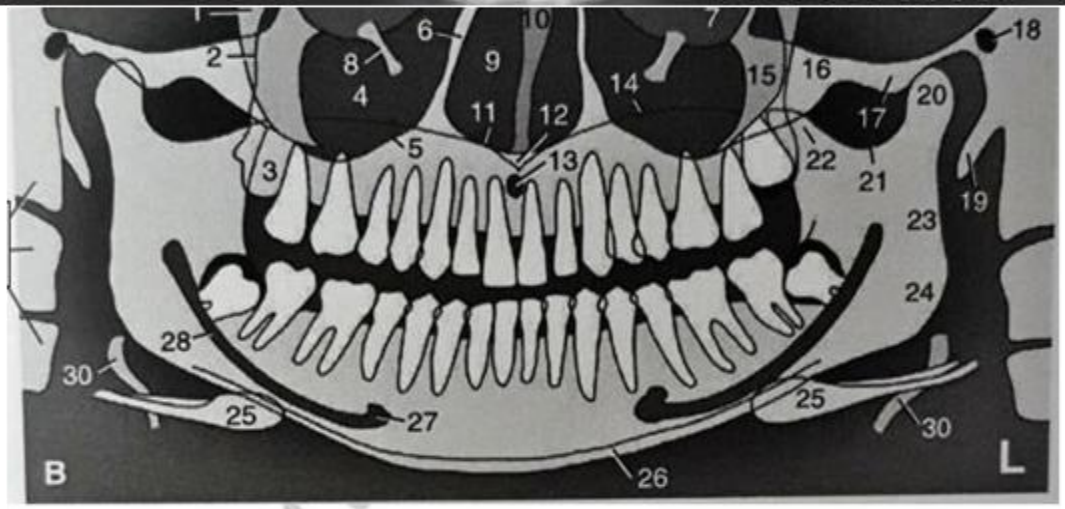


B

- improperly positioned patient. Patients don't sit straight or don't stretch their neck leading to large radiopaque region in the middle (vertebral shadow)

Interpretation of Panoramic Images

it is important to know a good panoramic radiograph the mandible is "U" shaped, the condyles are positioned about an inch inside the edge of the film and 1\3 of the way down from the top edge of the film. The occlusal plane exhibits a slight curve or "smile line", upwards. The roots of the maxillary & mandibular anterior teeth are readily visible.



Anatomical landmarks in the panoramic radiograph

1. Pterygomaxillary fissure
2. Posterior border of maxilla
3. Maxillary tuberosity
4. Maxillary sinus
5. Floor of the maxillary sinus
6. Medial border of maxillary sinus/ lateral border of the nasal cavity
7. Floor of the orbit
8. Infraorbital canal
9. Nasal cavity
10. Nasal septum
11. Floor of the nasal cavity
12. Anterior nasal spine
13. Incisive foramen
14. Hard palate/floor of the nasal cavity
15. Zygomatic process of the maxilla
16. Zygomatic arch
17. Articular eminence
18. External auditory meatus
19. Styloid process
20. Mandibular condyle
21. Sigmoid notch
22. Coronoid process
23. Posterior border of ramus
24. Angle of mandible
25. Hyoid bone
26. Inferior border of mandible
27. Mental foramen
28. Mandibular canal
29. Cervical vertebrae
30. Epiglottis