BDS Year 4 Regular batch

Academic Year 2023-2024

Subject: Oral Medicine

Topic: ORTHOPANTOMOGRAM

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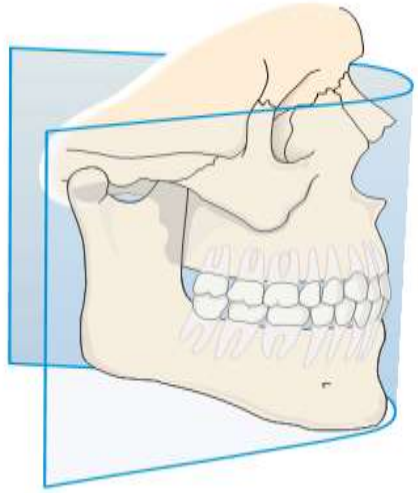
Introduction



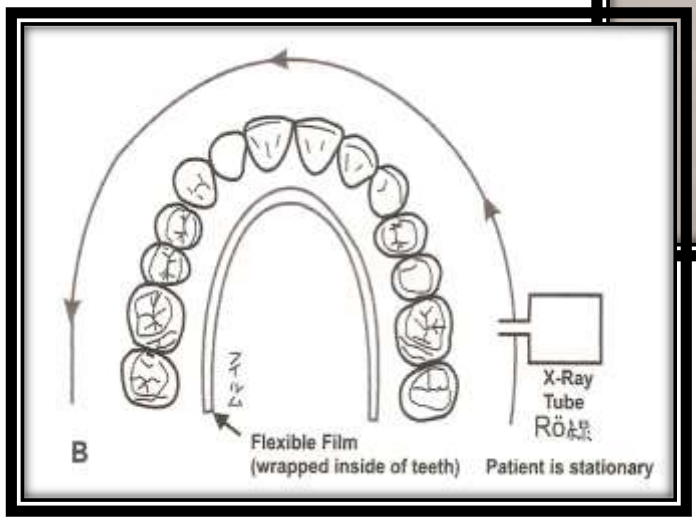
- Panoramic radiography is also known as pantomography or rotational radiography.
- A radiographic procedure that produces a single tomographic image of facial structures including both maxillary and mandibular areas and their supporting structures.

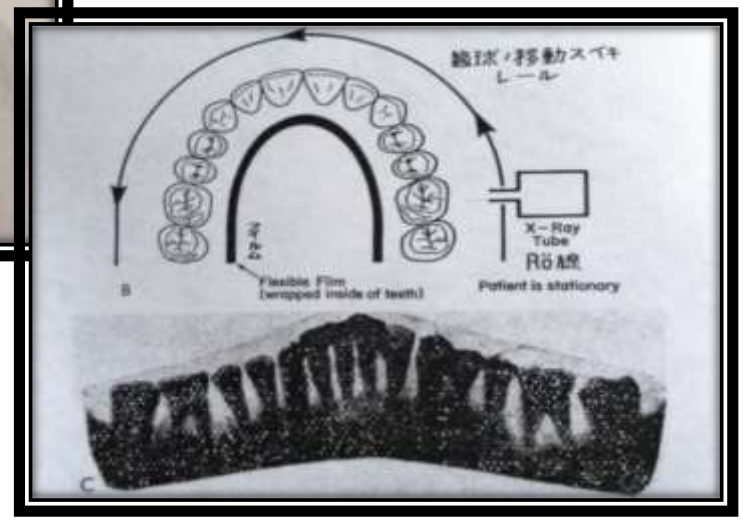
Tomography

- To view a "slice" of a structure
- Useful for examining centrally located structures where overlying structures obscure conventional images
- Panoramic radiographs are curved surface tomograms.

History

- **Dr. H. Numata of Japan in 1933 and experimented in 1934.**





In 1946 Dr. Yrjo Veli Paatero from Finland proposed& demonstrated a slit beam method of panoramic radiography for the dental arches (1949)

- **Latest OPG was introduced in 1984, which includes:**
  - **Three plane light line system**
  - **Rare earth screens**
  - **Control unit**
  - **Automatic kVp ramps**
  - **Multiple generator**
  - **Microprocessor controlled programming**

Indication

- Impacted wisdom teeth .
- Periodontal bone loss and periapical involvement..
- Dental implants
- Dental pain
- Dentoalveolar fractures and mandibular fractures.

- Odontogenic cyst, tumor.
- Orthodontic assessment.
- Caries detection.
- developmental anomalies
- Carcinoma in relation to the jaws
- Temporomandibular joint disorders
- Salivary stones (Sialolithiasis).

Advantage

- Broad coverage of facial bones and teeth
- Low patient radiation dose
- Convenient for the patient (films need not be placed inside the mouth)
- Ability to be used in patients when the opening is restricted e.g. trismus
- Short time required for making the image
- Easy to store compared to the large set of intra oral x-rays which are typically used.

Disadvantages

- **Image Quality : Shows magnification, geometric distortion, poor definition and overlapping of teeth images.**
- **Superimposition of spinal cord on anterior portion of OPG**
- **Overuse : Easy in obtaining OPG might lead to carelessness by substitution for other project that might be adequate.**
- **Cost factor : Quite high.**
- **Low exposure**

Principle

- If the film move at a speed that follows the moving projection of a certain point, this point will always be projected on the same spot on the film and will appear sharp.

- In the OPG, film attached to a rotating system and moves in opposite direction to the beam. The film is given the correct speed by apposing this movement by different movement relative to the beam.

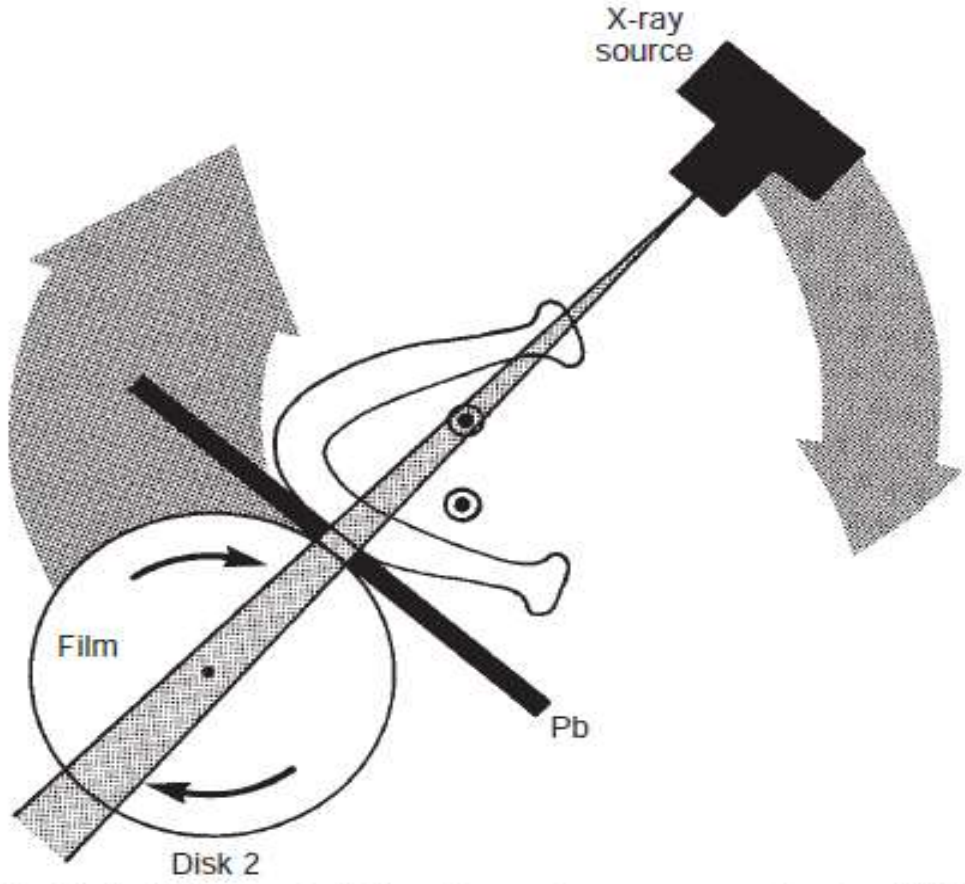


FIG. **11-4** Movement of the film and x-ray source about a shifting

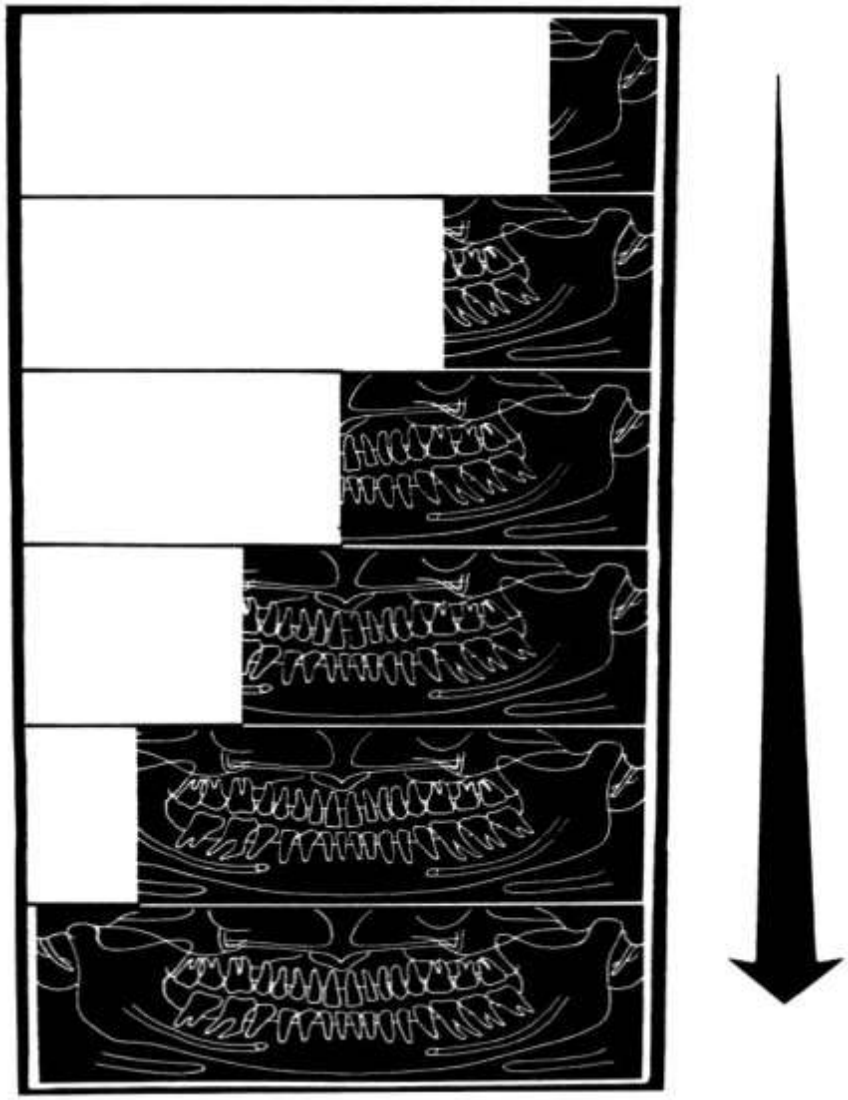


Diagram showing the gradual build-up of a panoramic tomograph over an 18-second cycle, illustrating how a different part of the patient is imaged at different stages in the cycle.

Rotation Center

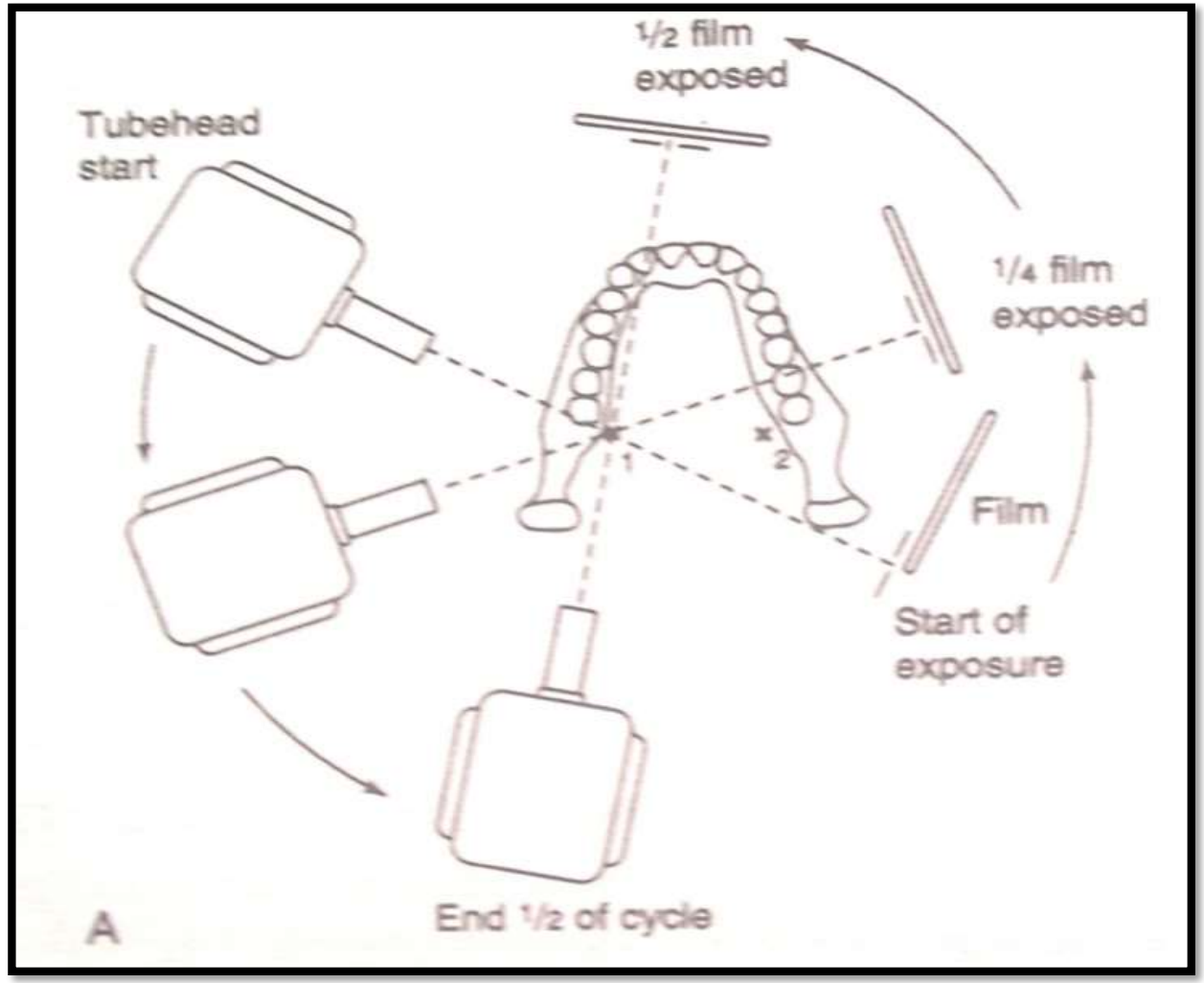
- In panoramic radiography , the **film or cassette carrier and x-ray tube** head are connected and rotated simultaneously around a patient during exposure.
- The point/axis, around which FILM AND the cassette carrier & x-ray tube head rotate is termed as the *rotation center.*
- The center of rotation changes as the film and tube head rotate which allows the image layer to confirm to the elliptical shape of the dental arches.

Type of rotation center

- Single center of rotatation
- Double center of rotation
- Triple center of rotation
- Moving center of rotation

- **Single center of rotation –**
- **Two center of rotation – individual left and right sides of the arc formed by the teeth and jaws closely form a part of a circle.**
- **Center of rotation be positioned some what anteriorly to the location of the third molar opposite the side being examined. Used in panorex machine.**

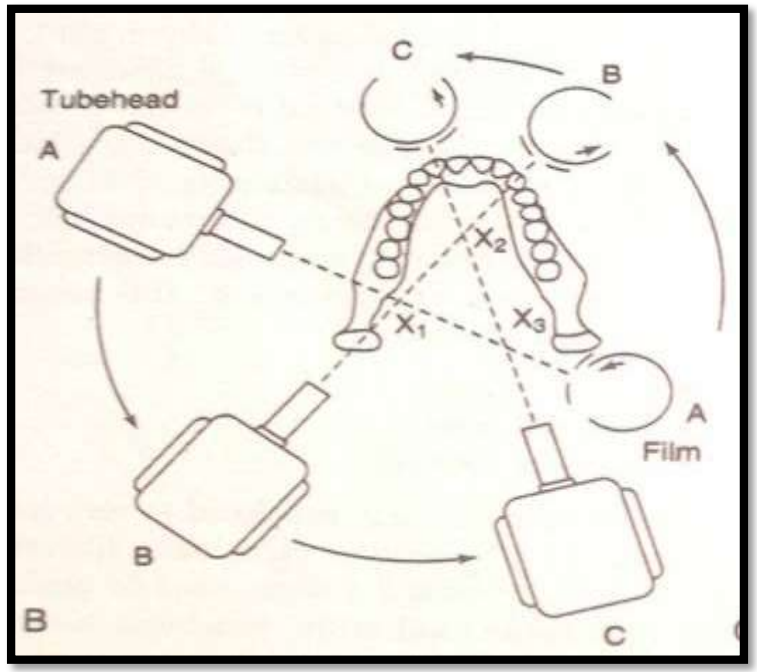
Double rotation center

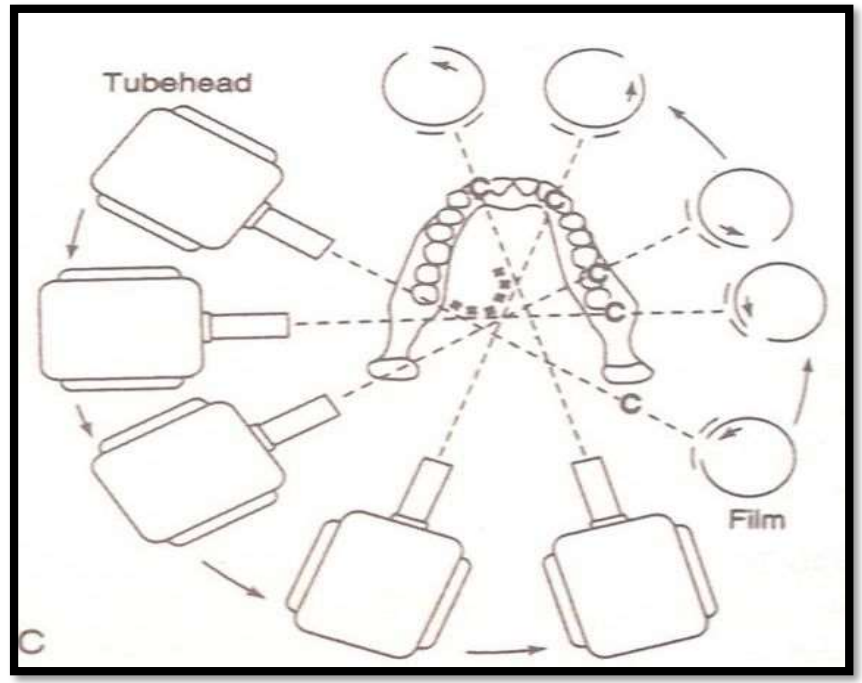


Three center of rotation:

- Divide the arc of the jaws in three areas:
  - Condyle to first bicuspid posterior segment
  - Cuspid to cuspid anterior segment
  - Contra lateral posterior segment
- Two centers bilaterally situated posterior to third molars and one posterior to incisors
- X ray beam can be shifted from one center to other without any interruption and a continuous image can be made from condyle to condyle eg. Panoram orthopantomograph.

Three Center Of Rotation/ moving

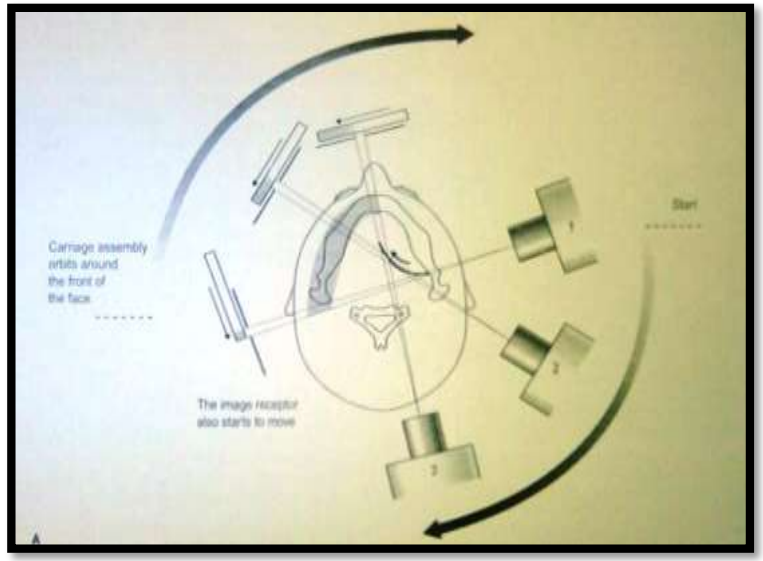


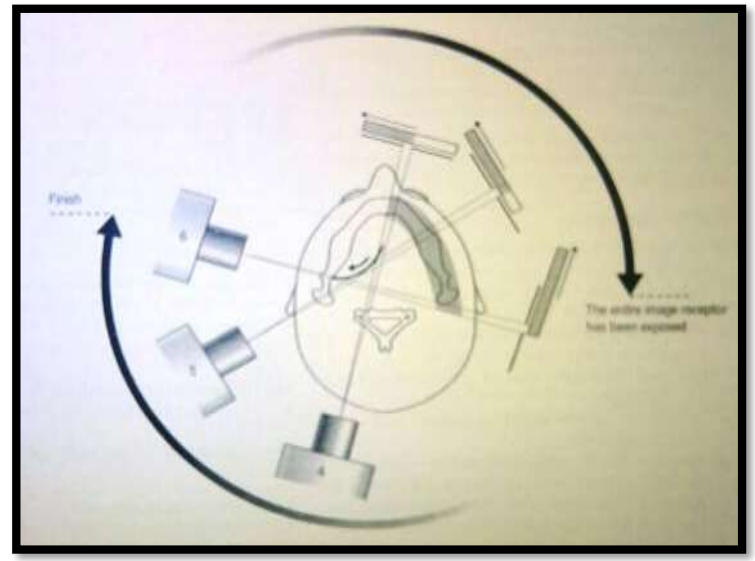


- Most panoramic machines now use a continuously moving center of rotation rather than multiple fixed locations.
- This feature optimizes the shape of the image layer to reveal the teeth and supporting bone.
- This center of rotation is initially near the lingual surface of the right body of the mandible when the left temporomandibular joint (TMJ) is imaged.

- **The rotation center moves forward along an arc that ends just lingual to the symphysis of the mandible where the midline is imaged.**

- **The arc is reversed as the opposite side of the face is imaged.**


Carriage assembly orbits around the front of the face
Start
The image receptor also starts to move


Finish

- **Conclusively, center of rotation changes as the film and tubehead rotate around the patient.**
- **This rotational change allows the image layer to confirm the elliptical shape of the dental arches.**
- **The location & number of rotational center influence the size & shape of the focal trough or image layer.**

Panoramic Imaging:
Principles of Image Layer Formation

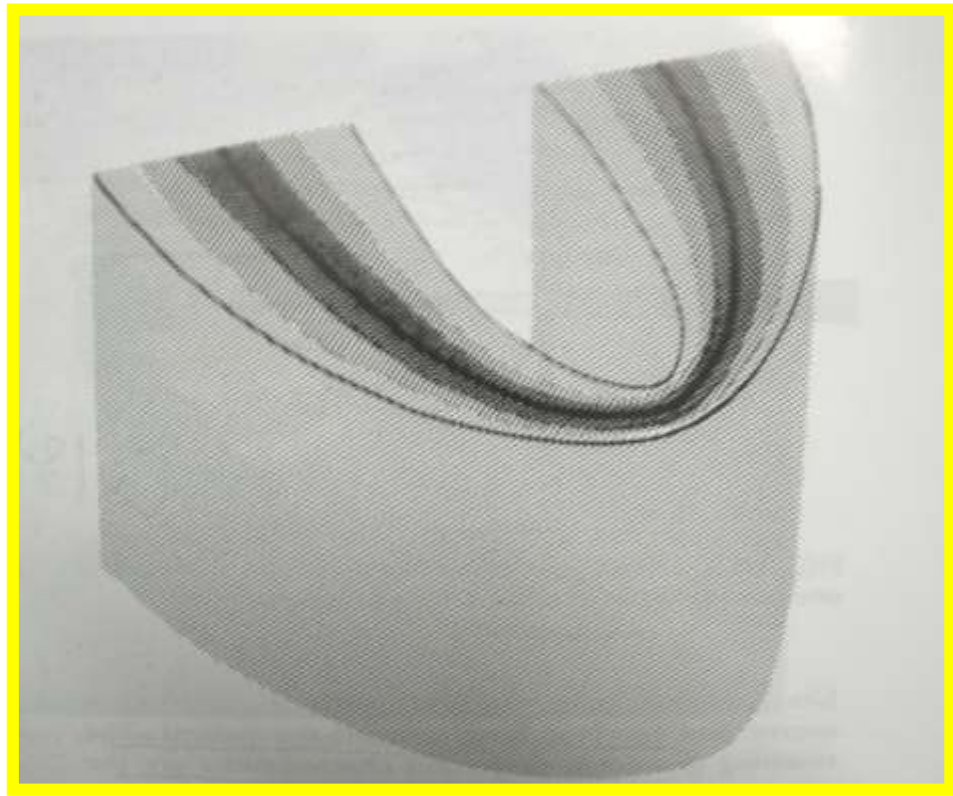
- In panoramic radiography, the focal trough is used to determine where the dental arches must be positioned to achieve the clearest image.

- Focal trough also known as image layer.

The focal trough or image layer

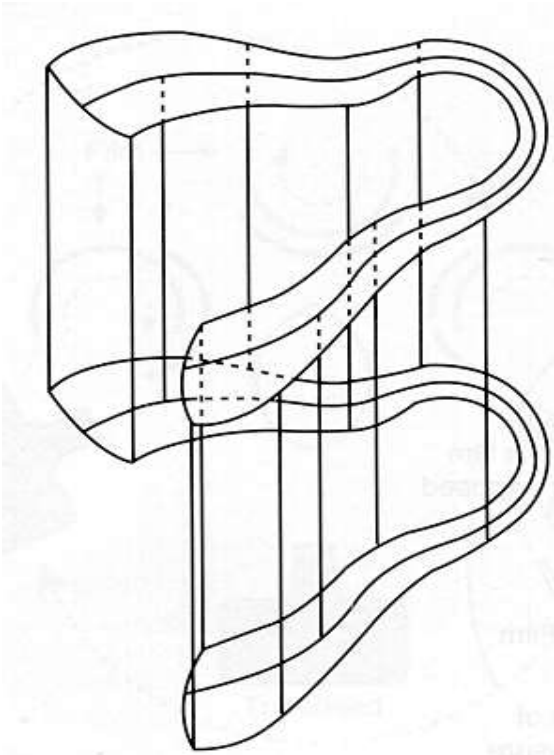
- It is three dimensional curved zone in which structures lying within are clearly demonstrated on a panoramic radiograph.
- Determines position of dental arches
- Objects outside this plane will appear distorted, fuzzy, or may not be visible

- **The image layer is called the focal trough**

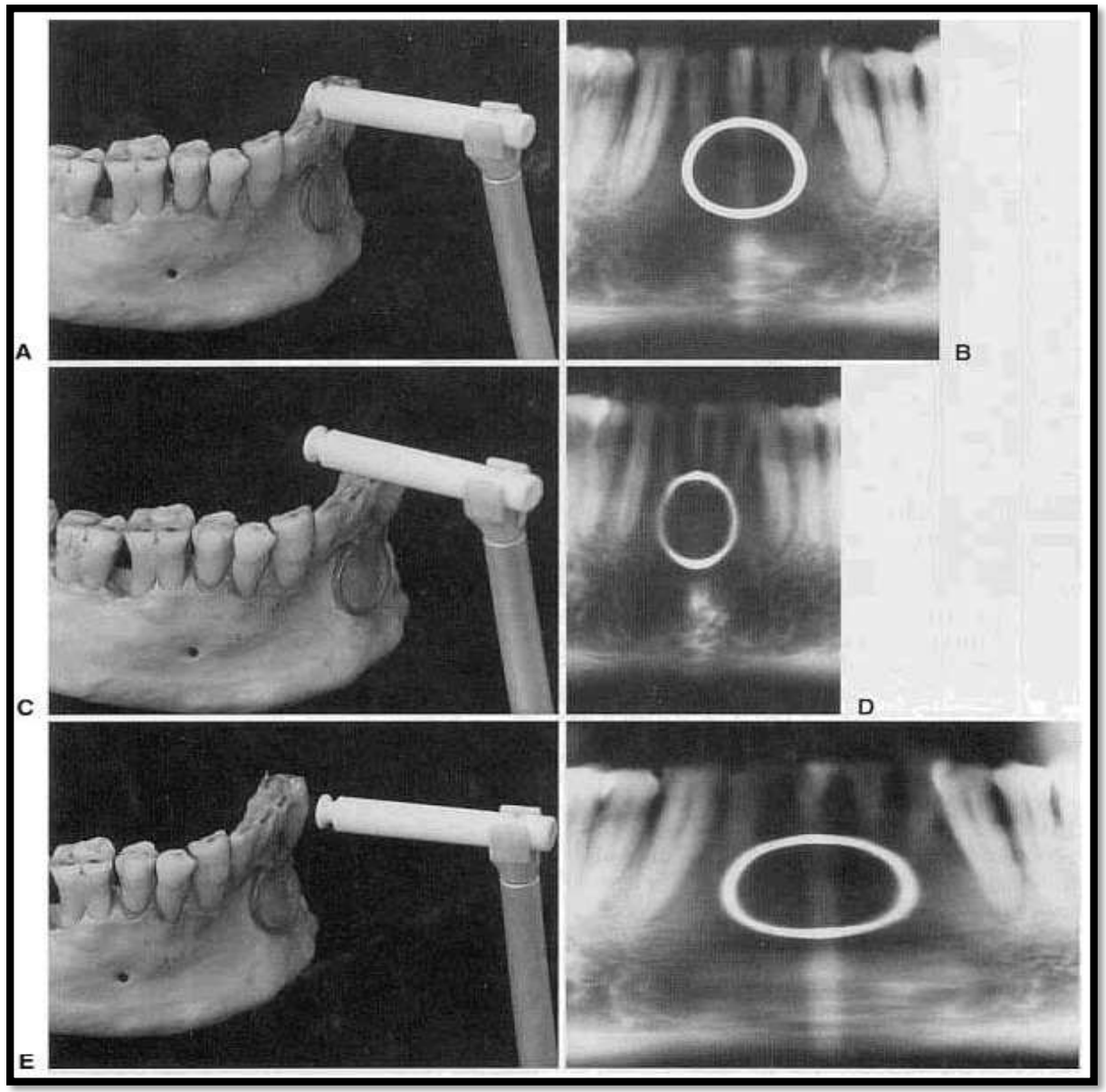


Panoramic Imaging:
Principles of Image Layer Formation

- Vertical and horizontal dimensions match only when the object lies within a particular plane called the central plane or sharply depicted plane of the image layer



- The arches should be placed within the image layer
- The image layer thickness depends upon the effective projection radius and width of the beam
- Size and shape varies according to the manufacturer
- Closer the rotation center narrower the focal trough. In most machines narrow in the anterior region and wide in the posterior region


A
B
C
D
E

Equipment:

Main component include:

- X ray tube head:
- Head positioner
- Exposure controls

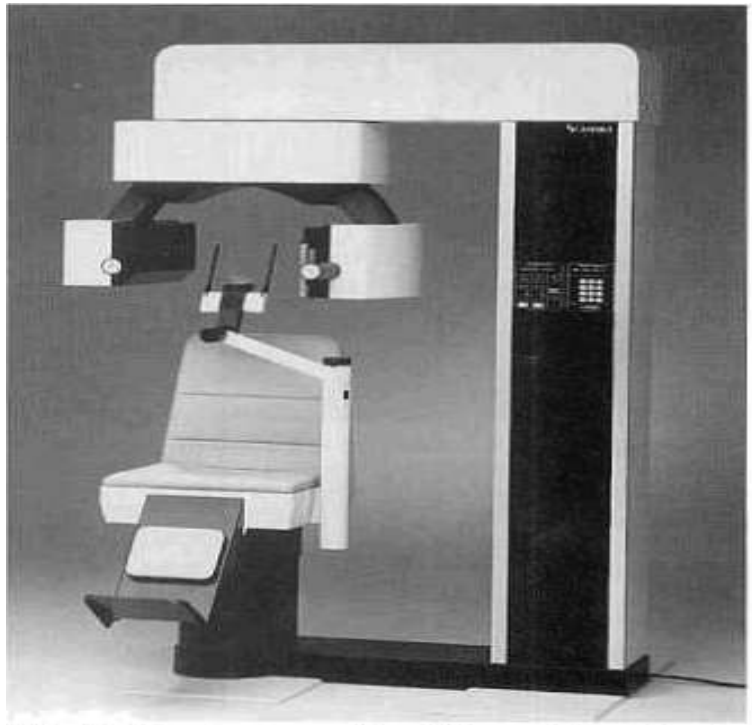


FIG. **10-11** Scanora multimodality machine. (Courtesy Soredex Inc., Milwaukee, WI.)

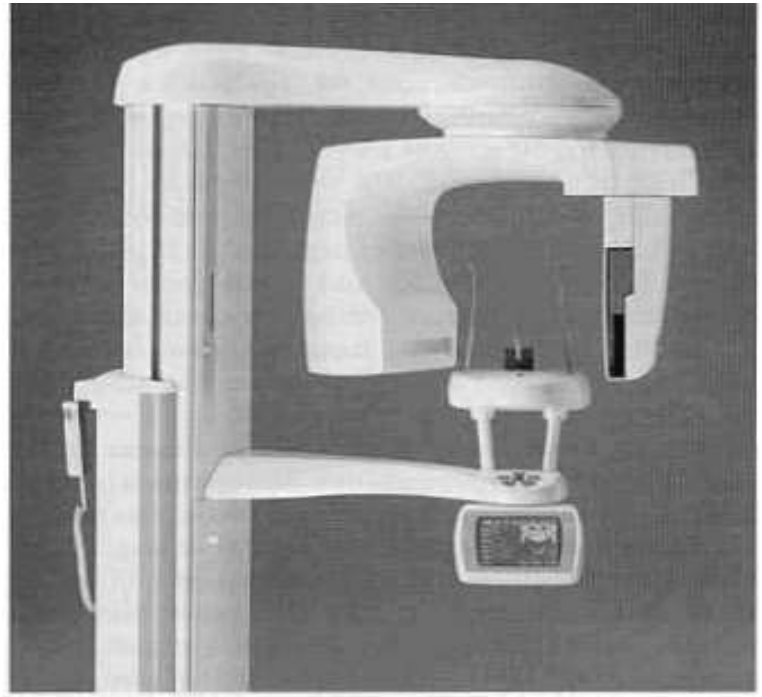


FIG. **10-10** ProMax (PLANMECA) Panoramic machine. (Courtesy Planmeca Inc., Roselle, IL.)

Exposure controls:

- MA & KvP settings are adjustable and varied to accommodate patient of different sizes

Exposure time is fixed

- Exposure parameters:
- MA 15 KvP 76 sec 15 dose 0.103 mR
- MA 15 KvP 80 sec 15 dose 0.116 mR

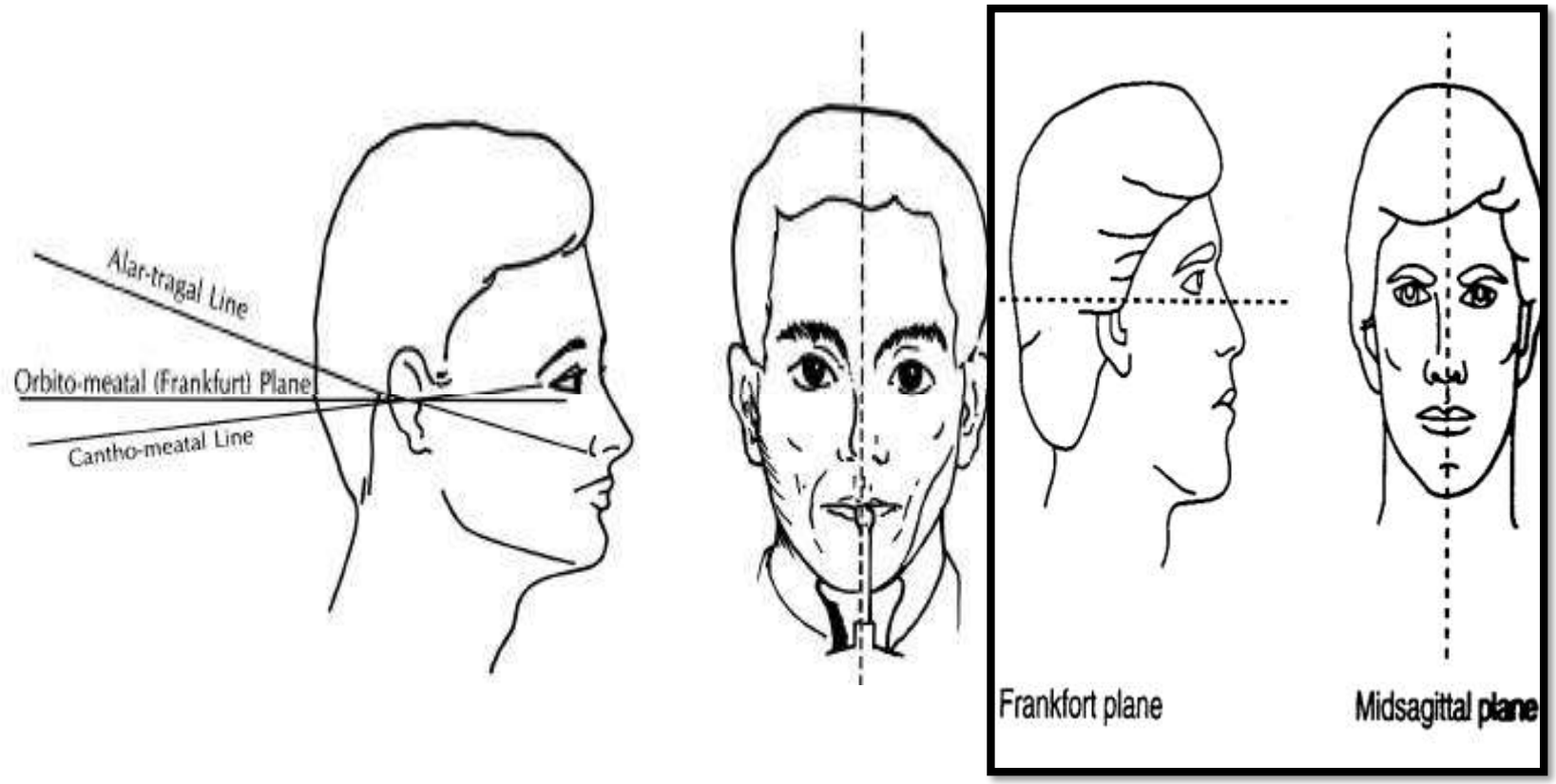
Patient preparation

- History taking
- Instruct the patient about the procedure.
- Radiation protection
- Removal of the ear / eye / nose wear.

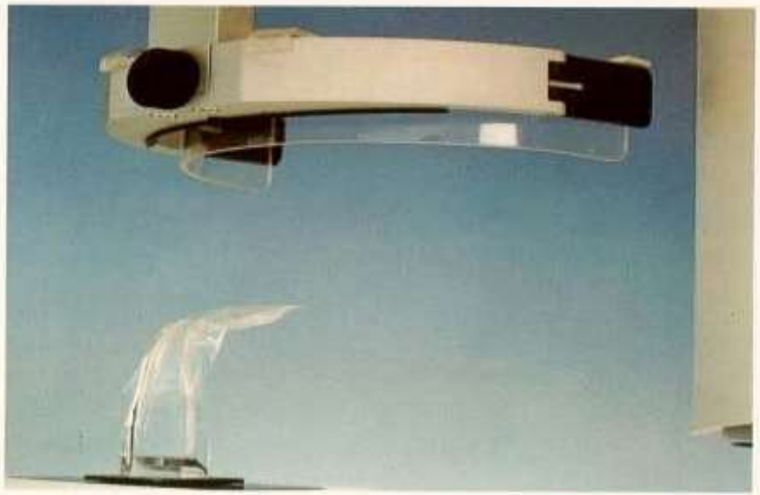
Patient positioning:

- Sit or stand upright
- Bite on the bite block
- Position of the midsagittal plane.
- Position of Frankfort horizontal plane
- Tongue positioning
- Make patient wear a lead apron without thyroid color and remove all objects from head which will interfere with film exposure.

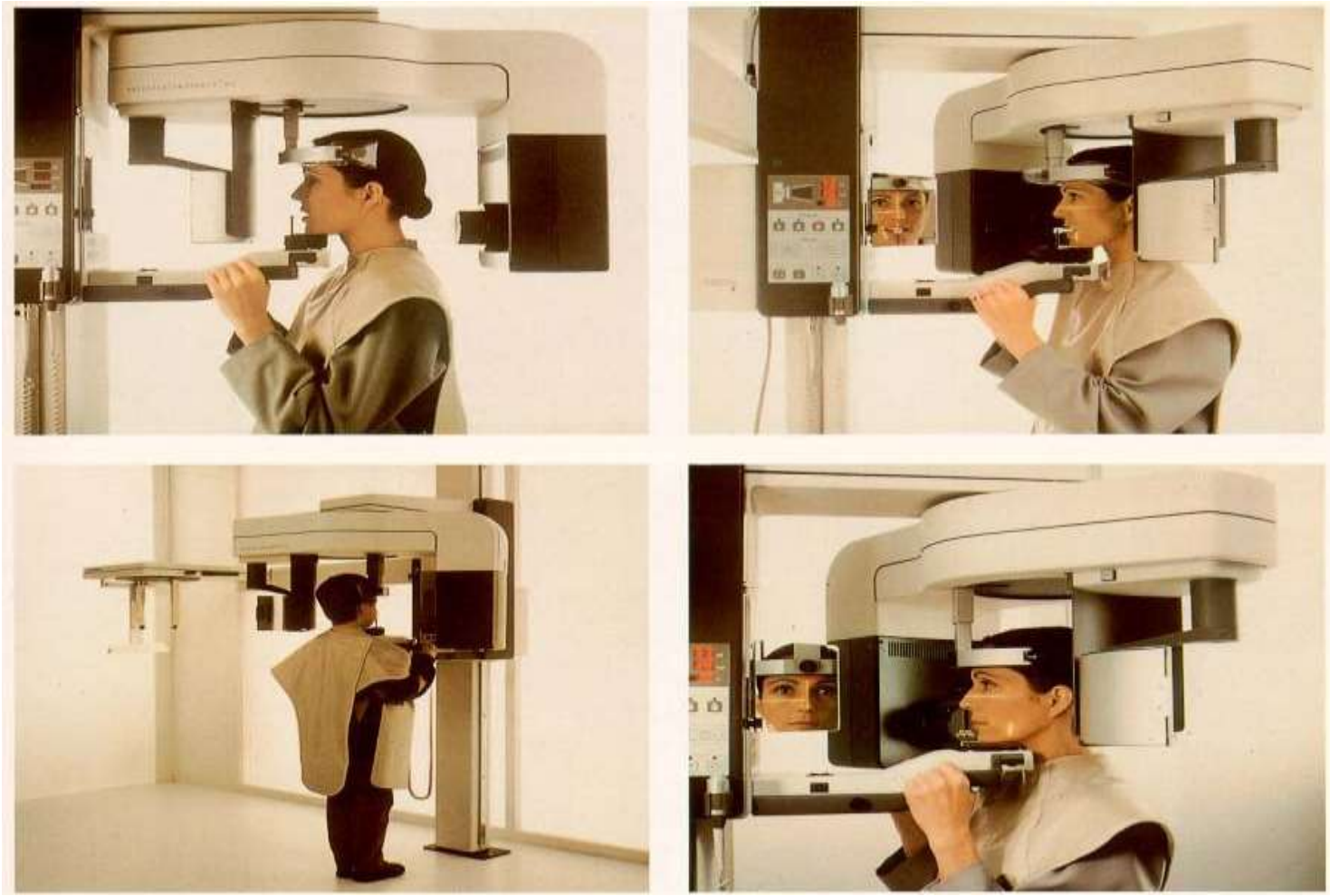
Four planes to remember








- Midsagittal plane is perpendicular to their and aligned with vertical center of chin rest.
- Frankfort plane be parallel to floor.
- Ala tragus line be 5^{o} down and forward.



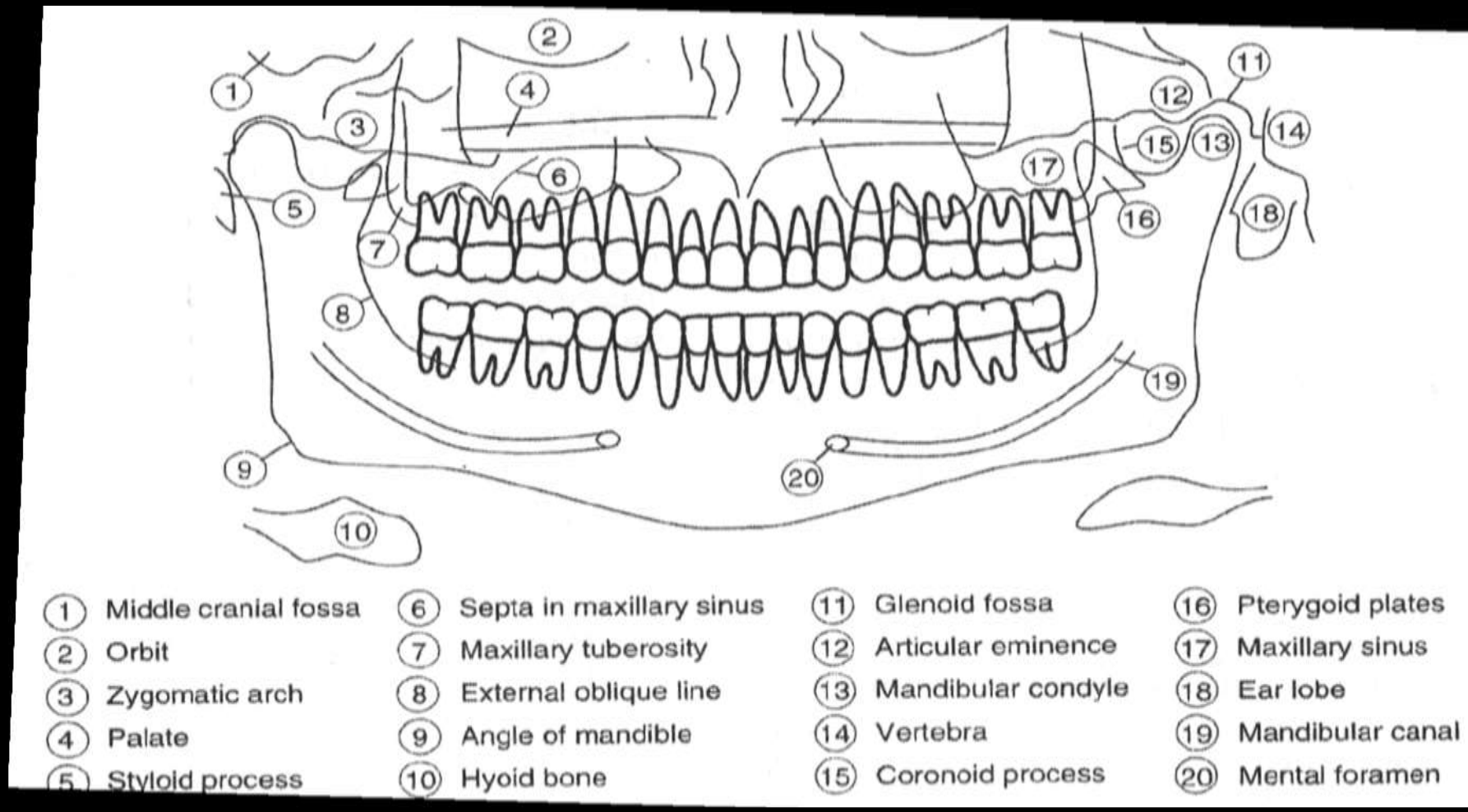
Radiation ethics

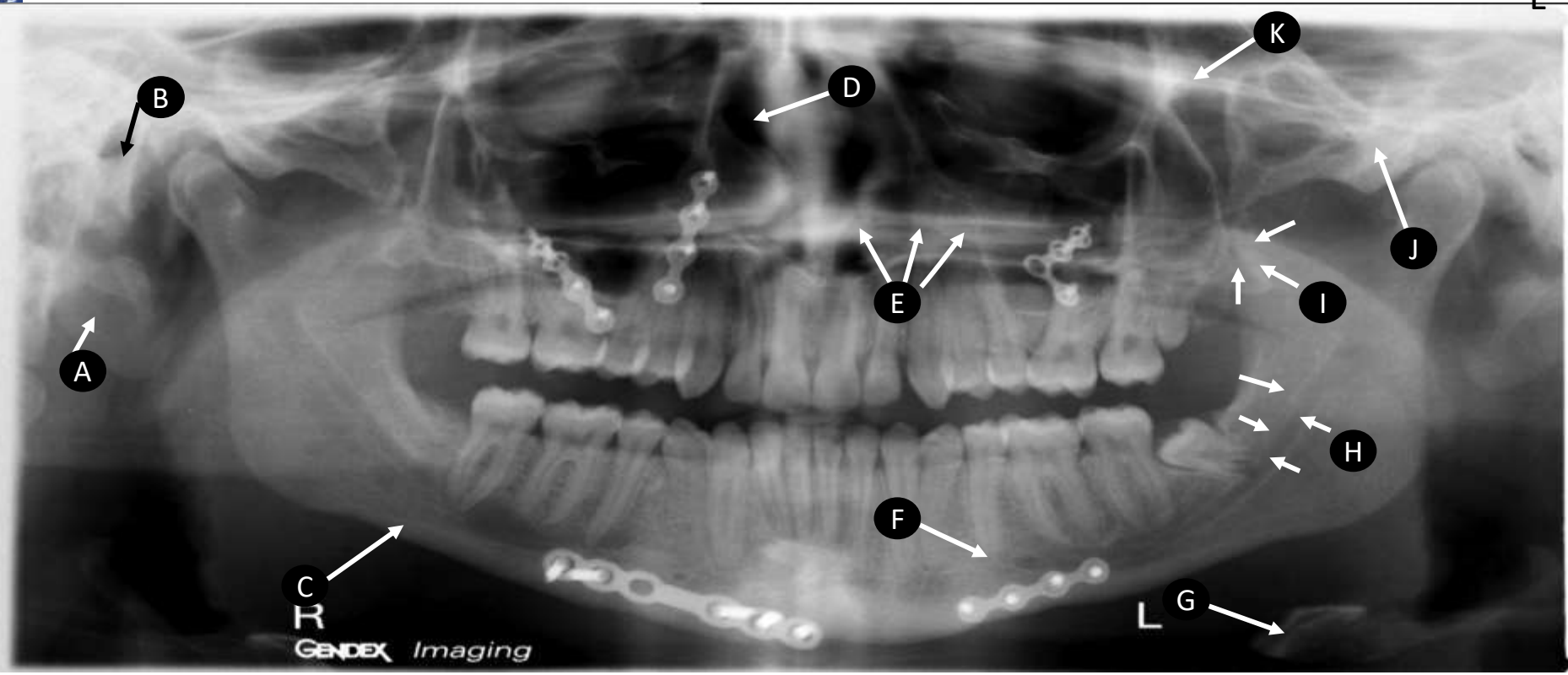
- Like any medical imaging utilizing ionizing radiation, there will be a degree of direct ionizing damage and indirect damage from free radicals created during the ionization of water molecules within cells.

- A rough estimate of the risk of fatal cancer from a panoramic radiograph is about 1 in 1,000,000.

- The age of the person being imaged also alters the risk, with younger people having a slightly higher risk. E.g. the 1 in 1,000,000 risk would be doubled for someone in the 10-20 age group

Normal anatomical landmark





A. Ear lobe
B. External auditory meatus
C. Submandibular gland fossa
D. Nasal septum
E. Hard palate
F. Mental foramen
G. Hyoid bone
H. Mandibular canal
I. Pterygoid plates
J. Articular eminence
K. Pterygomaxillary fissure

A. Patient preparation errors

1.Ghost images:

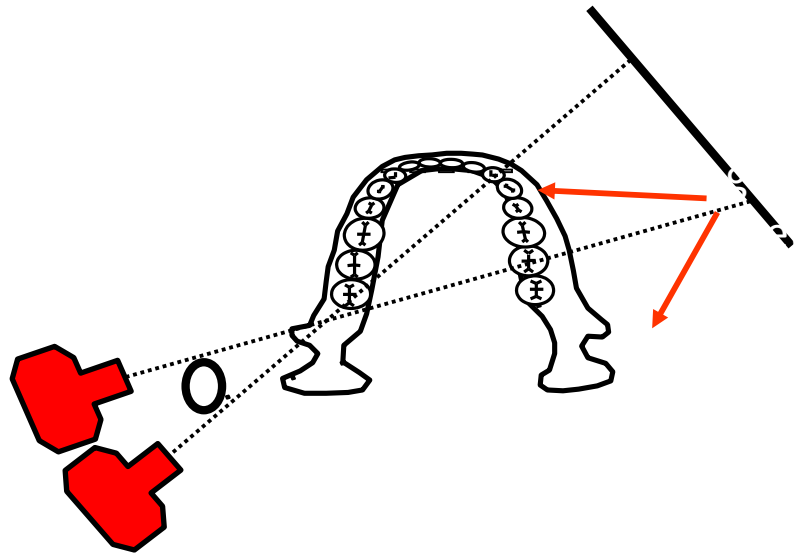
- Radiopaque artifact that appear
- only if the objects Ex (eye glass, orthodontic retainer..) are not removed.

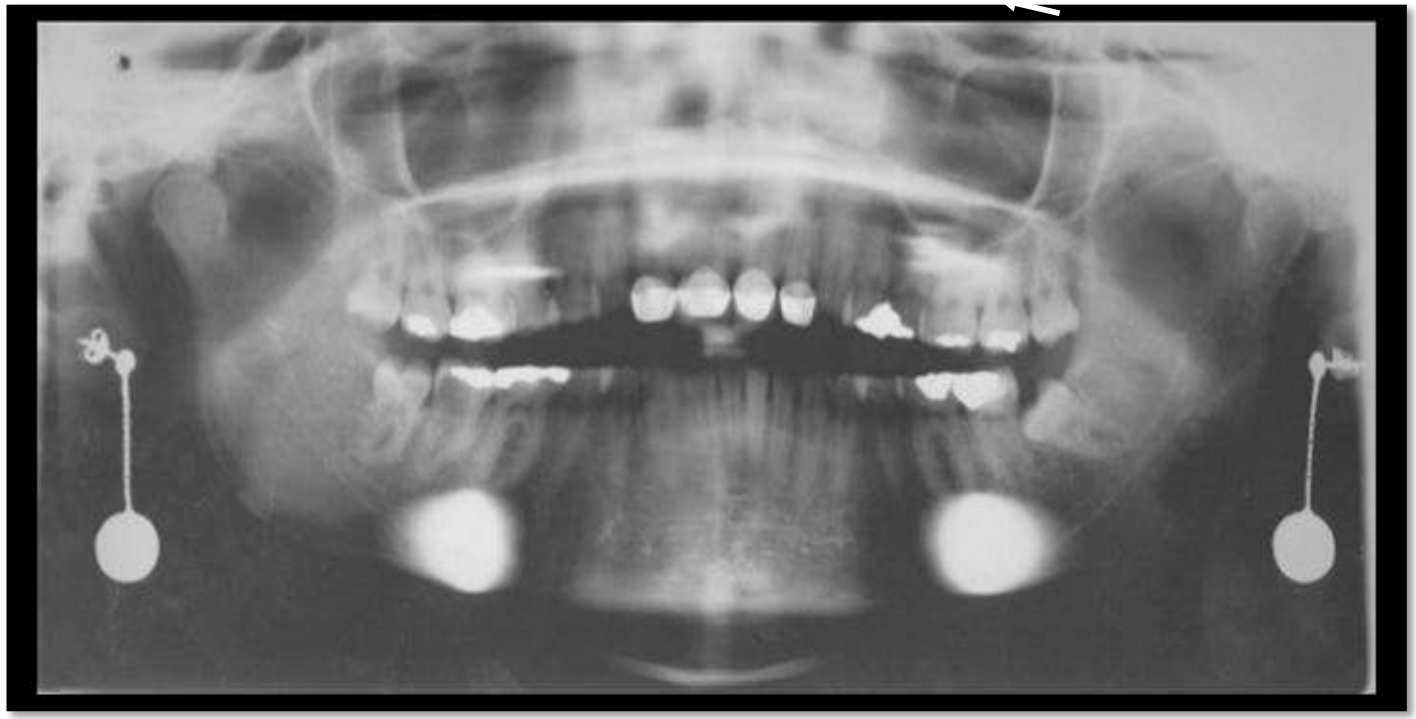
2.Lead apron artifact:

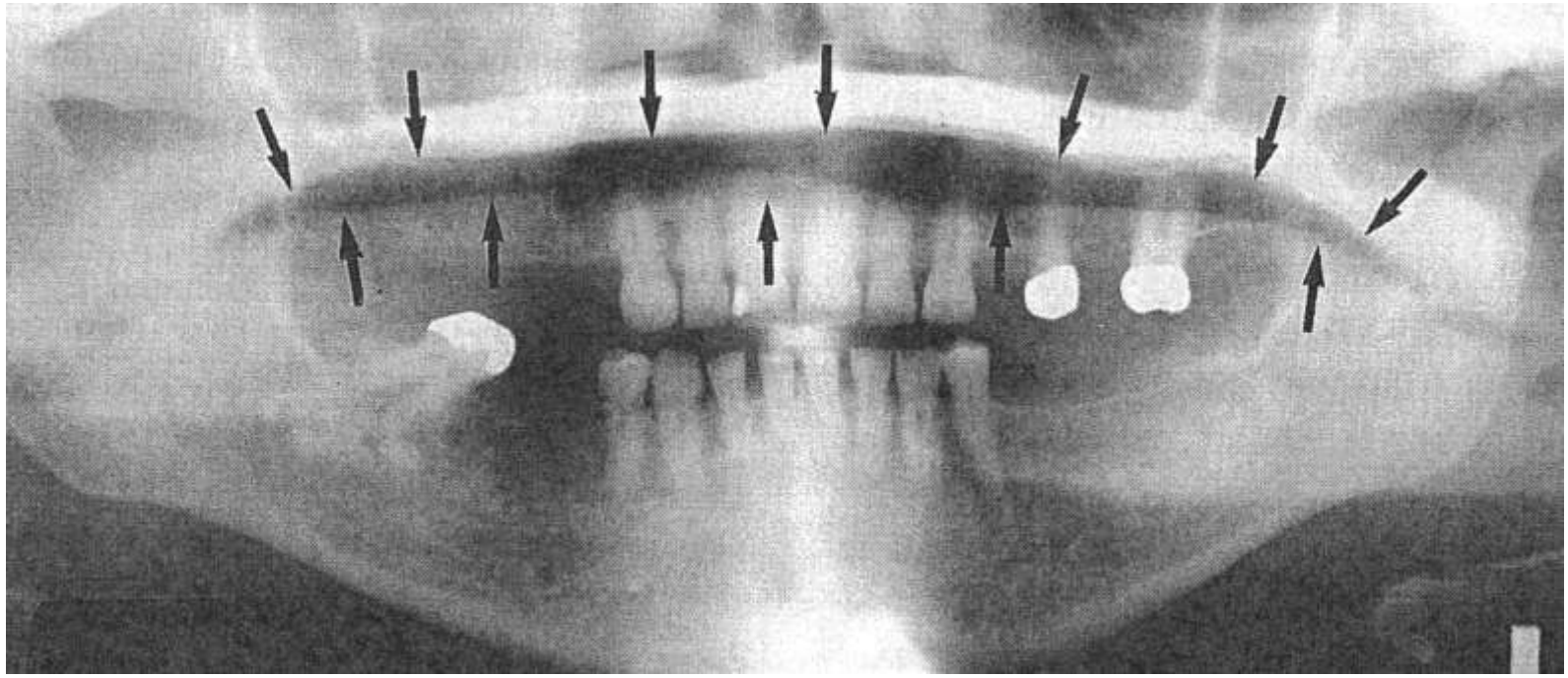
- only if the dental radiographer used lead apron with thyroid collar.

Ghost Image

Ghost images are formed by dense objects located between the tubehead and the rotation center. These ghost images usually result from external objects such as earrings, but they may be produced by dense anatomical structures such as the mandible.







B. Patient positioning errors

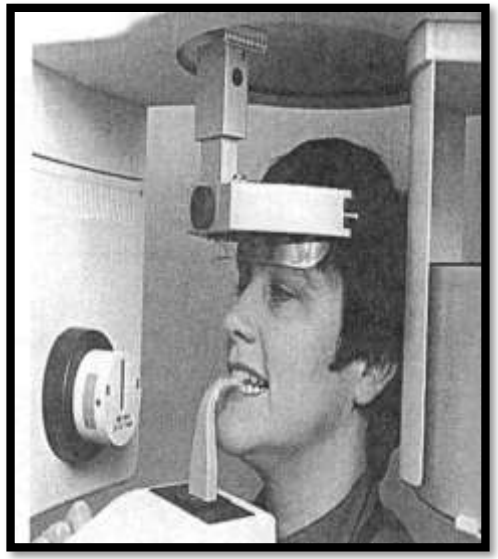
1.positioning of lips and tongue :

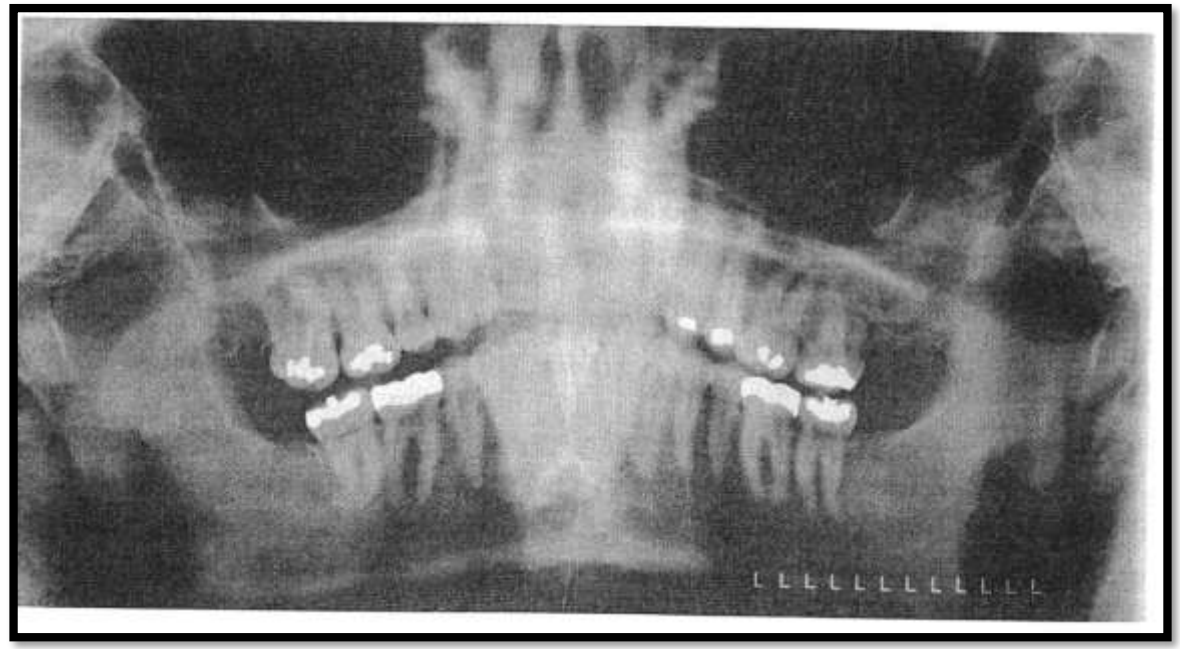
- If patient lips are not closed on Bite blocks during the Exposure, Dark radiolucent shadow results that obscure the anterior teeth.
- If tongue is not in contact with palate , dark radiolucent shadow will Obscure the apices of maxillary teeth.

2.Positinong of Frankfort plane Upward :

If patient's chin is too high or tipped up, Frankfort plane is angled Upward the following will result:

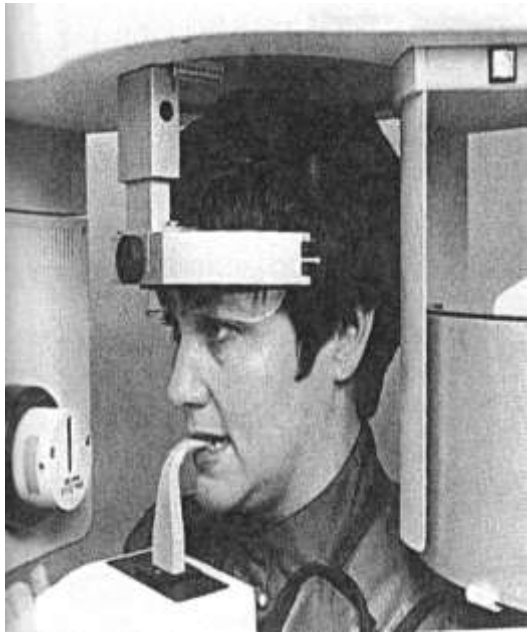
- The hard palate and floor of nasal cavity appear superimposed over the roots of maxillary teeth.
- There is a loss of detail in the maxillary incisors region
- The maxillary incisors appear blurred and magnified
- "A reverse smile line " will appear on the radiograph

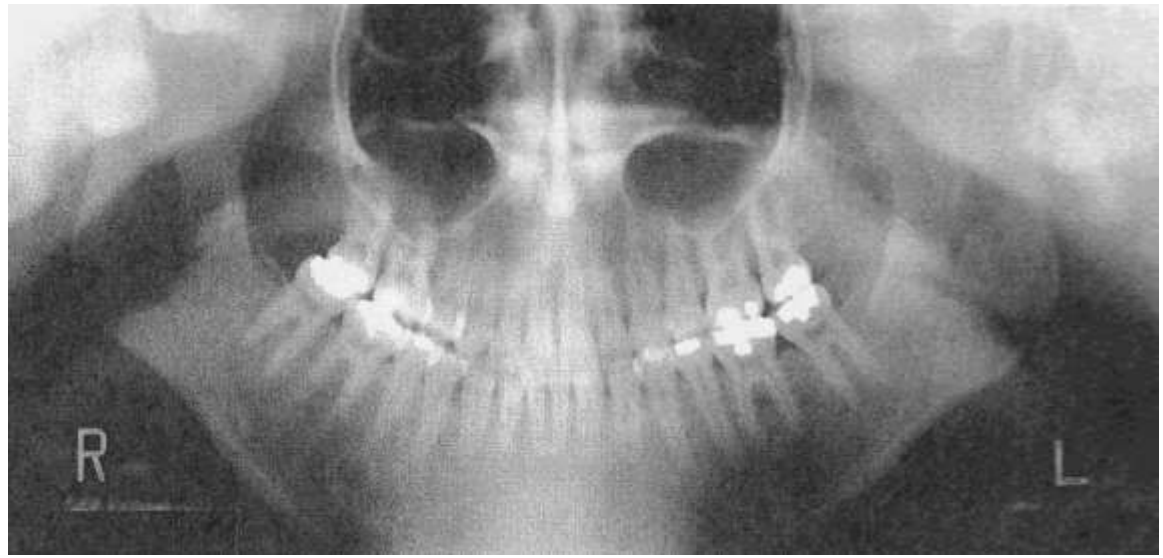




3.Positinong of Frankfort plane Downward

- If the patient's chin is too low, the Frankfort plane is angled down ward it will result in:
- the mandibular incisors appear blurred
- There is a loss if detail in the anterior apical region
- The mandibular condyles may not be visible
- A "curved Upward smile line" will appear.

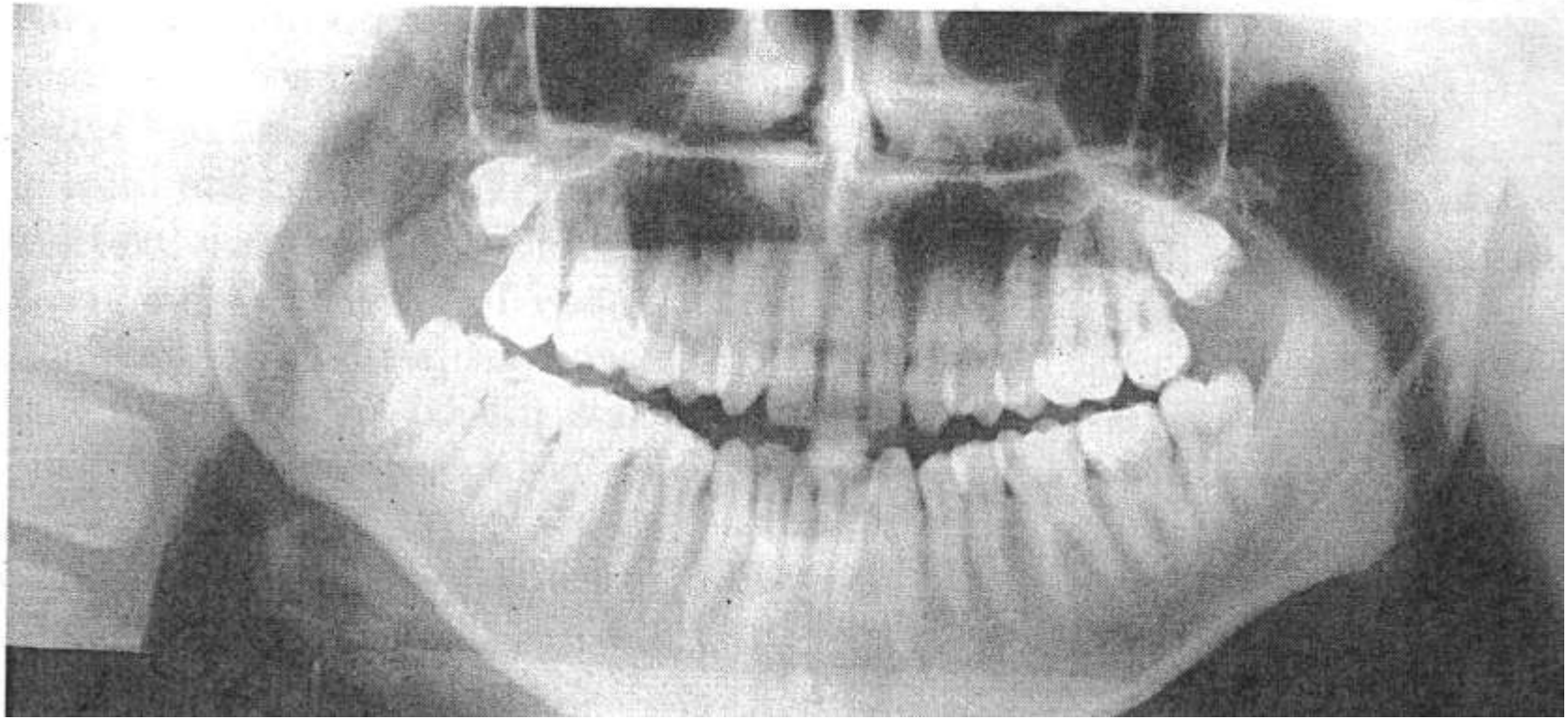



R
L

4.Postinong of teeth Anterior to Focal trough (not in the groove in the Bite block)

- The teeth will appear blurred
- if too far anterior to the focal trough it will appear “skinny” and out of focus.

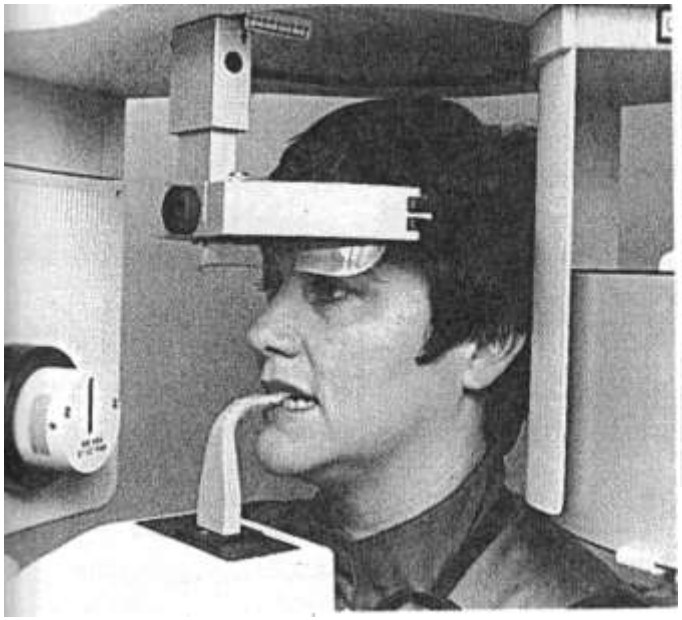
Teeth anterior to focal trough



Positioning of teeth posterior to Focal trough:

- ✓ The teeth will appear blurred
- ✓ If too far the anterior teeth will appear “Fat”

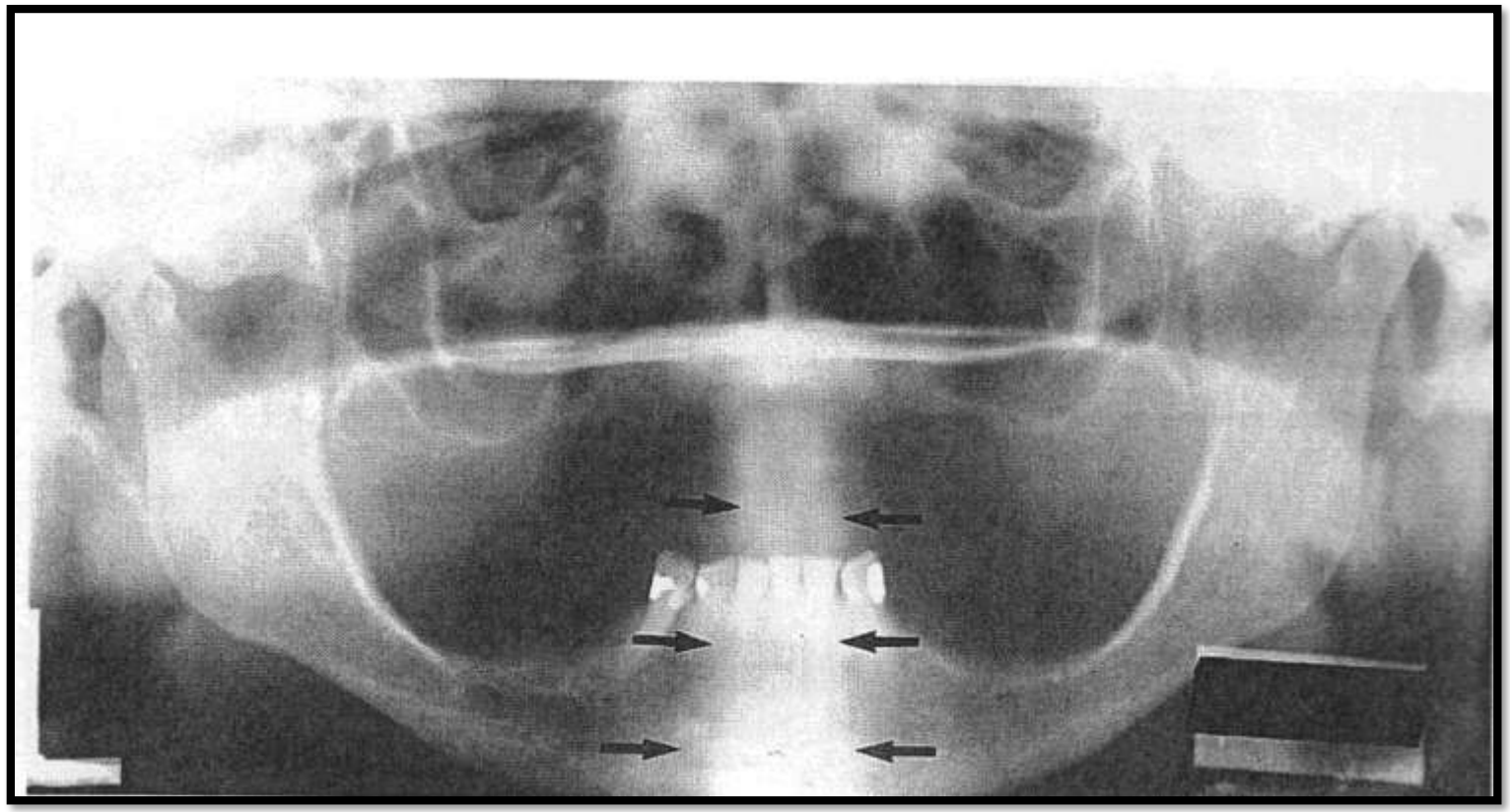
Tooth posterior to focal trough



Positioning of Midsagittal plane:

- If the patient head is not centered the ramus and the posterior teeth appear unequally magnified on the panoramic radiograph
- The side farthest from the film appears magnified and the closer appear smaller.


R
L



7.Postioning of spine:

- If patient is not sitting or standing with straight back ,cervical spine appears as Radiopacities in the center of the film

Conventional radiographic error

- Dark radiograph
- Light radiograph
- High contrast
- Low contrast
- Film fog
- Partial image
- Static electricity
- Etc…

Evidence

Authors	H Devlin et al
Title	Object position and image magnification in dental panoramic radiography: a theoretical analysis
CEBM Level	Level 3a
Aim	To investigate how image magnification and distortion in dental panoramic radiography are influenced by object size and position for a small round object such as a ball bearing used for calibration.
Results	The average magnification of the 2.5 mm ball bearing was 1.292 (0.0445) horizontally and 1.257 (0.0067) vertically with a mean ratio of 1.028 (0.0322); standard deviations are in parentheses. The figures for the 6 mm ball bearing were 1.286 (0.0068), 1.255 (0.0018) and 1.025 (0.0061), respectively. Derived positions of each ball bearing from magnification were more consistent horizontally than vertically. There was less variation in either direction for the 6 mm ball bearing than the 2.5 mm one.
Interpertation	Automatic measurement of image size resulted in less variation in vertical magnification values than horizontal. There are only certain positions in the focal trough that achieve zero distortion.

?????

Question 1:

The zone in which structures are clearly demonstrated on a panaromic radigraph is termed the:

A. Focal trough
B. Rotation center
C. Ghost image
D. Midsagittal plane

Question 2:

The imaginary line that passes from the bottom of the eye socket through the top of the ear canal is termed the:

A. Midsagittal plane

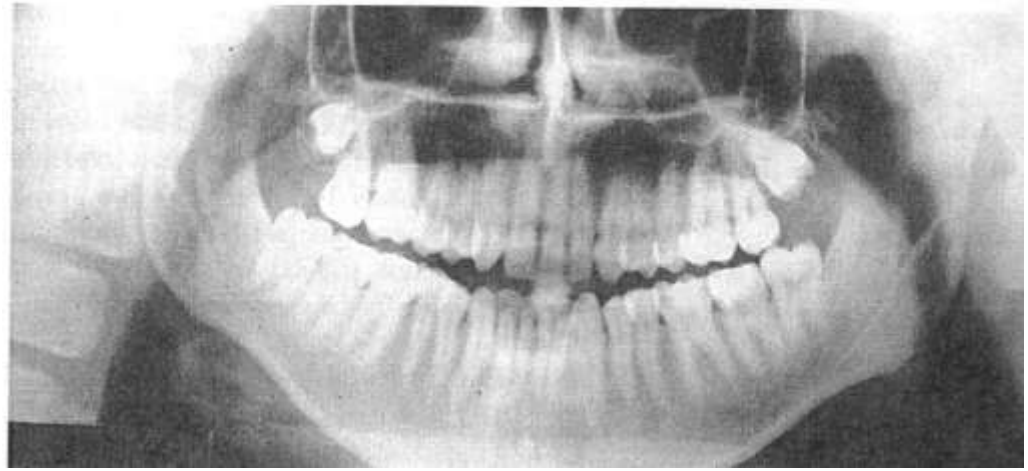
B. Frankfort plane

C. Vertebral plane

D. Orbital plane

Question 3

Identify the error & name it



A. Position of of Frankfort plane Downward

B. Position of teeth Anterior to Focal trough

C. Position of teeth posterior to Focal trough

D. None

Question 4:

The father of panaromic radiography is:

A. Paul Lauterber
B. Alen Cormek
C. H. Numata
D. Godsfray Hounsfield

Question 5:

Identify the error and name it

A. Ghost image
B. Grainy image
C. Dark image
D. None of the above

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Deemed to be University

THANK YOU

SUMANDEEP VIDYAPEETH