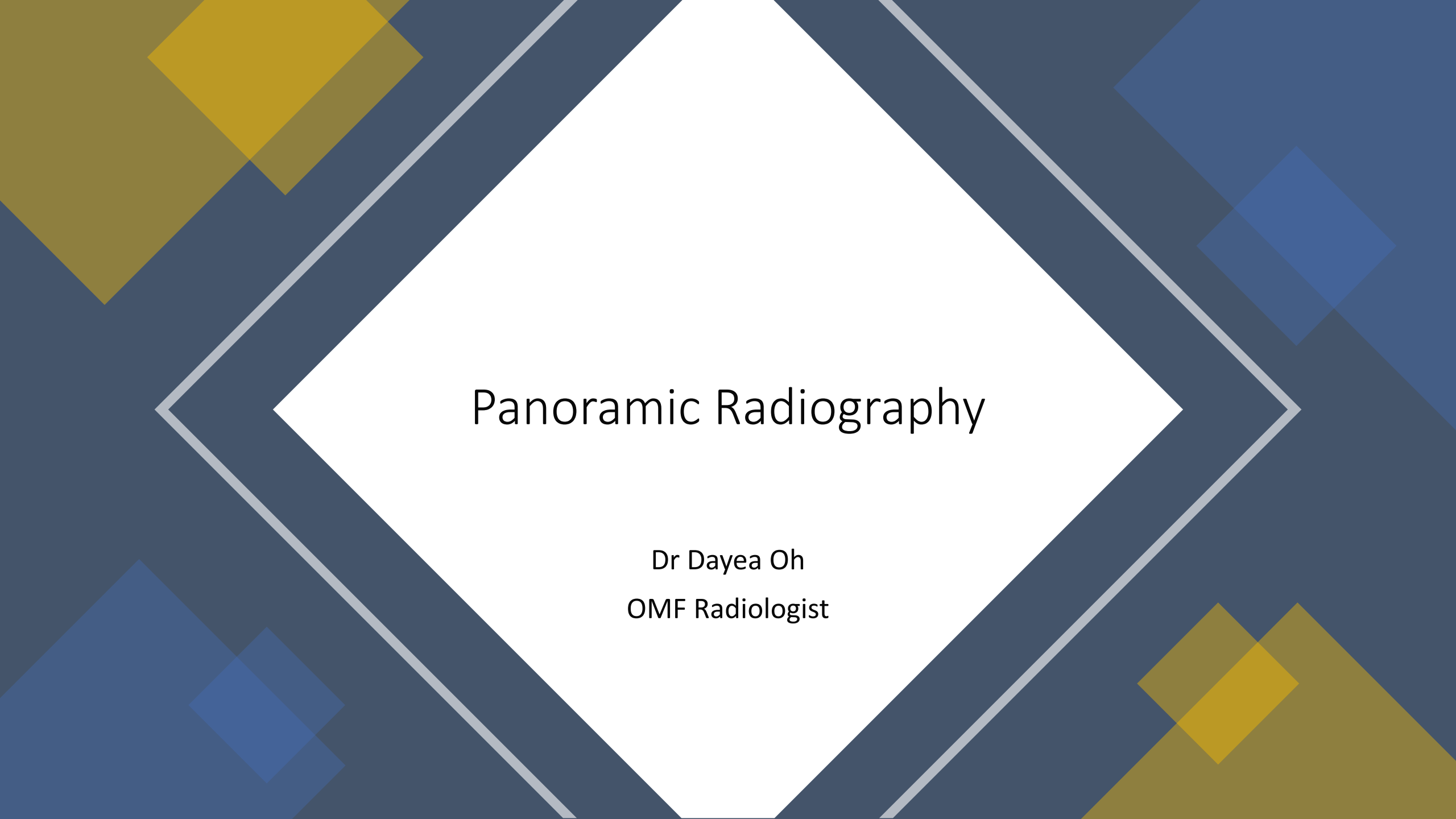
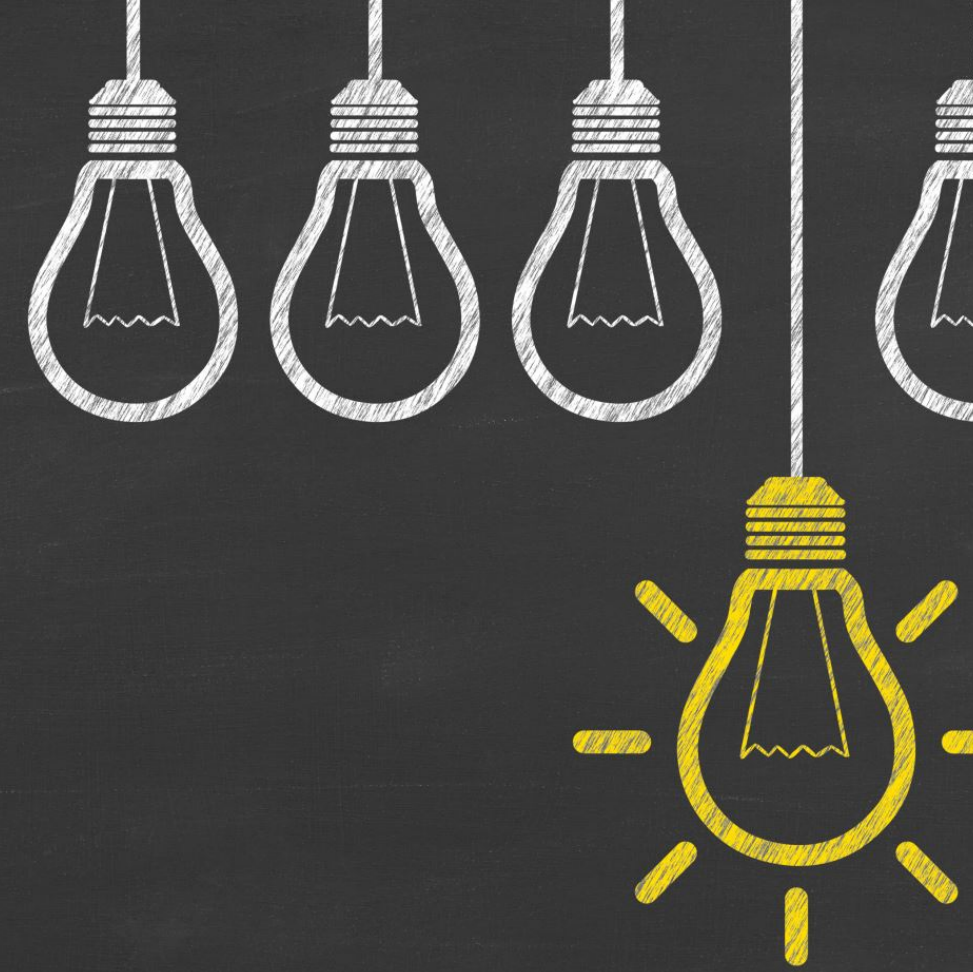




Panoramic Radiography

Dr Dayea Oh
OMF Radiologist

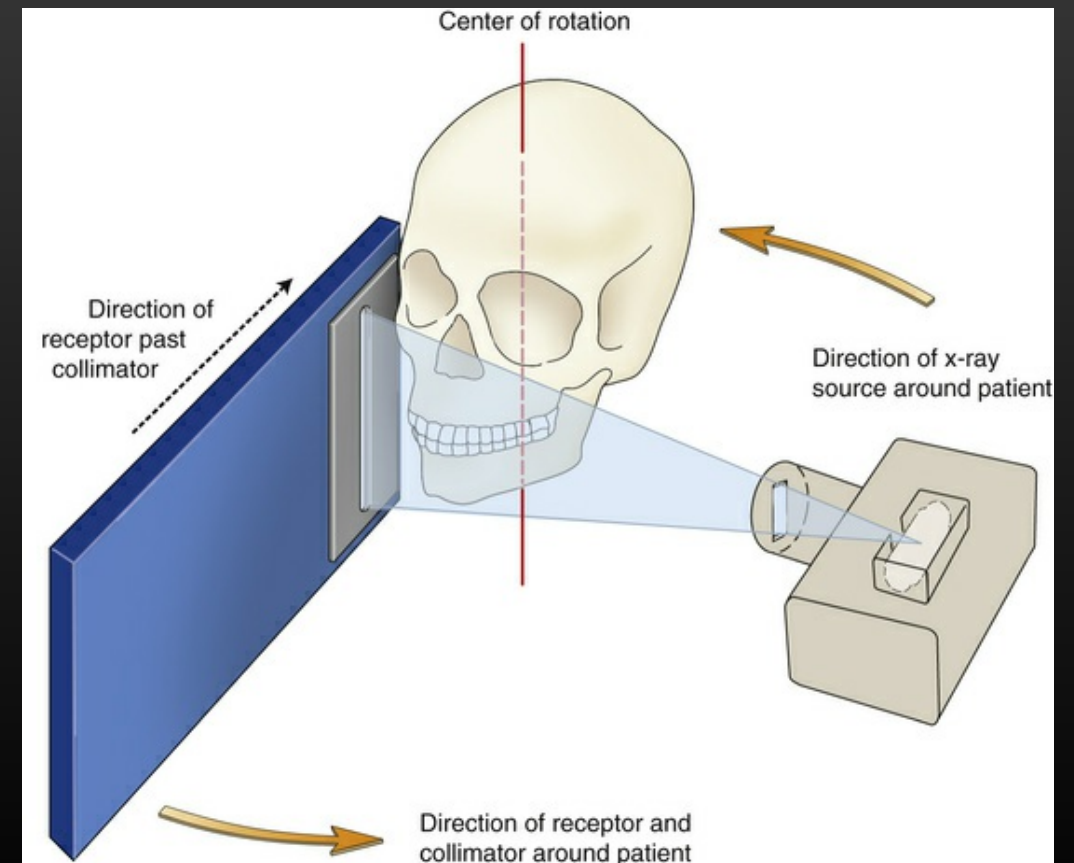
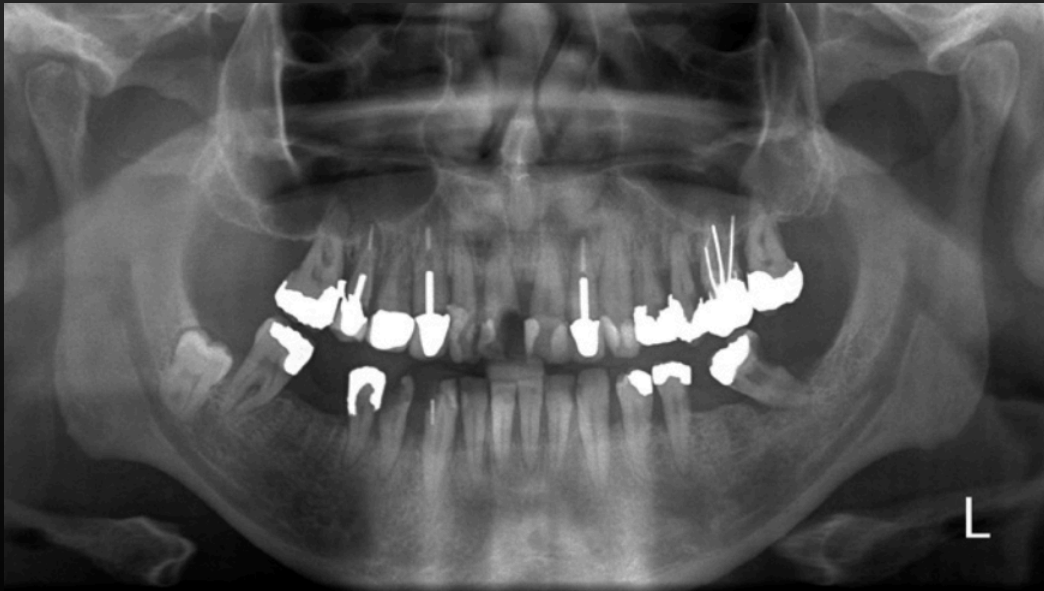


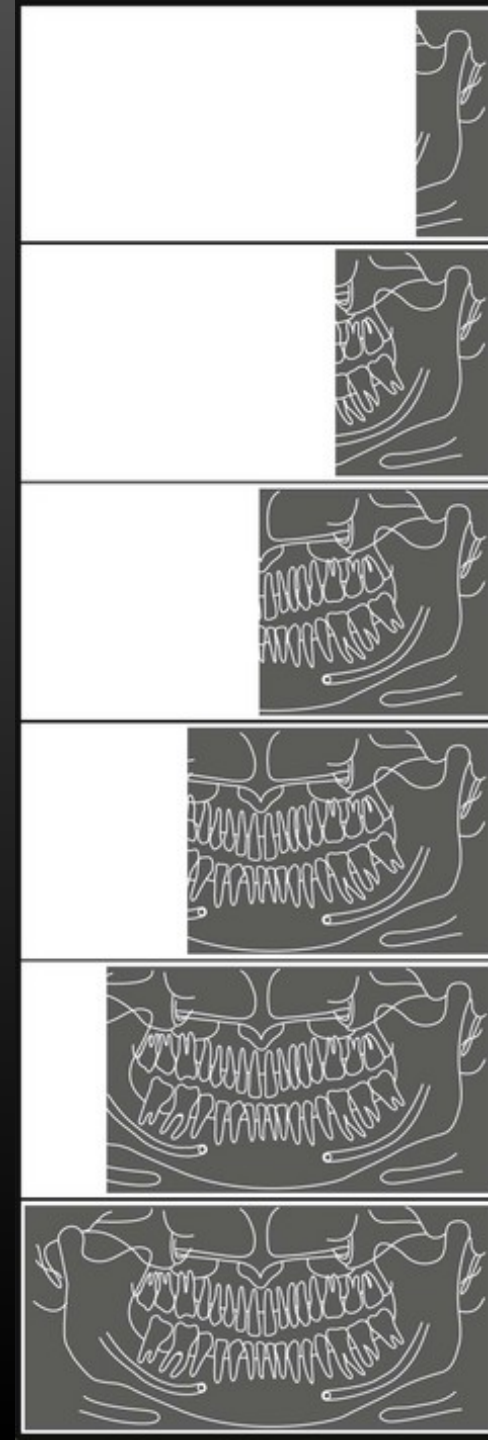
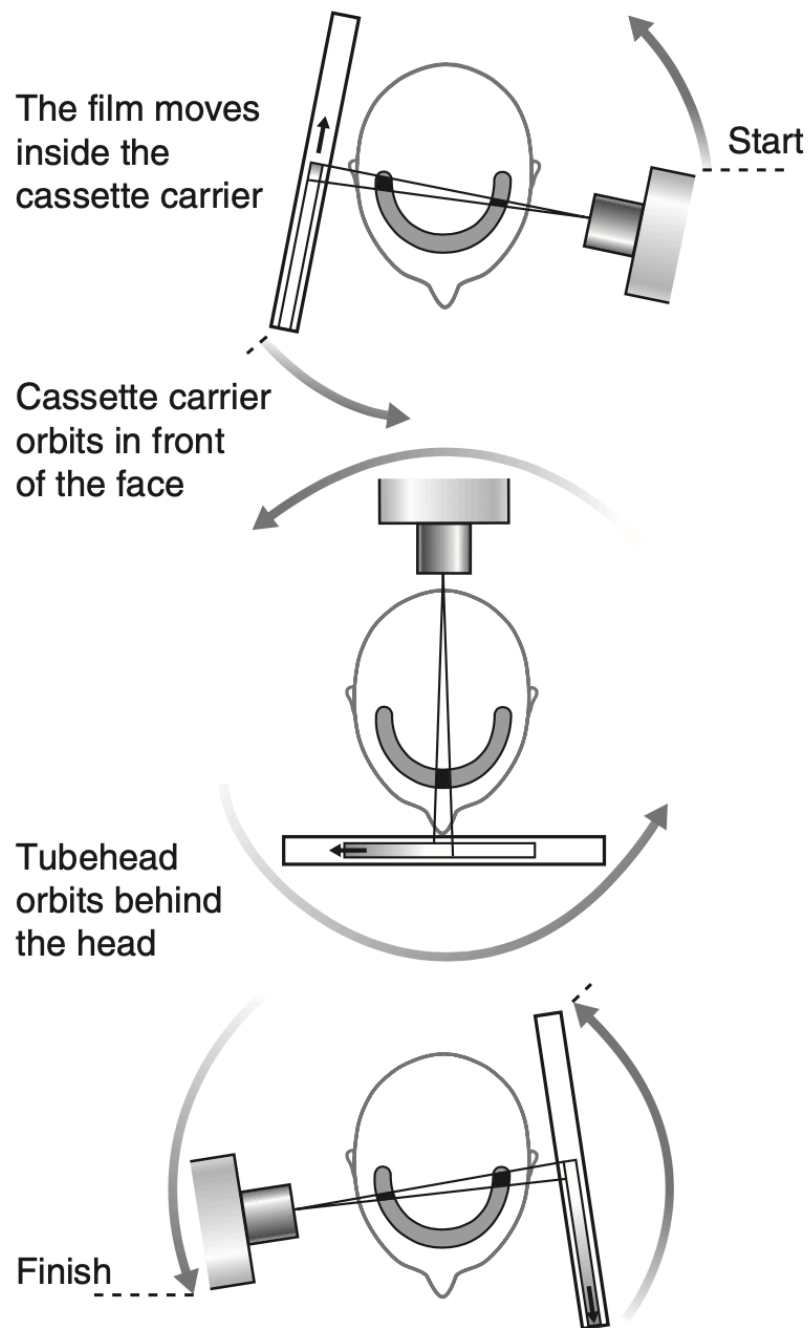
Learning Objectives

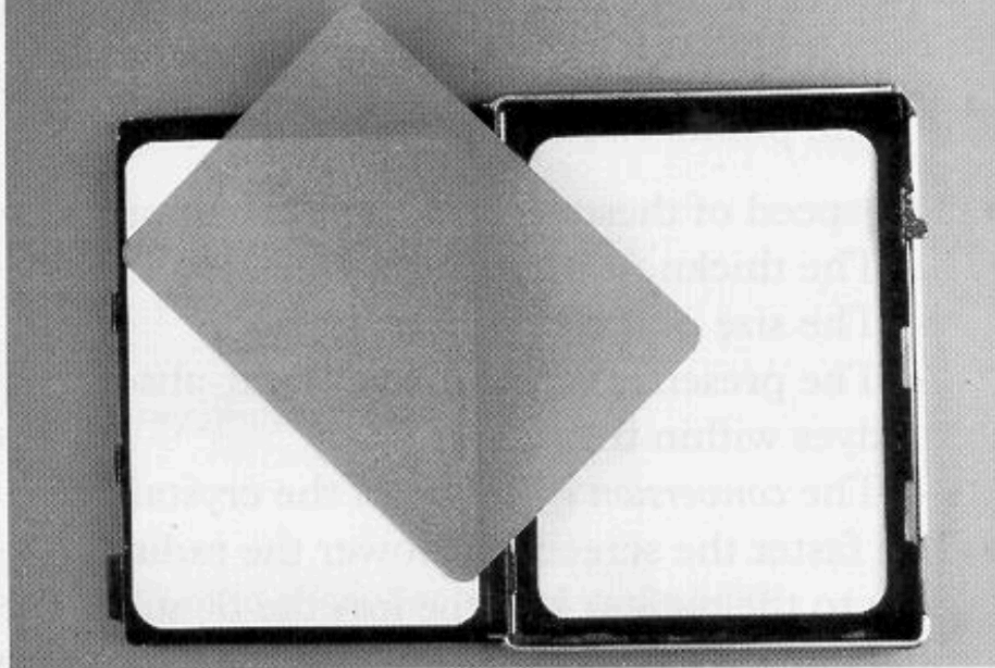
- What is panoramic radiography (PR)?
- What are the components of an extra-oral film cassette?
- What are intensifying screens?
- What is focal trough?
- Understanding correct PR techniques
- How are artefacts produced?
- Understanding PR Anatomy
- What are the indications for panoramic imaging?

Panoramic Imaging

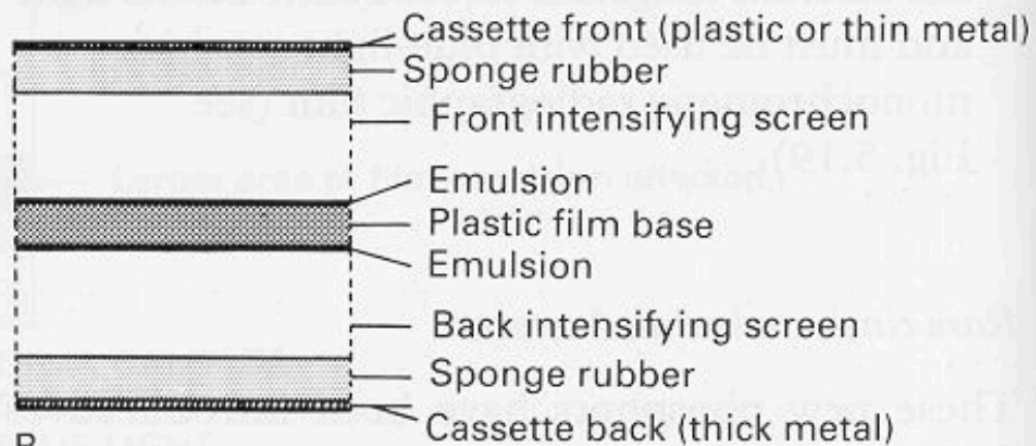
- AKA OPG (orthopantomogram)
- Tomographic image of maxillofacial structures using a rotating x-ray source & receptor







A



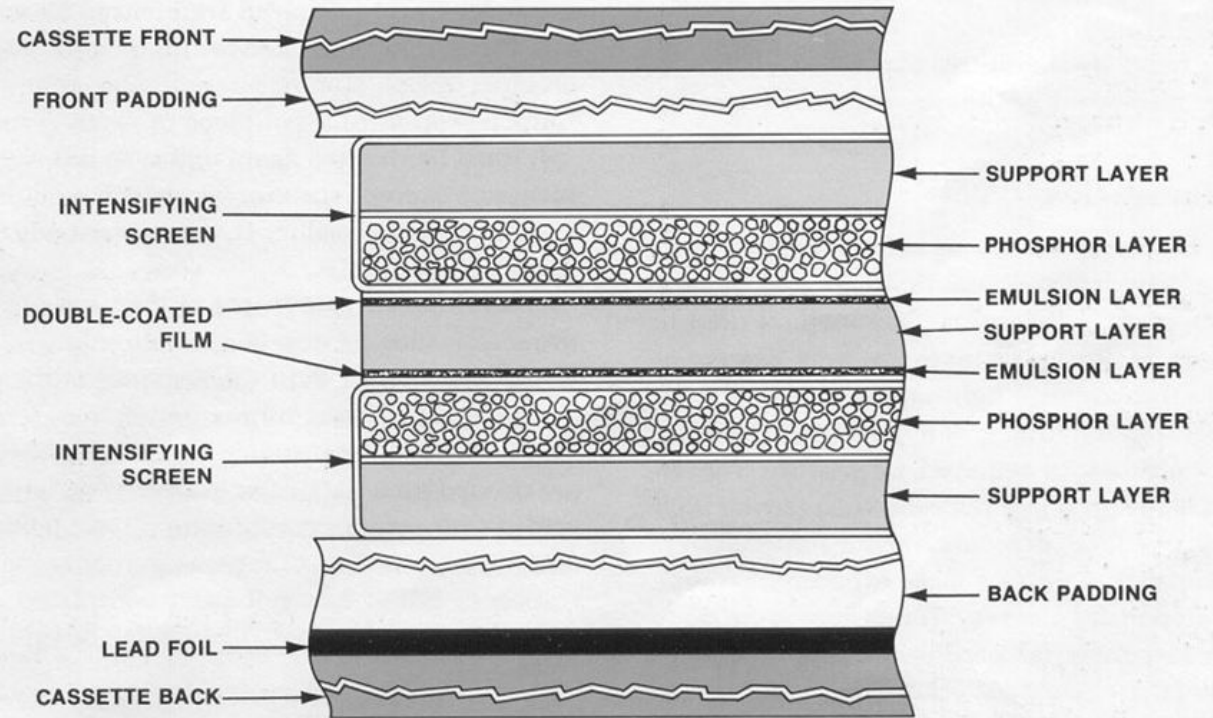
B

Fig. 5.21A A standard 18 × 13 cm cassette opened up showing the white intensifying screens and the film.

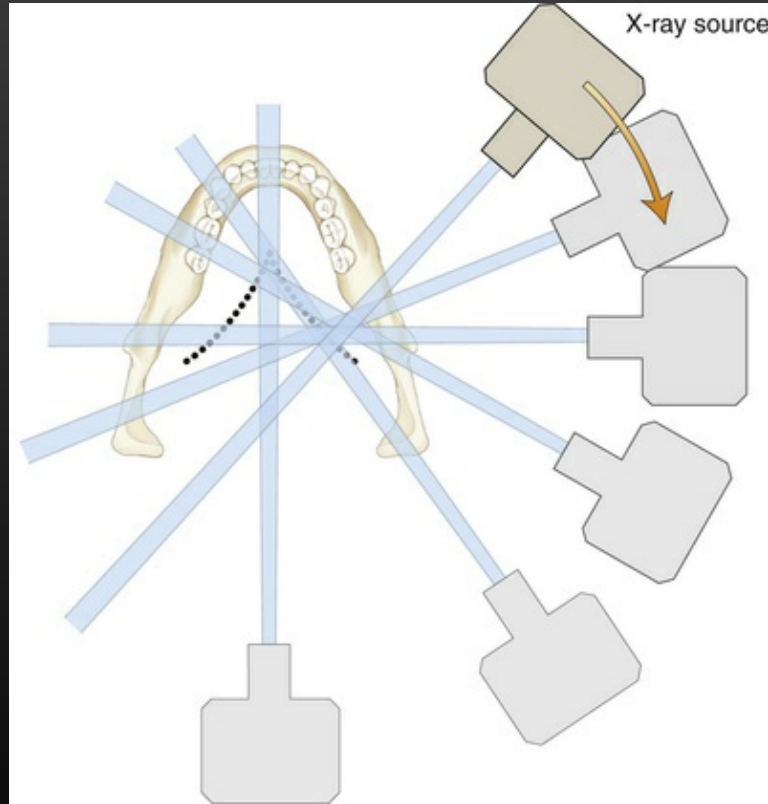
B Diagram showing the cross-sectional components in a cassette.

Emulsion layer: light-sensitive silver halide crystals coated onto both sides of a transparent base material.

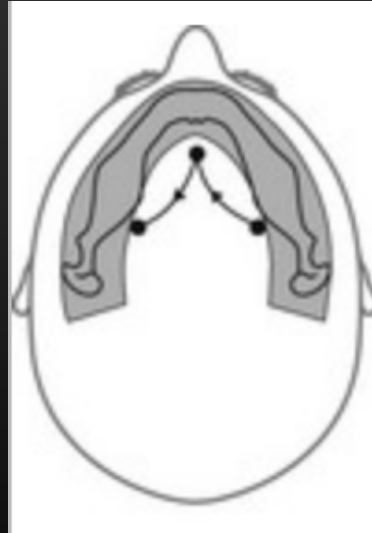
Double sided films have *increased optical density*



Focal Trough / Image Layer



Arch (mandible) shape



3D zone

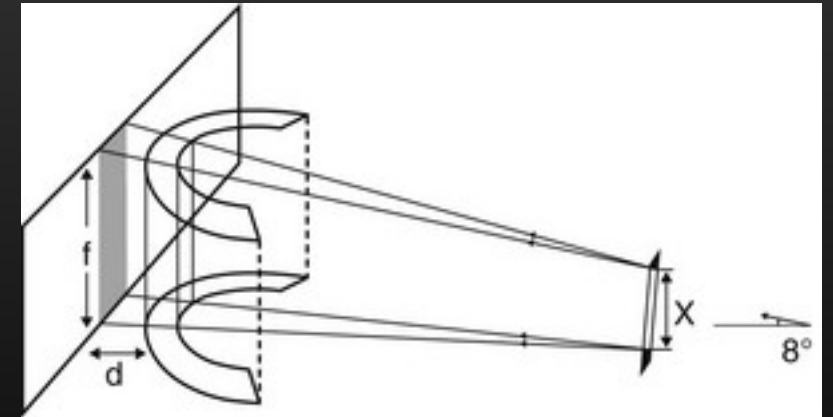
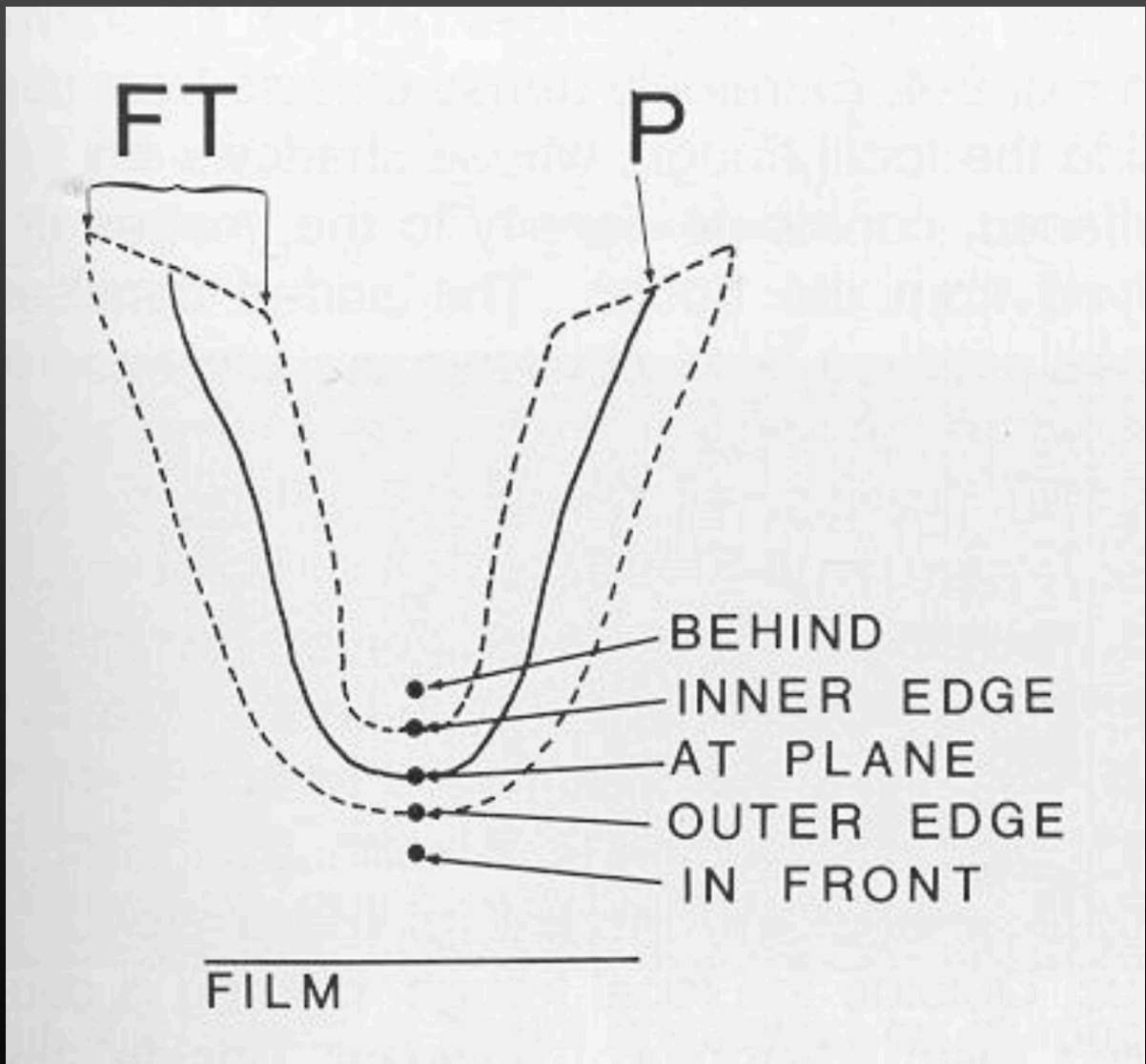




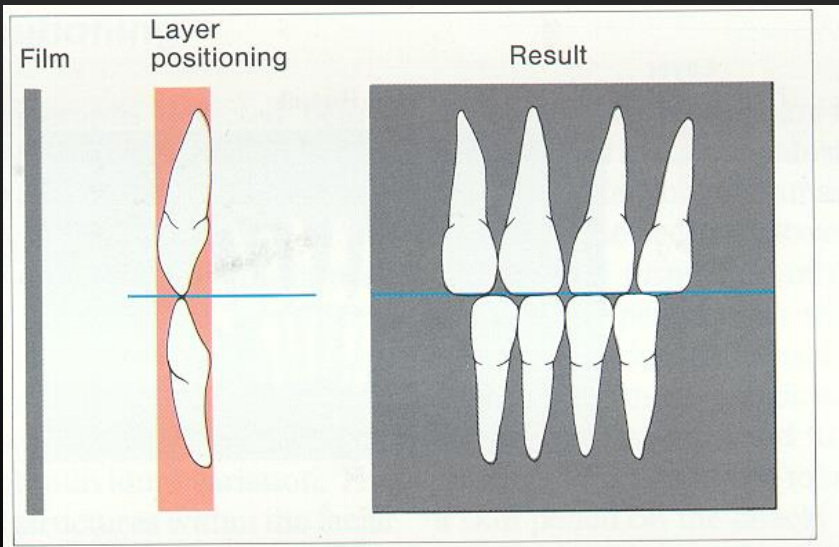
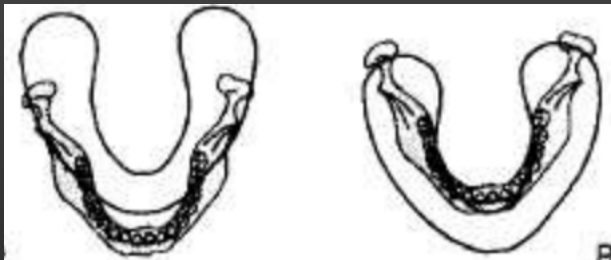
Fig. 1-10 Position of focal trough (FT) to the jaw for Panorex (*left*), Orthopantomograph (*middle*), and Panelipse (*right*) (based on the work of Lund and Manson-Hing, 1975a).



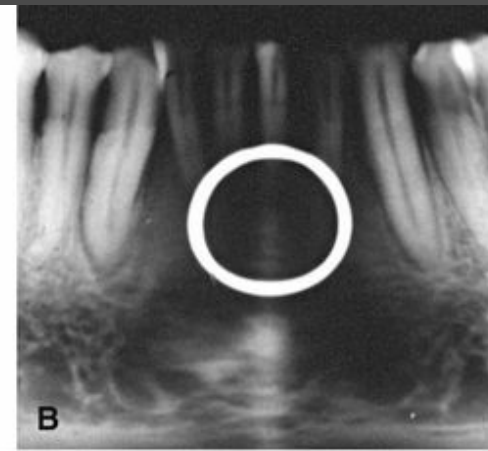
OPG coverage



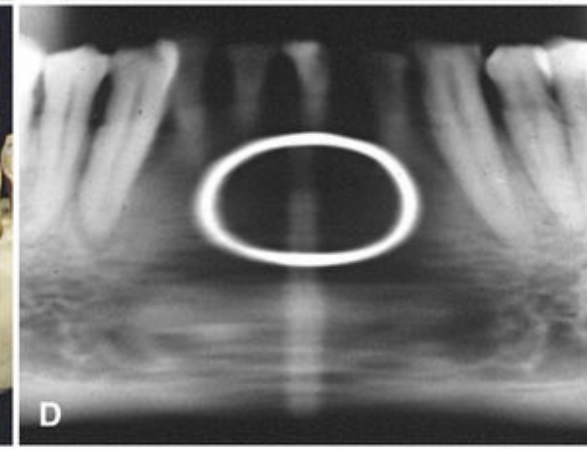
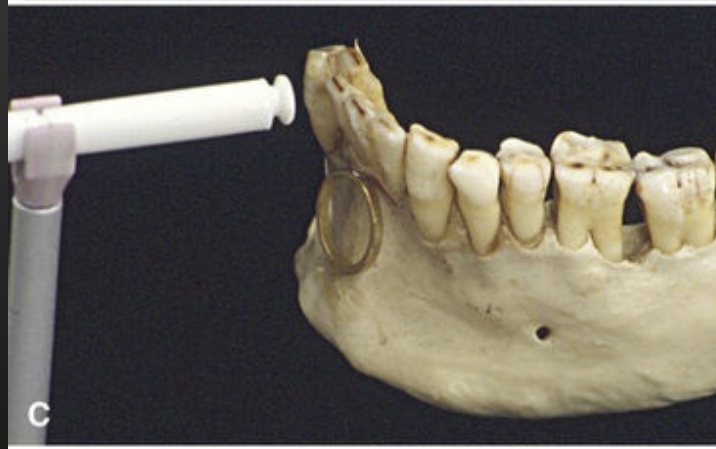
Note the posterior teeth are still within the focal trough



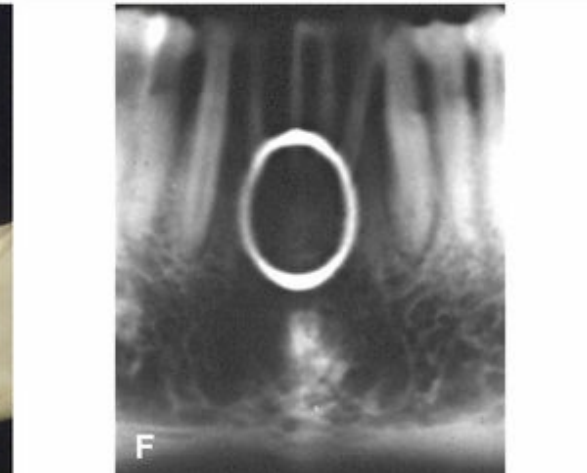
In position



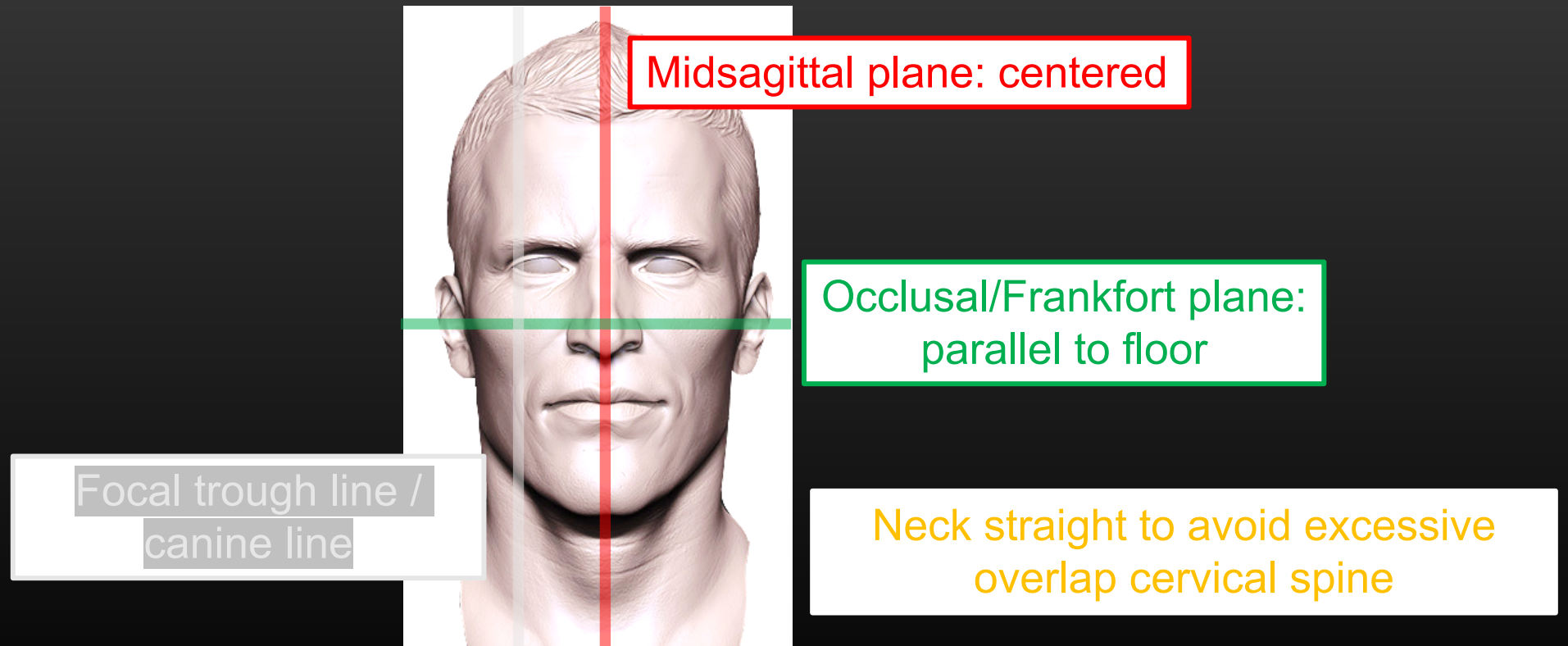
Behind



In front



OPG - Patient Positioning



WATCH → <https://www.youtube.com/watch?v=YeHp78Dv0fM>

No jewelry

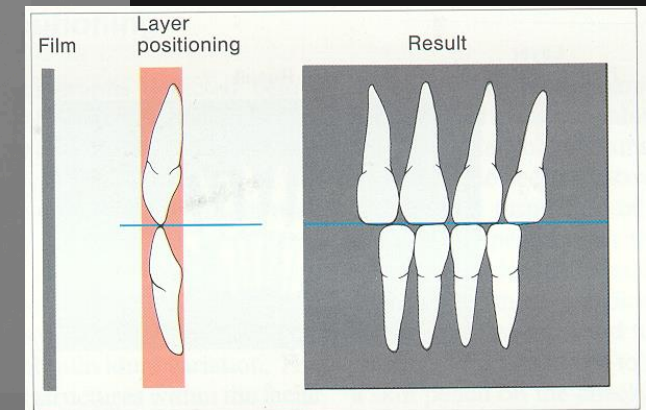
No movement (~10-20s; fast modes available when needed)

Close lips, place and hold tongue against palate

Midsagittal

Focal trough line

Frankfort Plane : superior border of the external auditory meatus to the infraorbital rim



beam

receptor



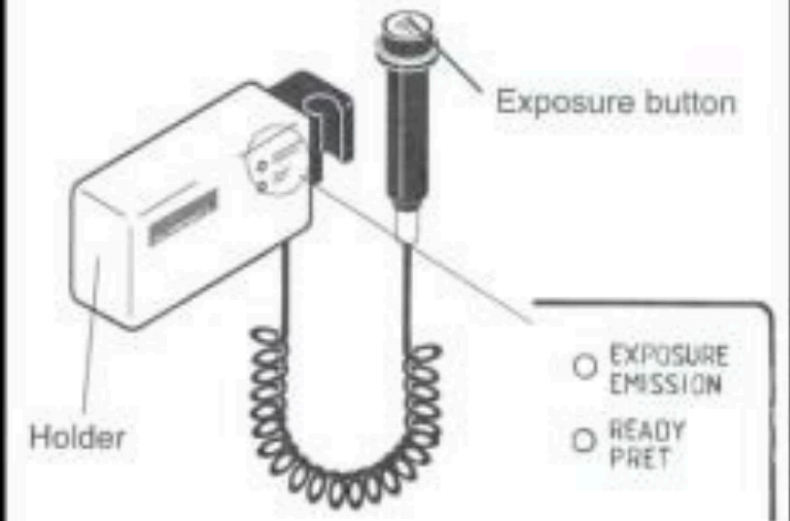
Planmeca OPG

Bite peg



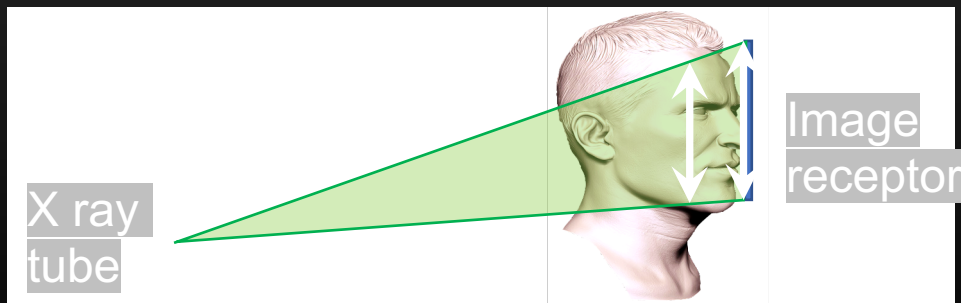
Bite grooves

Remote exposure switch

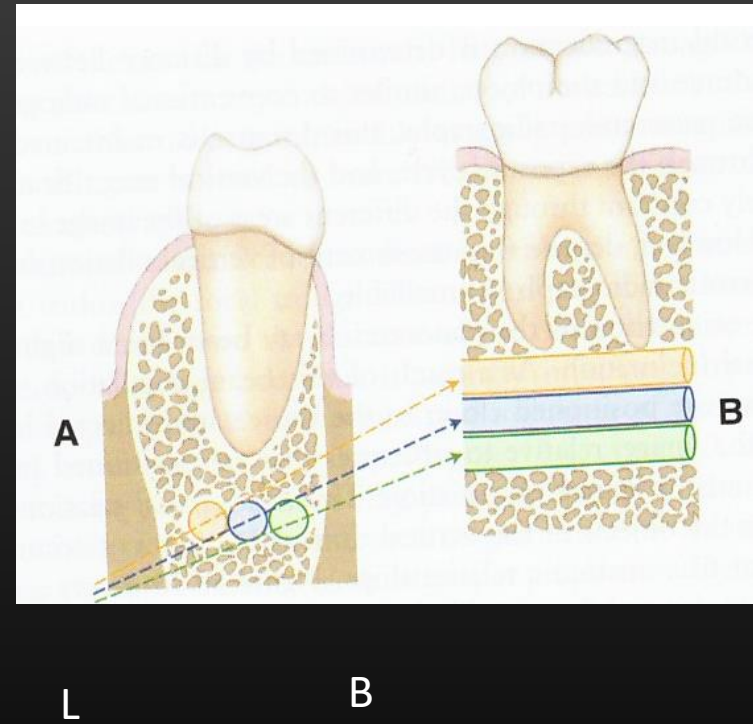


beam

receptor



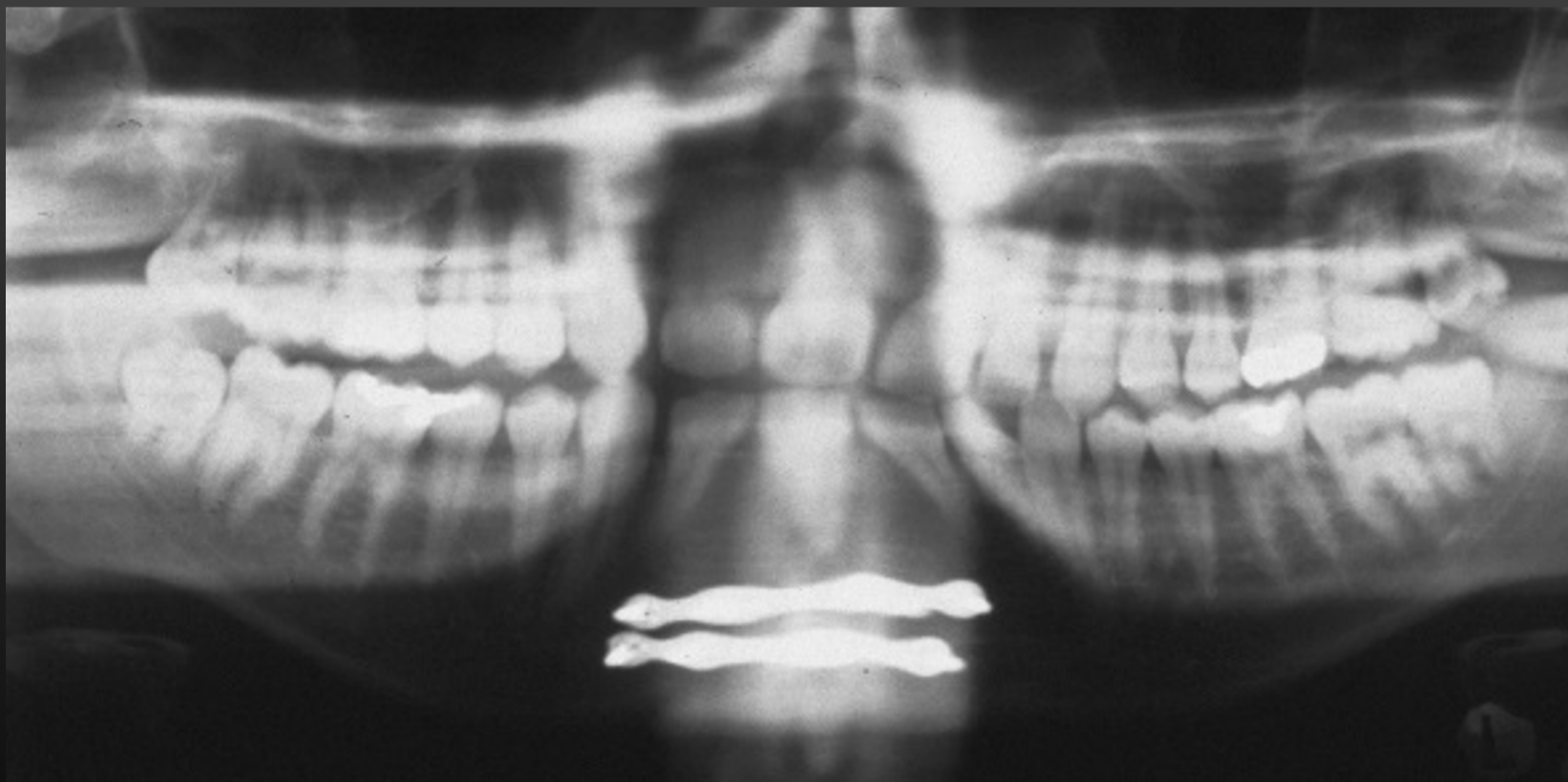
-8° angulation



Positioning Errors

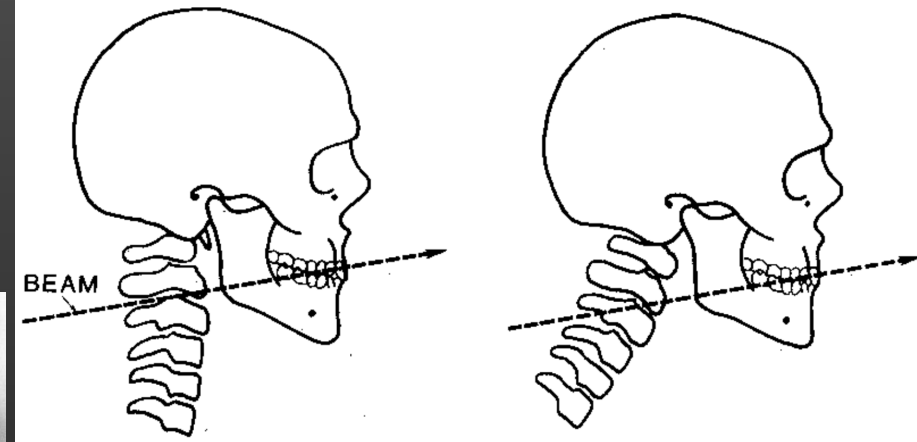


Teeth in front of focal trough



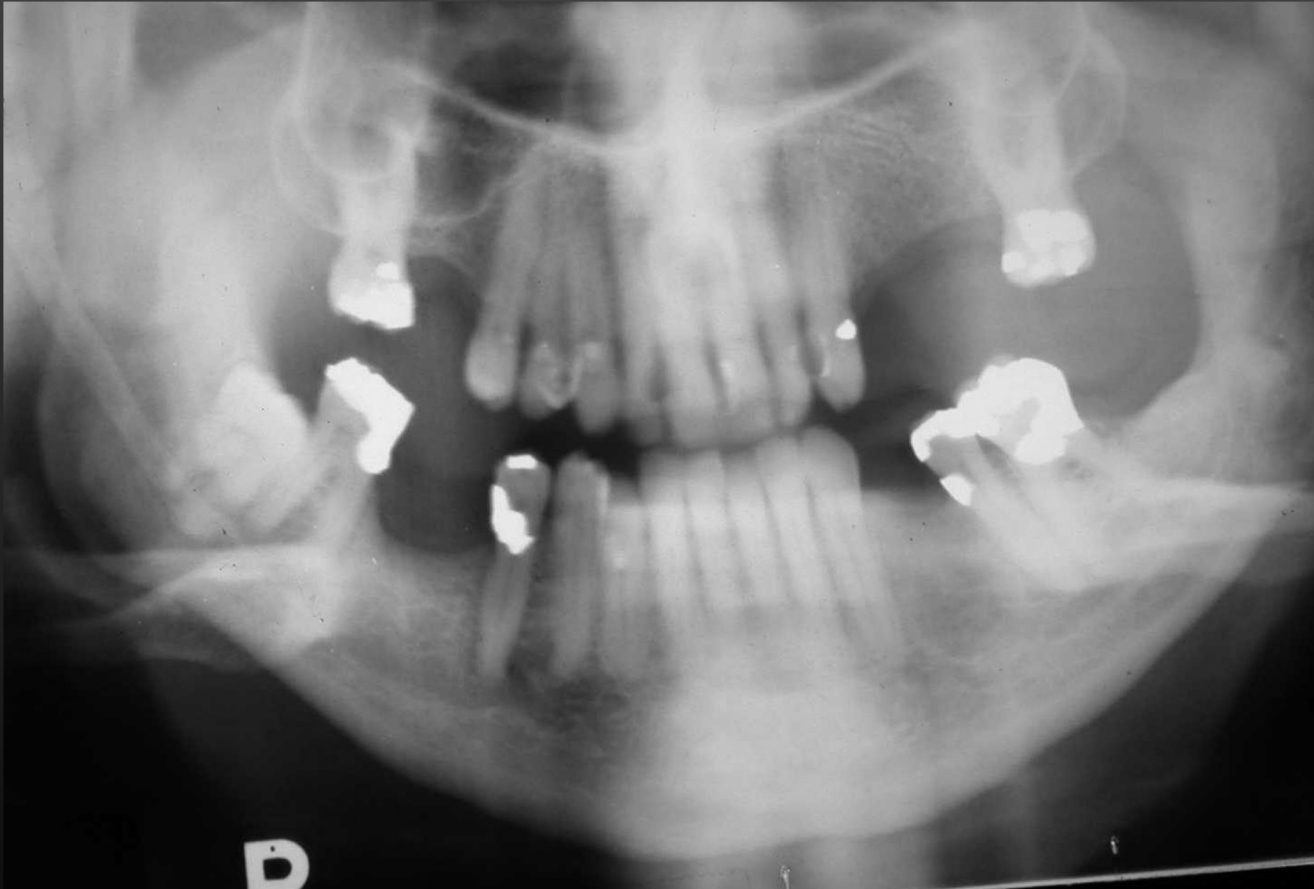
Teeth behind the focal trough

-8° angulation



Spine not straight

No bite peg use (overlapping of teeth)



Head tilting to the right

- Incorrect midsagittal

Chin down

- Incorrect Frankfort plane
- "Exaggerated smile"
- Superiorly positioned hyoid bone
- Condyles not visible (too high)

Neck extension

- Too much spine in the middle



Chin up

- Incorrect Frankfort plane
- “Reverse smile”
- Condyles not visible

Neck extension

- Too much spine in the middle

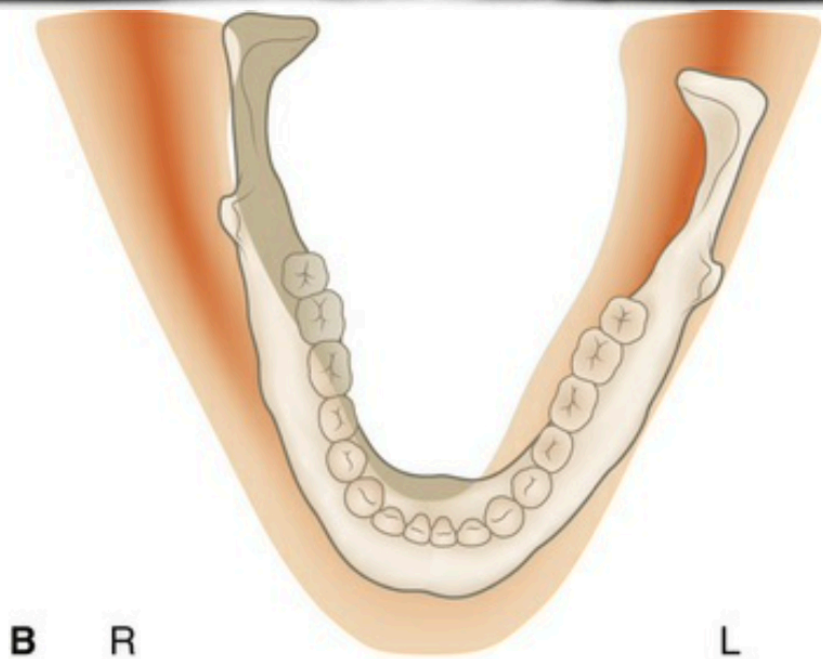
Tongue not touching the palate

- Palatoglossal airspace over the maxillary roots



Rotated to the right
(incorrect midsagittal)

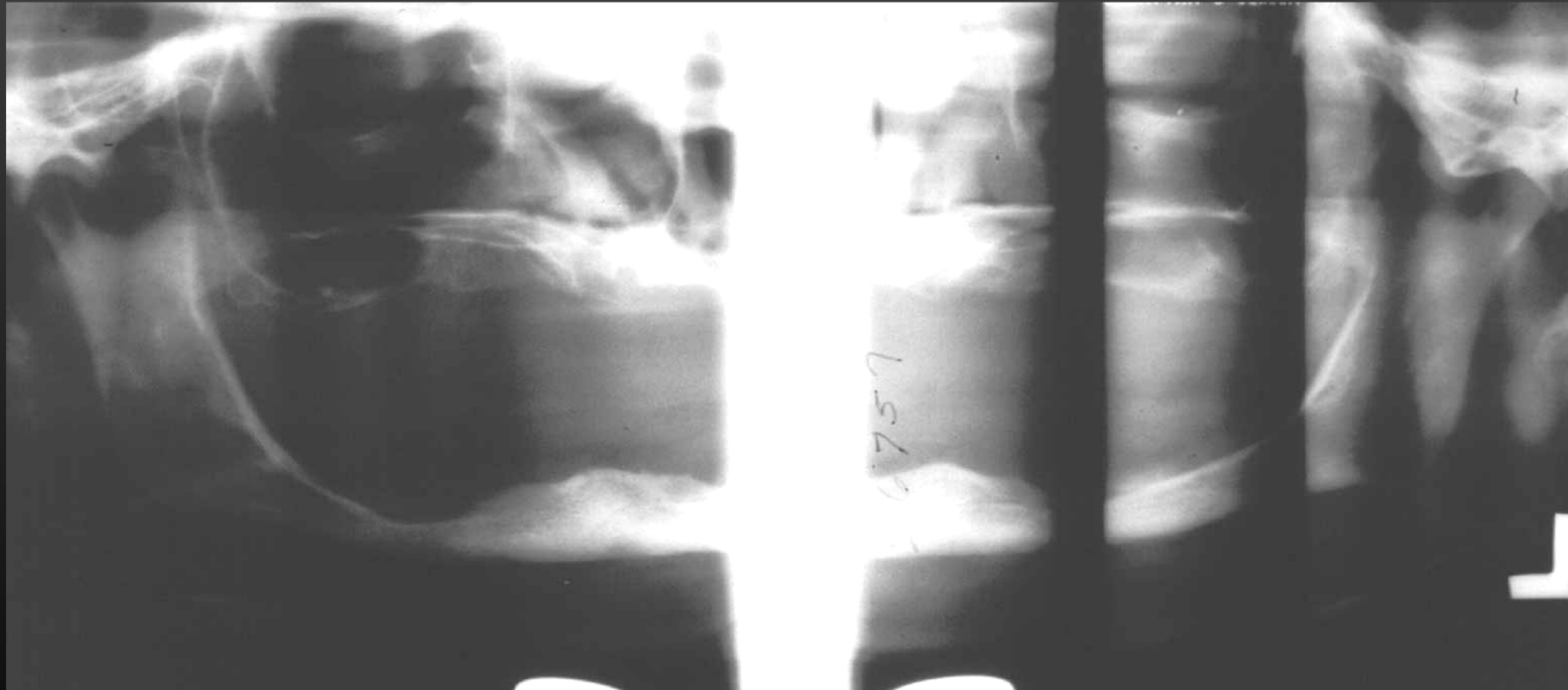
- Right-sided posterior teeth are behind the focal trough → horizontal magnification
- Asymmetry of the hemimandibles
- Opaque appearance of the left maxillary sinus





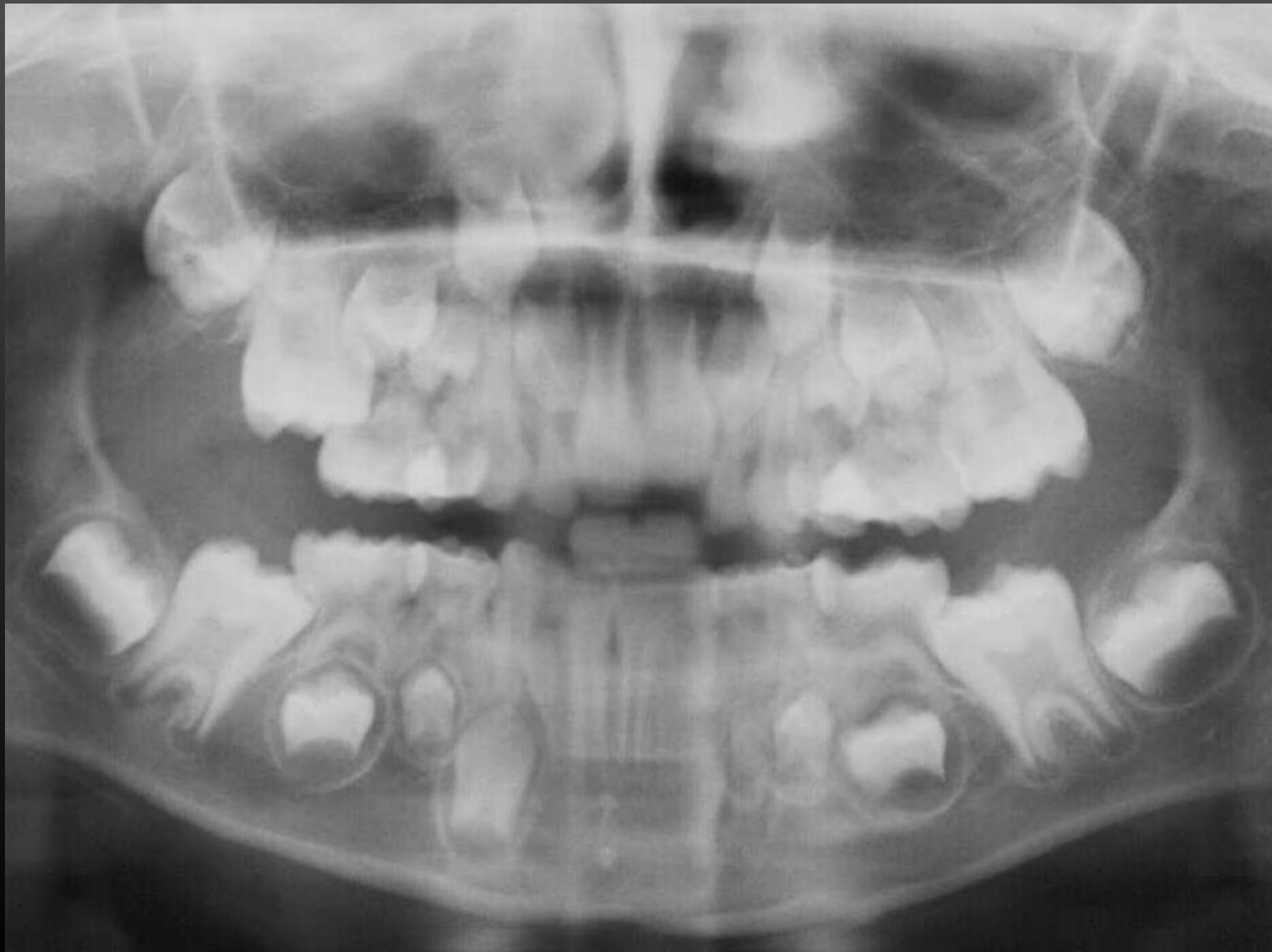
Rotated to R

Shoulder hit



Patient moved horizontally; deletion & doubling



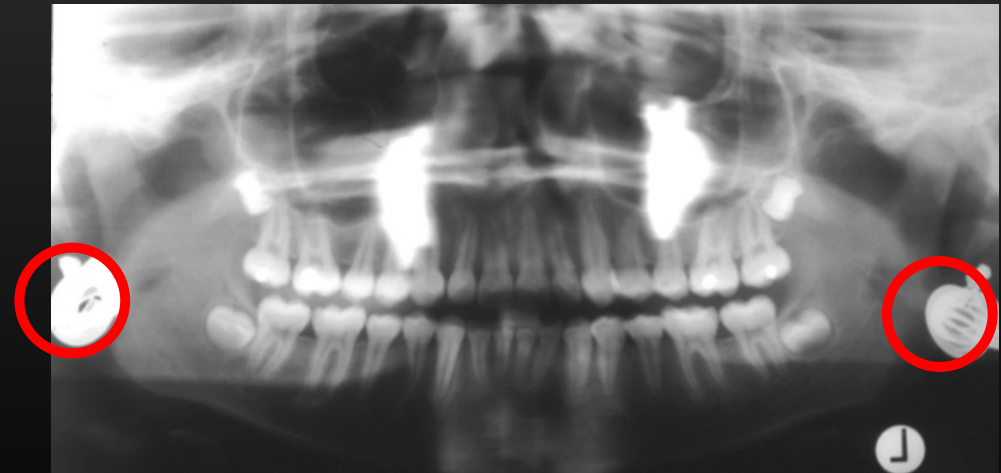
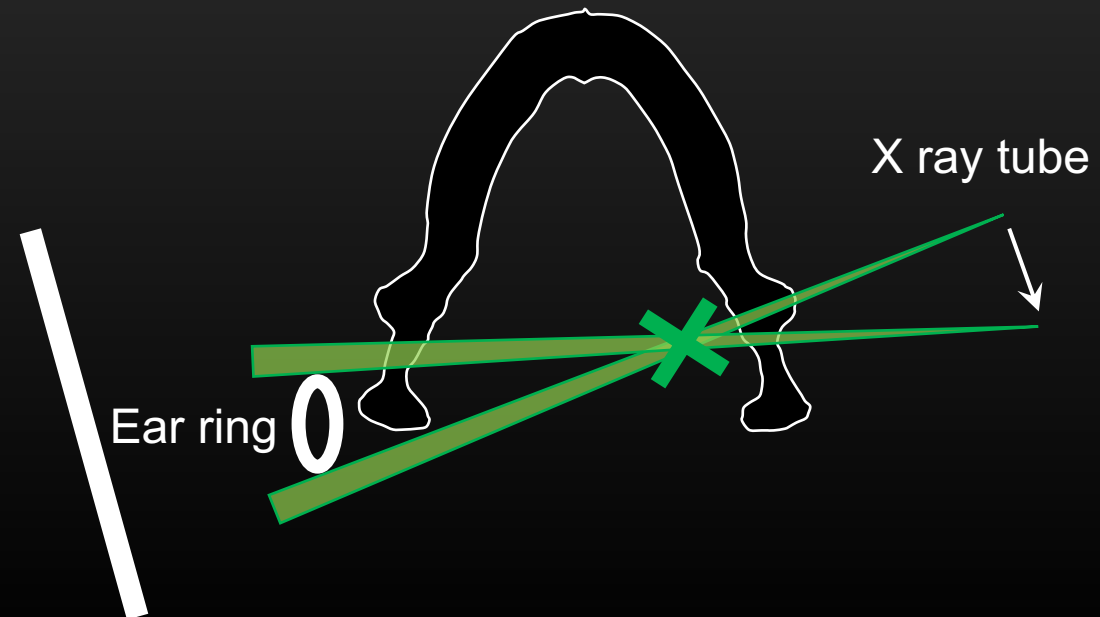
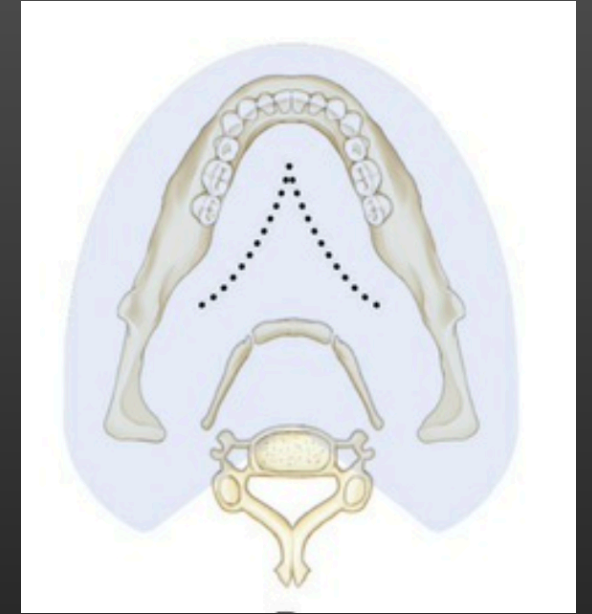


Doubling of 74 & 34

Real Images, Ghost Images &
Double Images

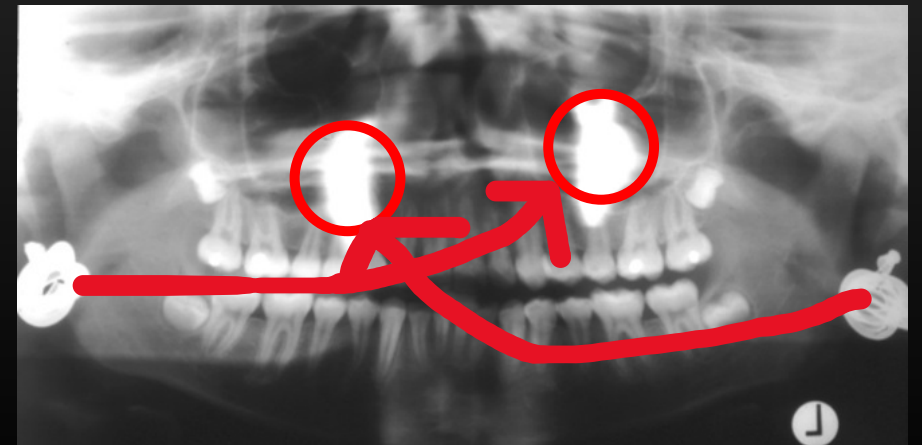
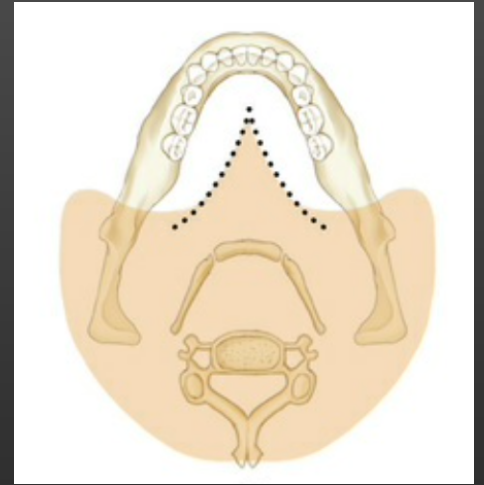
Real Image on OPG

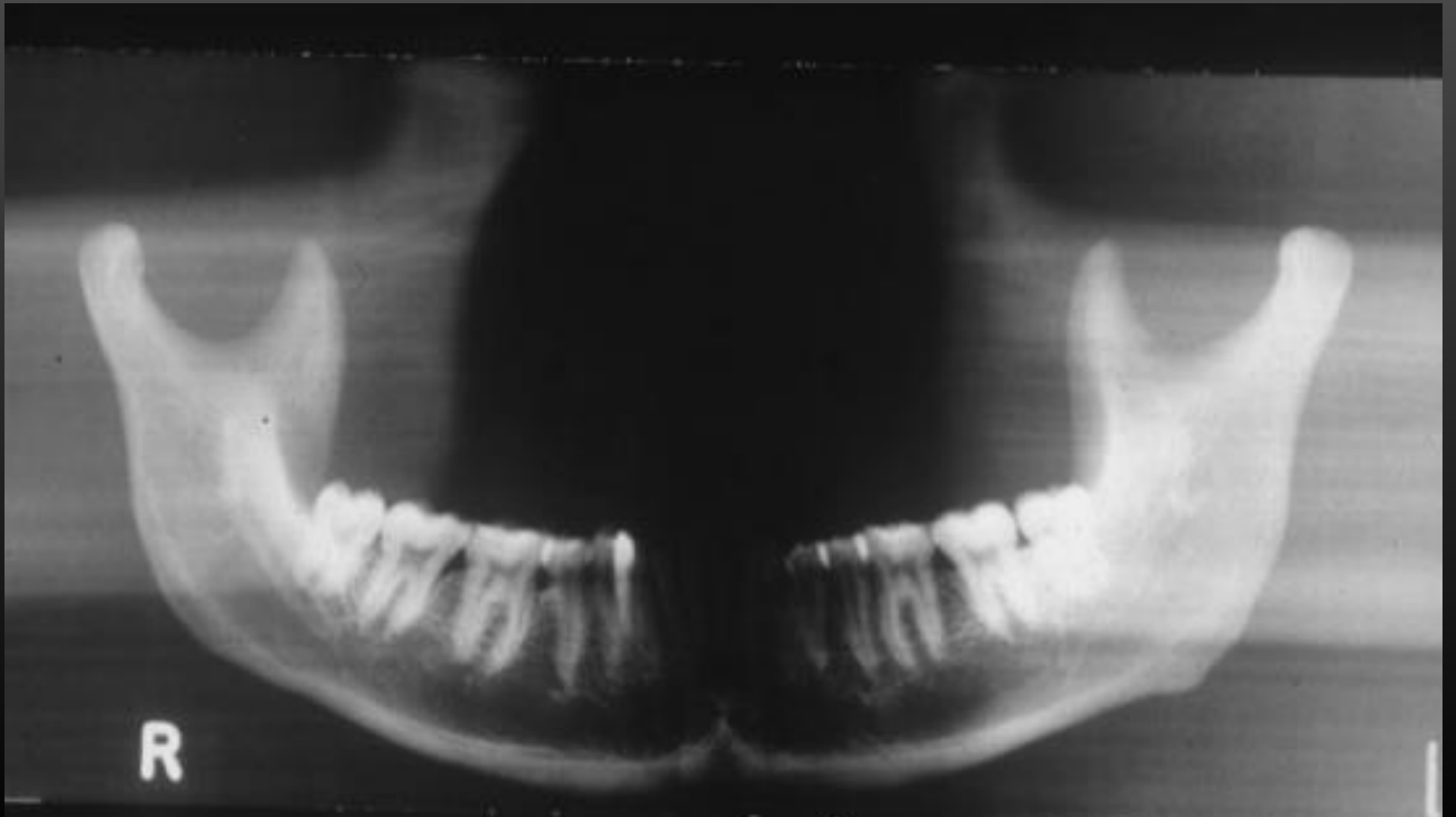
- Object is **between centre of rotation and receptor**
- Sharper if closer to focal trough



Ghost Image on OPG

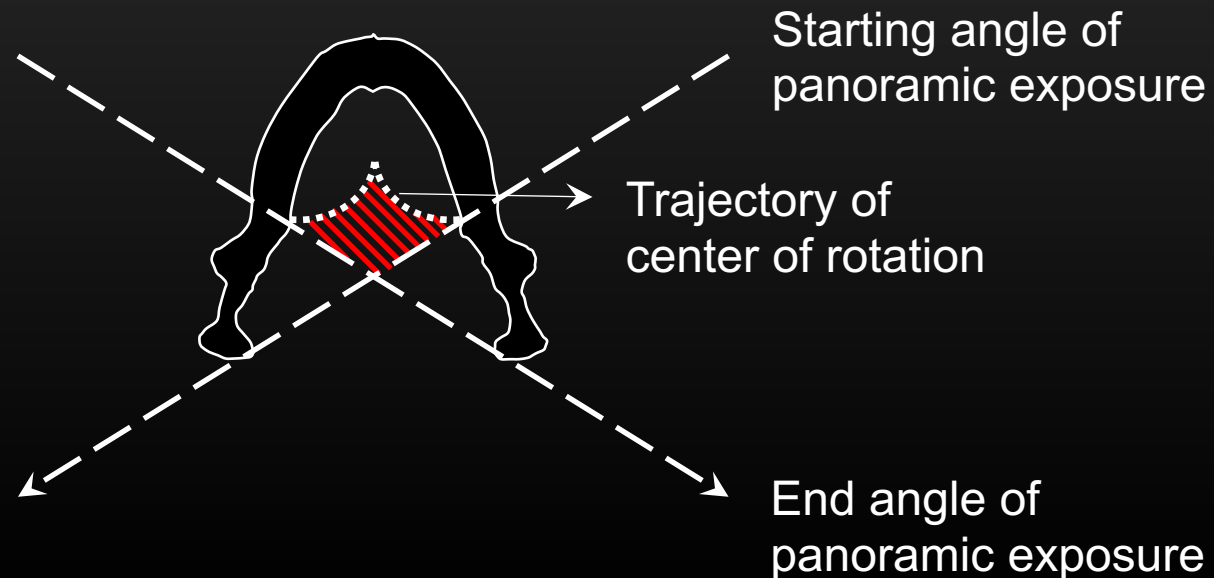
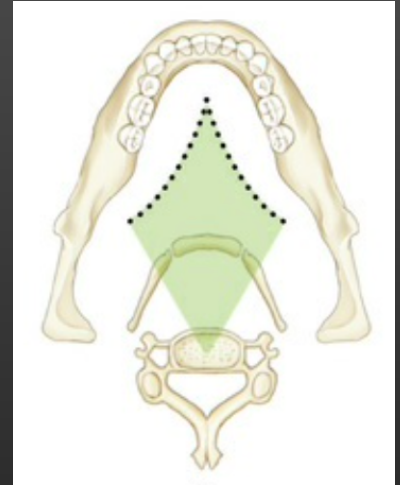
- Object between x-ray source and centre of rotation
- Usually outside of focal trough: appears blurred and magnified
- Appears on opposite side of image (L $\leftrightarrow$ R) and higher on the image (*due to upward beam*) than their anatomical location
- Mandibular ramus, hyoid bone, cervical spine, earrings, etc.



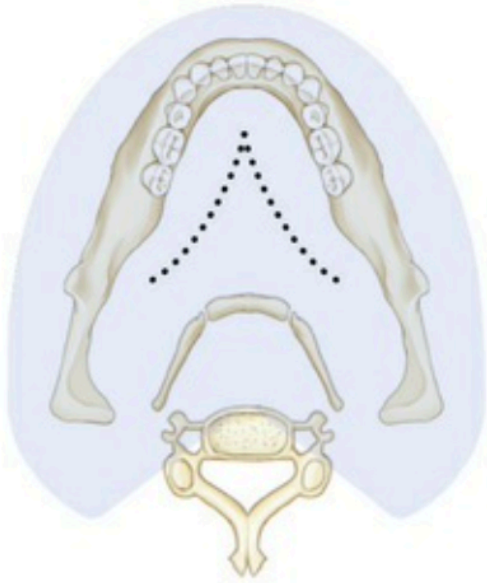


Double Image on OPG

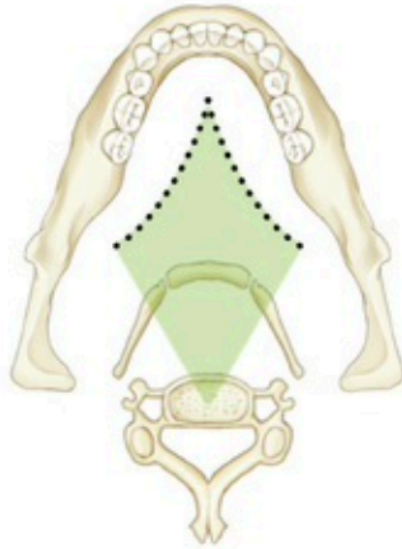
- Object is posterior to centre of rotation (**the red diamond area**) and intercepted by beam twice
 - Structures in the centre eg. Hyoid bone, epiglottis, cervical spine, palate
- Double images are **mirror** images, appearing on the **same location** but opposite sides



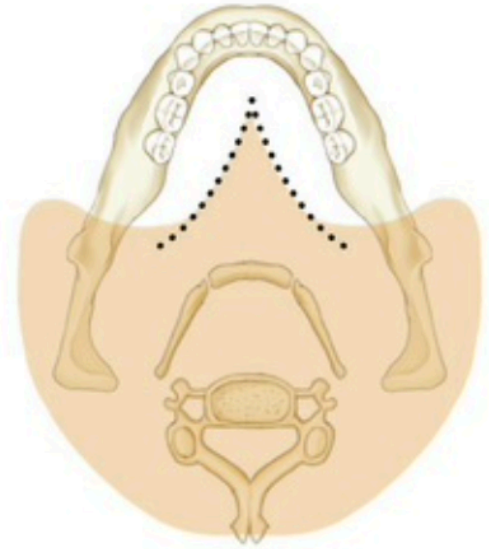
Real Image Zone



Double Image Zone



Ghost Image Zone



OPG artefacts

- Incorrect patient positioning
 - Chin down
 - Chin up
 - Head tilting
 - Head rotation
 - Movement
 - Horizontal (following the beam or opposite to the beam direction)
 - Vertical
 - Swallowing
 - Soft tissue position
 - Tongue to the palate
 - Lips closed
- Focal trough position
 - Head in front of the focal trough
 - Head behind the focal trough
- Neck extension
- Collision with shoulder
- Ghost images
- Foreign materials eg. Earrings, necklace, denture left in situ, etc.

Error	Appearance on Image	Correction
Ghost images	Ghost image resembles real image	Have patient remove all radiodense objects before exposure
	Projected on opposite side of film and is higher	
Lead apron artifact	Radiopaque, cone-shaped artifact in center of image	Use lead apron without thyroid collar
Patient lips not closed	Dark radiolucent shadow around anterior teeth	Remind patient to close lips around bite block
Patient chin too high	Condyles may not be visible	Keep Frankfort plane parallel with floor
	Maxillary incisors appear blurred and magnified.	
	Reverse smile line (frown) or flat occlusal plane	
Patient chin too low	Exaggerated smile line (Joker)	Keep Frankfort plane parallel with floor
	Condyles higher on image Mandibular incisors appear blurred; roots appear short	
Patient too far forward (in front of focal trough)	Anterior teeth appear narrow	Make sure patient's teeth are in bite block notches & Focal trough line is at the tip of the Mx canines
	Spine is visible on film	
Patient too far back (posterior to focal trough)	Anterior teeth appear magnified	Make sure patient's teeth are in bite block notches & Focal trough line is at the tip of the Mx canines
	Ramus isn't entirely visible	
Patient head not centered (Head rotation to right / left)	Ramus and posterior teeth appear unequally magnified	Keep midsagittal plane perpendicular to floor & ensure indicating light is located at center of patient's nose
	Side farthest from receptor appears magnified	
	Side closest to receptor appears smaller	
	Example: Patient turned to right will produce image with magnification on right side and overlapping of contacts	
Head Tilt	Asymmetry of the face on OPG. Eg. Head tilt to the right -> The right side of the face is more inferiorly positioned than the LHS	Ensure the patient's midline & the frankfort plane are perpendicular to each other
Tongue not touching the palate	Glossopalatal airspace is superimposed over the Mx tooth roots.	Make sure the patient's tongue is touching the palate during the scan (without swallowing)
Patient spine isn't straight / neck extension	Cervical spine (ghost image) appears as linear radiopacity in center of image	Have patient stand as tall as possible. Seat patient if necessary.
Swallowing	Soft palate is lifted to the nasopharynx (blocking the airway) + Hyoid bone is lifted	Make sure the patient does not swallow during the scan

OPG Anatomy

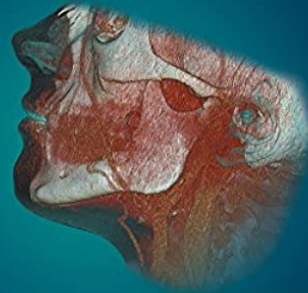
OPG Anatomy Exercise

- Teeth (count teeth first)
- Hard palate & Soft palate
- Maxilla
 - Incisive canal
 - Intermaxillary suture
 - Maxillary sinuses
 - Draw Floor, Anterior and Posterior walls
 - Innominate line (zygomatic process)
- Mandible
 - Angle, ramus, body, coronoid process, condylar neck, condylar head, pterygoid fovea, sigmoid notch
 - External oblique ridge
 - Submandibular fossa
 - Mandibular canal & Mental foramen
- Zygomatic arch
 - Zygomatico-zygomatic suture
 - Zygomatic process of temporal bone
- Articular eminence
- Pterygoid plates
- Pterygomaxillary fissure
- Orbital rims
- Infraorbital canal & foramen
- Nose
 - Nasal cavity, septum, turbinate (conchae)
 - Soft tissue
- Anterior nasal spine
- Hyoid bone
- Epiglottis
- Cervical spine
 - C1, C2, C3, C4
 - Atlanto-axial joint space
- Styloid process
- Mastoid process
- Ears
 - External auditory meati
 - Soft tissue
- Tongue (dorsal border)
- Tonsillar tissues (if visible)
- Facial soft tissue creases – e.g. nasolabial folds (if visible)
- Posterior pharyngeal wall
- Airspaces
 - Palatoglossal airspace (when tongue is not up)
 - Nasopharynx and oropharynx

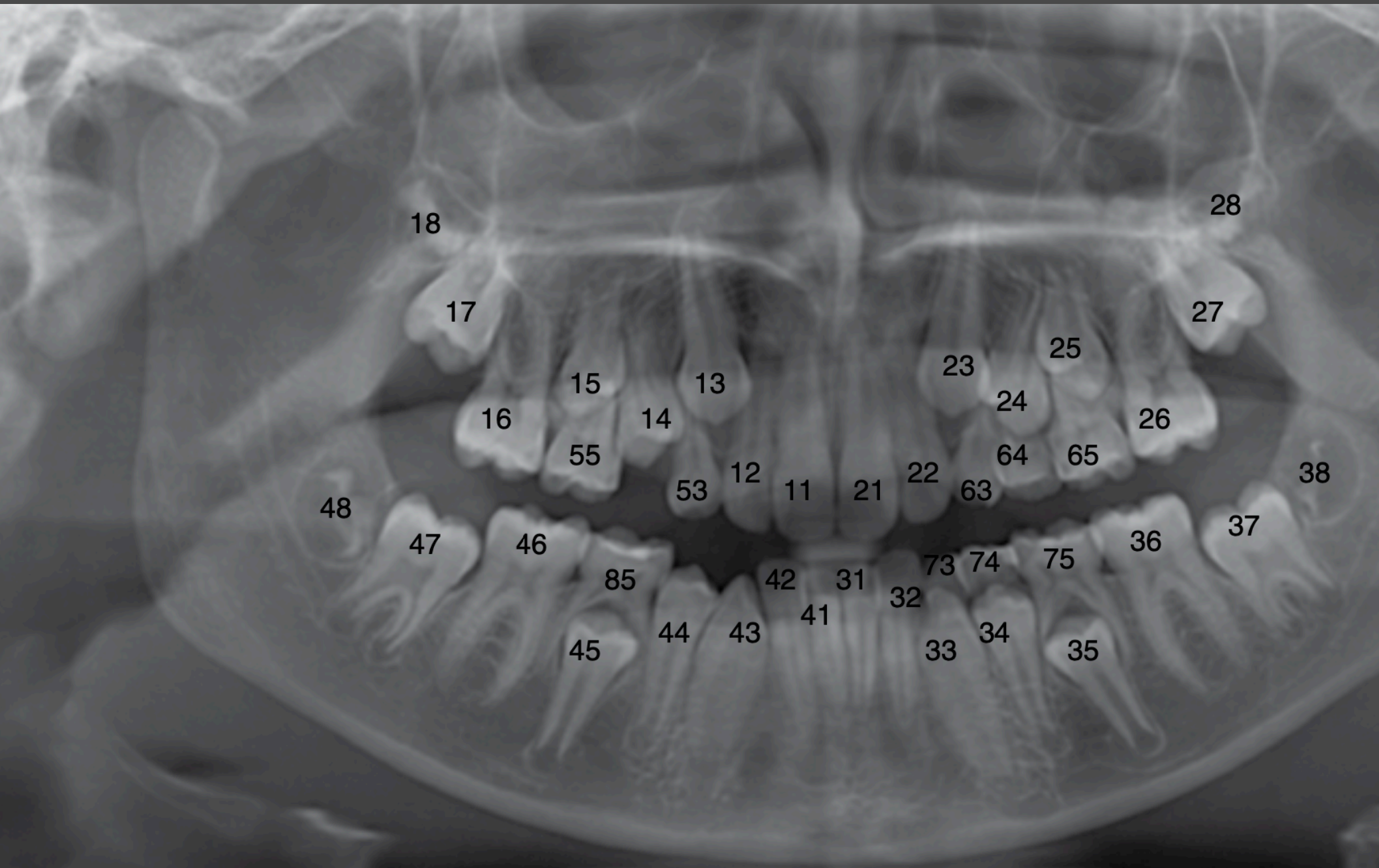
Counting Teeth

Atlas of Oral and
Maxillofacial
Radiology

BERNARD KOONG



WILEY Blackwell

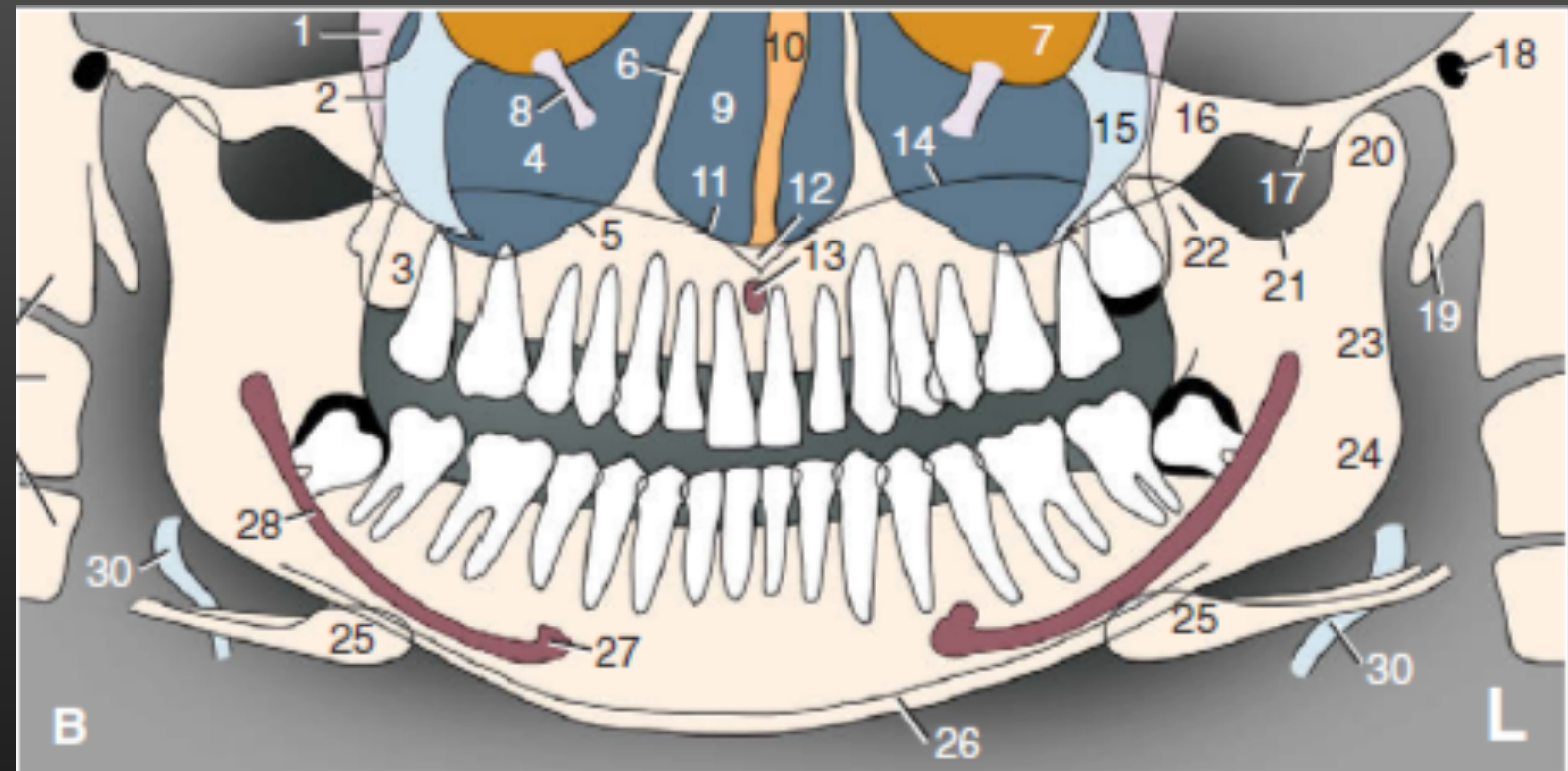




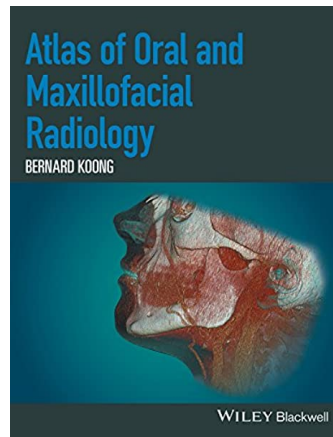
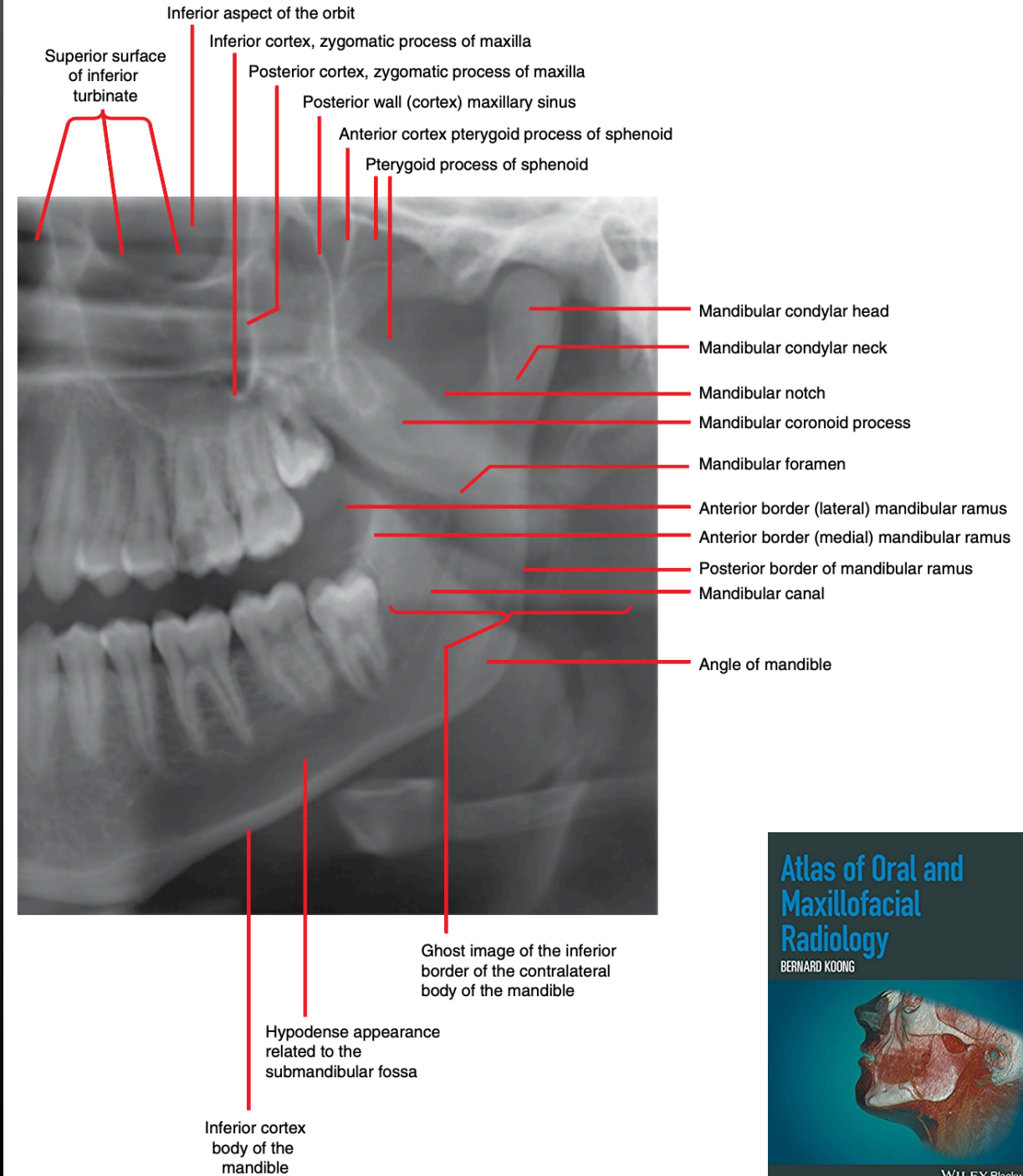
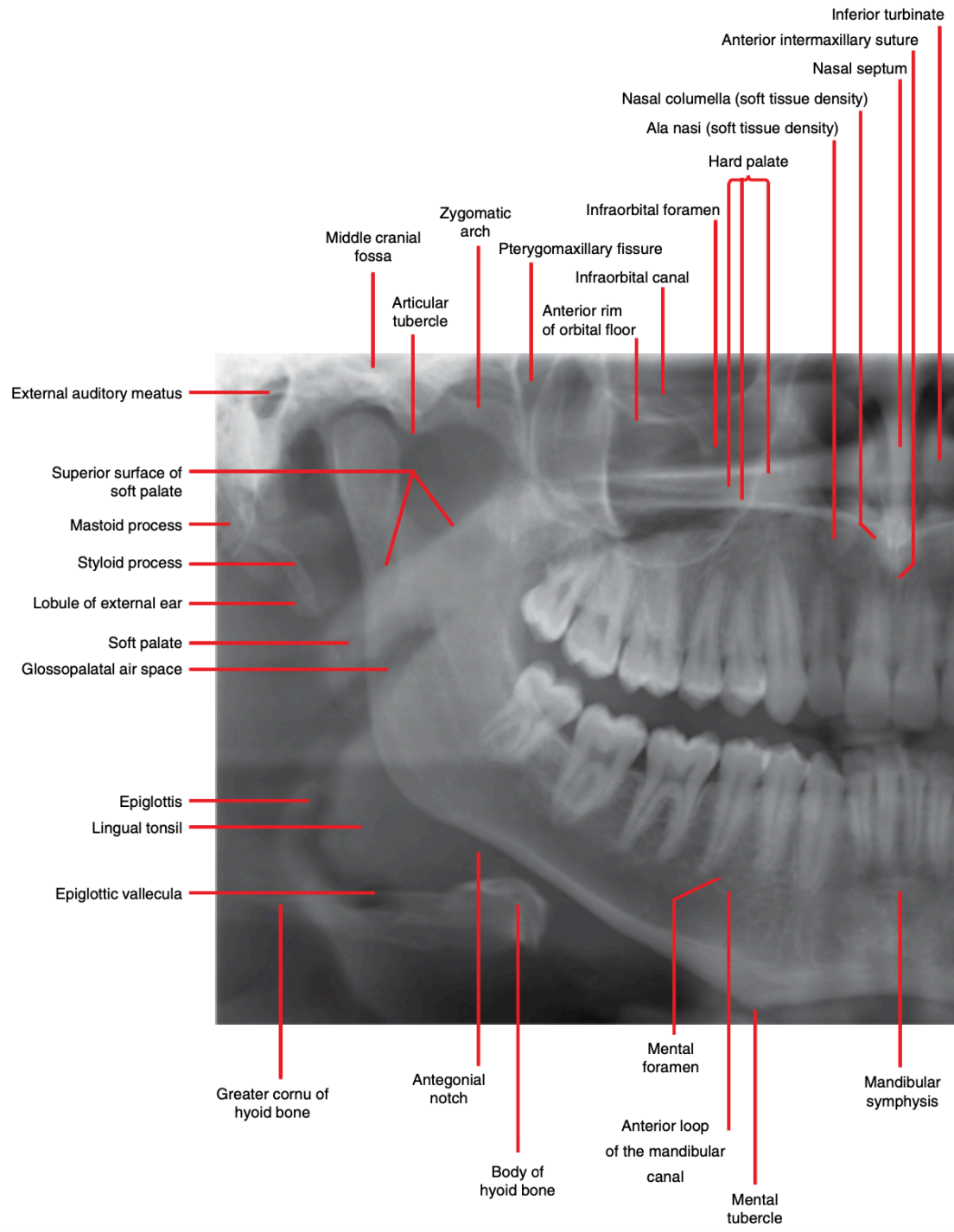


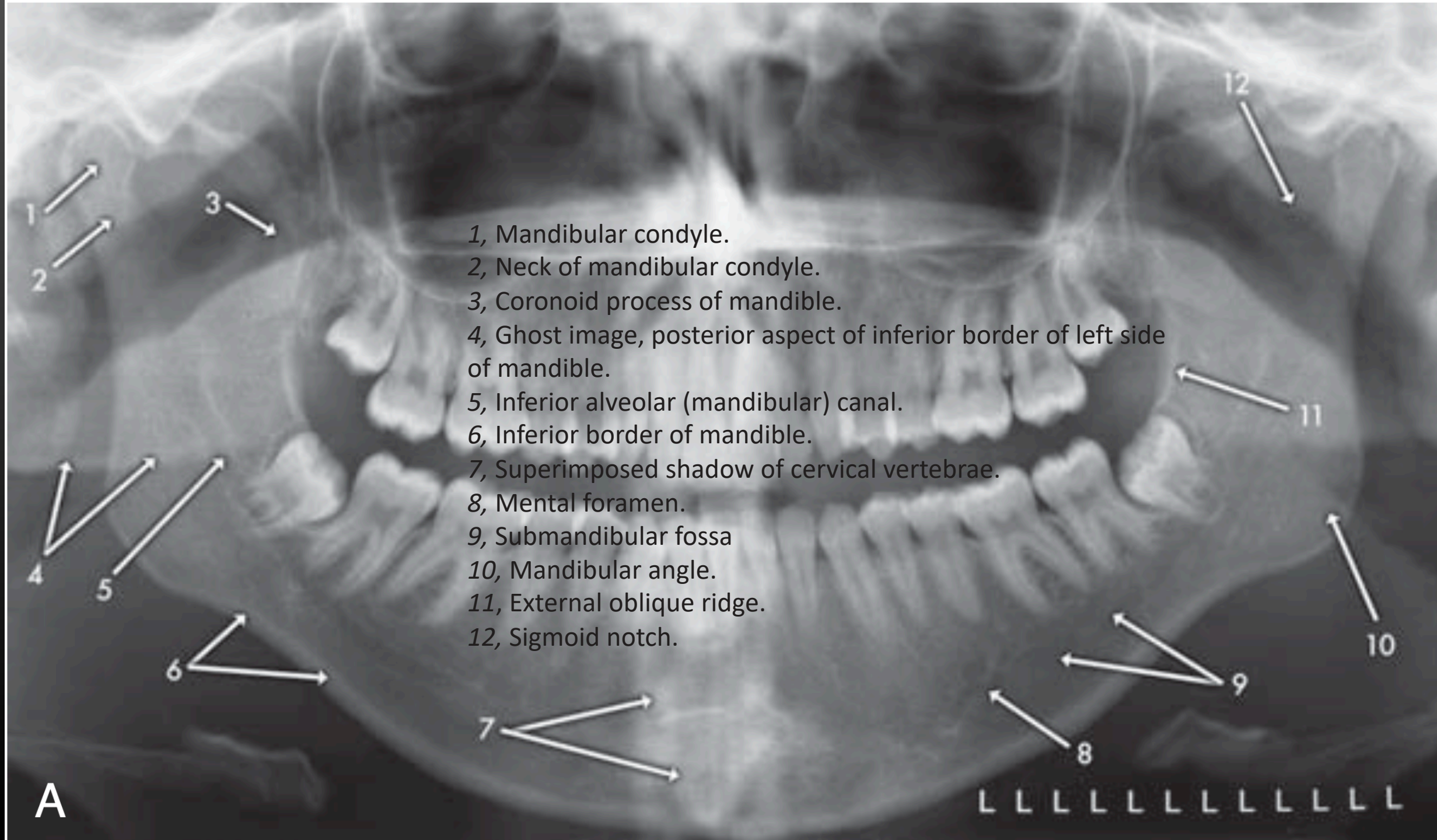


Note the double image of palate, hyoid & spine



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





1, Mandibular condyle.

2, Neck of mandibular condyle.

3, Coronoid process of mandible.

4, Ghost image, posterior aspect of inferior border of left side of mandible.

5, Inferior alveolar (mandibular) canal.

6, Inferior border of mandible.

7, Superimposed shadow of cervical vertebrae.

8, Mental foramen.

9, Submandibular fossa

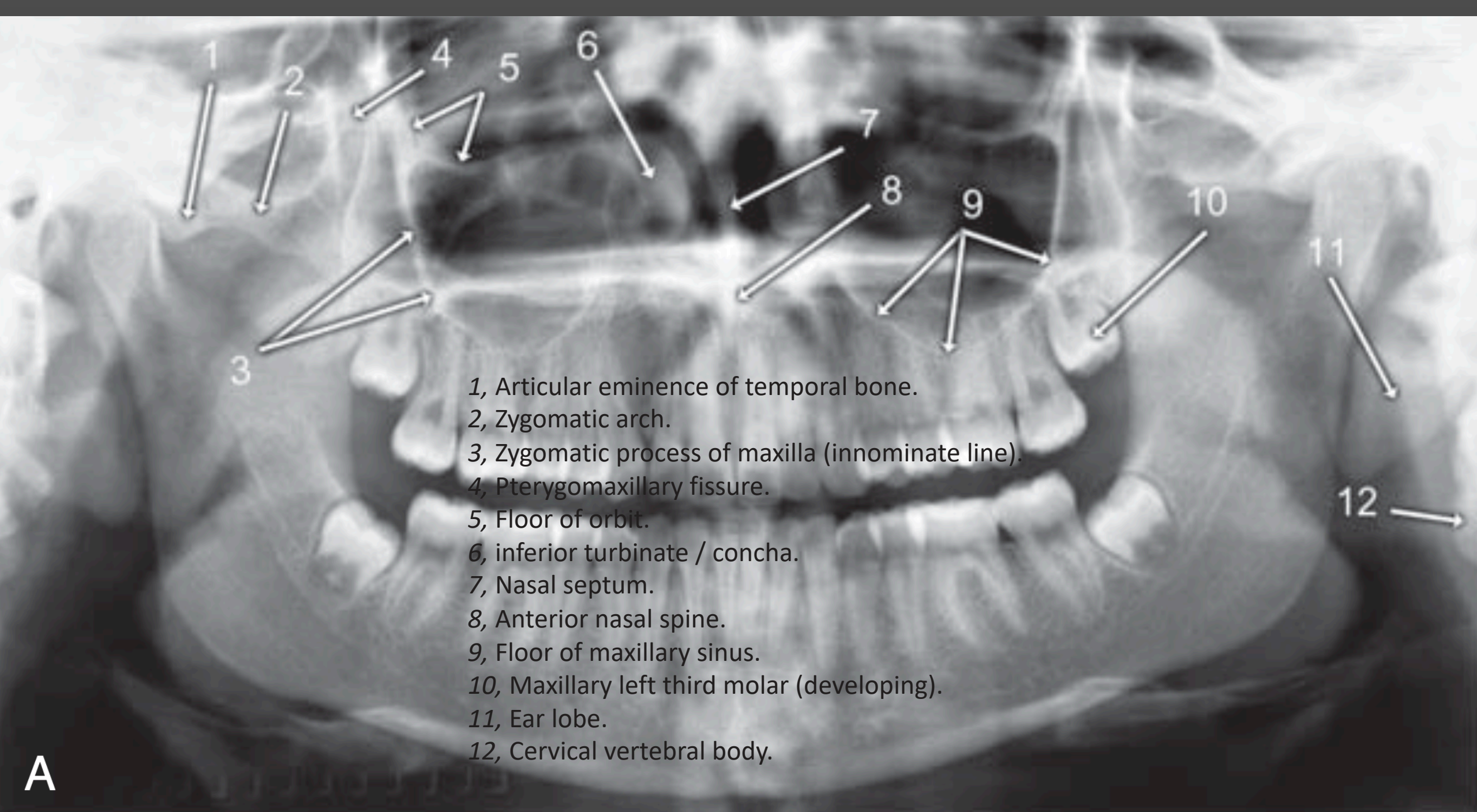
10, Mandibular angle.

11, External oblique ridge.

12, Sigmoid notch.

A

L L L L L L L L L L L L L

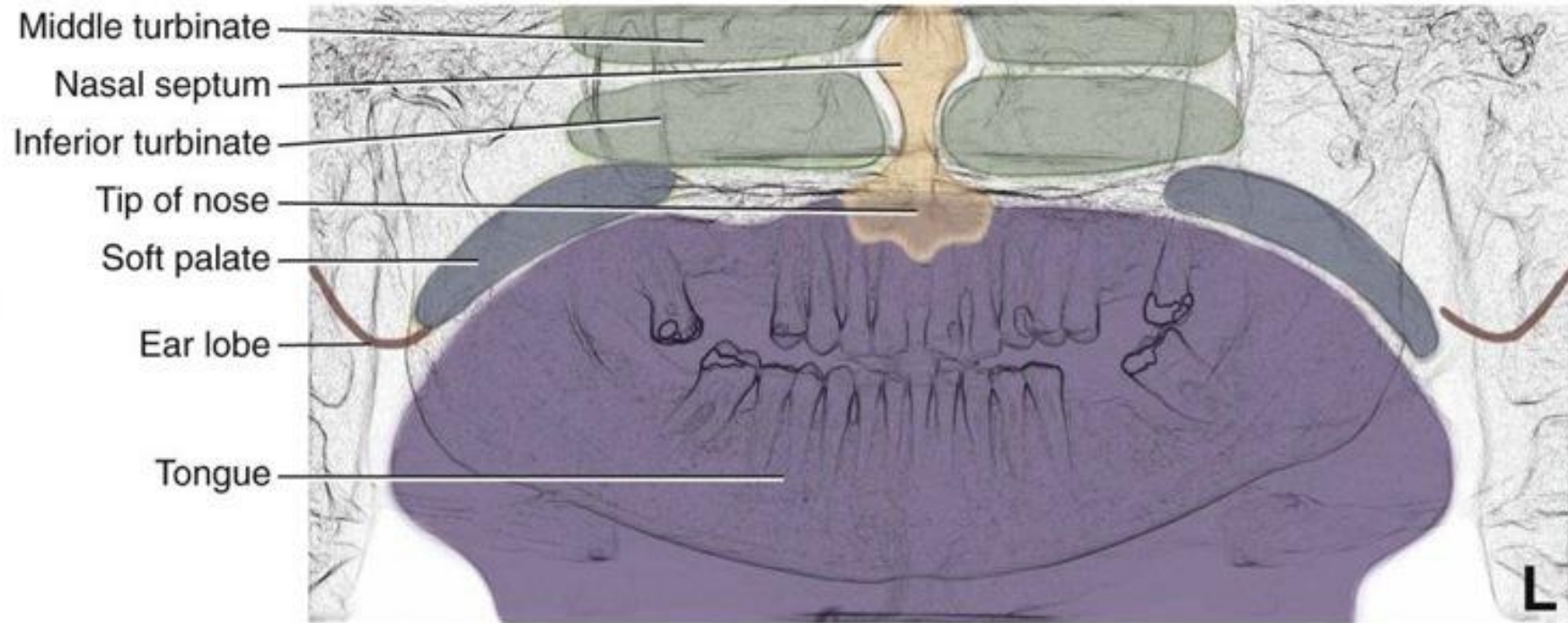


A

A



B



Nasal airway

Nasopharynx

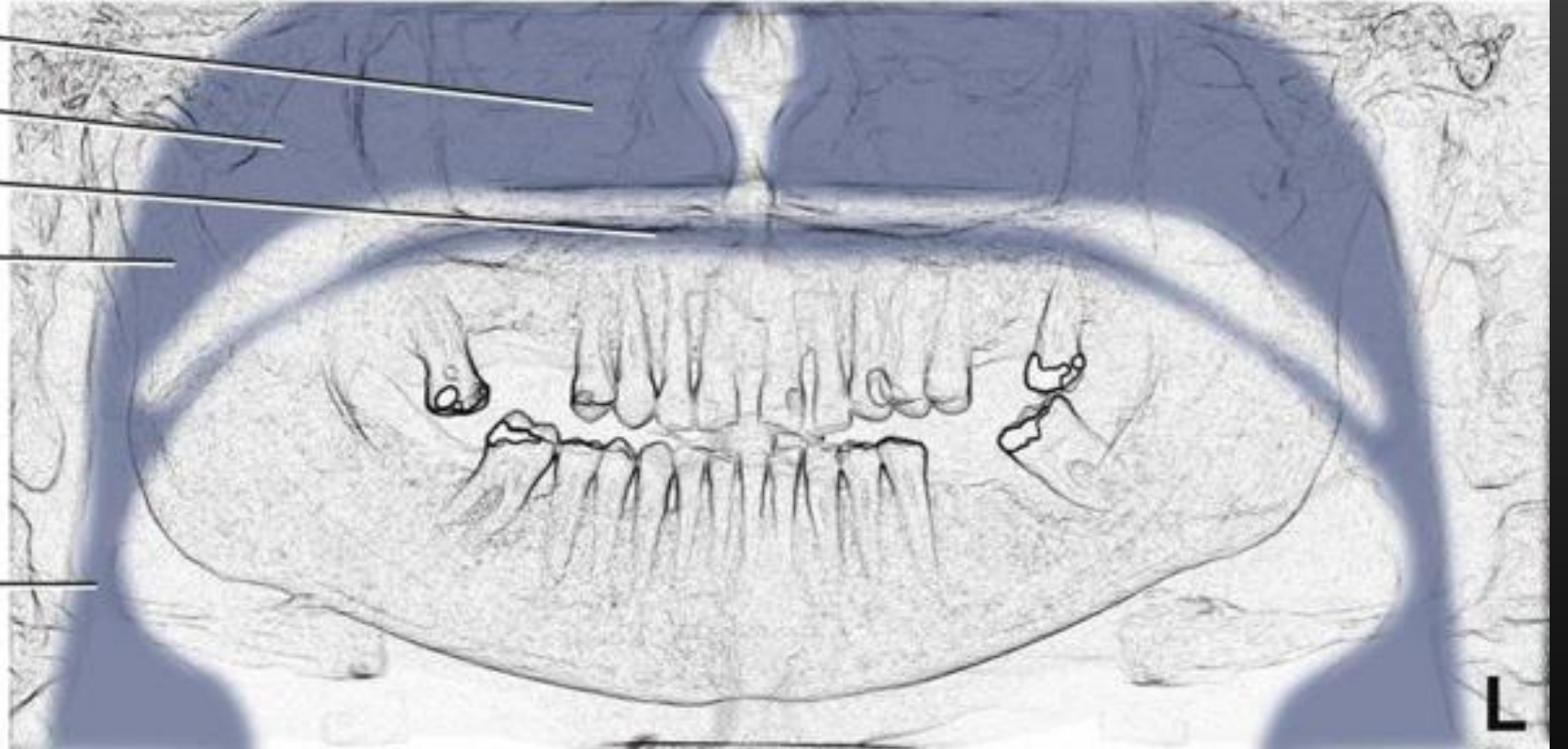
Oral airway

Velopharynx

Oropharynx

C

L



General Indications for PR

“General dental screening” *OPGs are NOT accurate for caries assessment*

- Impacted third molars
- Periodontal screening (periodontal bone loss)
- Mixed dentition & Eruption pattern of permanent teeth
- Orthodontics
 - Crowding, impacted canines, etc.
- Dental anomalies
- Jaw Pathology
 - Inflammatory lesions, odontogenic tumours & cysts, etc.
- Trauma (esp. mandibular fracture)
- *TM Joints (not accurate 😞)*

Further Reading

Essentials of dental radiography and radiology 5th edition
by Whaites, Eric; Drage, Nicholas
Churchill Livingstone 2013

Pocket atlas of dental radiology
by Pasler, Friedrich A; Visser, Heiko
Flexibook, 2007

Oral radiology: principles and interpretation 7th edition
by White, Stuart C; Pharoah, M. J
Permalink 2014
- 8th edition available now

END