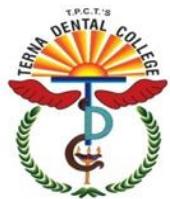


LECTURE TITLE:
EXTRA – ORAL RADIOGRAPHY-2
SKULL RADIOGRAPHY



LEARNING OBJECTIVES

- To understand the concepts of extra-oral radiographic projections.
- To learn about the various accessories and the related underlying working principles used in extra oral radiography.
- To understand the indications of use of various skull radiographs.

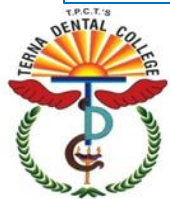


Contents

- **INTRODUCTION**
- **INDICATIONS & DRAWBACKS**
- **PROCEDURE**
- **MOST COMMONLY USED VIEWS FOR MAXILLOFACIAL IMAGING**

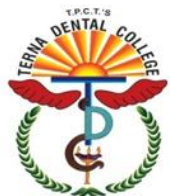
Radiography of the Skull

1. Lateral cephalogram
2. PA cephalogram
3. PA Skull
4. Towne's Projection



Posterioranterior Projection (also known as occipito frontal projection of Nasal Sinuses)- There are 2 methods for obtaining this projection.

1. Posterior Anterior (Granger Projection)
2. Modified method, Inclined Posterior Anterior (Caldwell Projection)

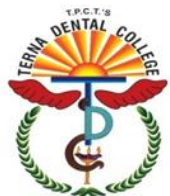


Radiography of Base of the Skull

1. Submento Vertex projection

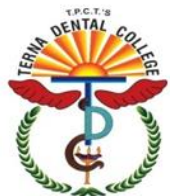
Radiography of the Zygomatic Arches

1. Jughandle view (A Modification of submento vertex view)



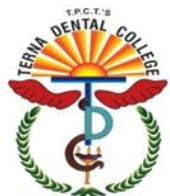
Radiography of the Mandible

1. PA Mandible
2. Rotated PA Mandible
3. Lateral Oblique
 - A. Body of mandible
 - B. Ramus of mandible



INTRODUCTION

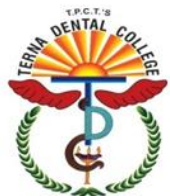
- **Extraoral radiography** are those in which both x-ray source and image receptor are placed outside the patient's mouth.
- Extraoral radiographs are produced with conventional dental x-ray machines, certain models of panoramic machines or higher capacity medical x-ray units.



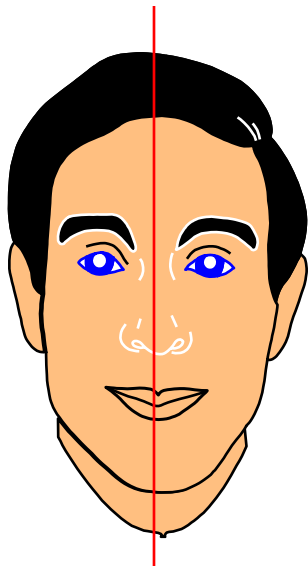
- It requires **Cassette, Films, Intensifying Screens and Grids.**
- **Cephalometric and skull views require at least a 8X10 inch image receptor, whereas oblique lateral projections of the mandible can be obtained with 5X7 inch image receptor.**



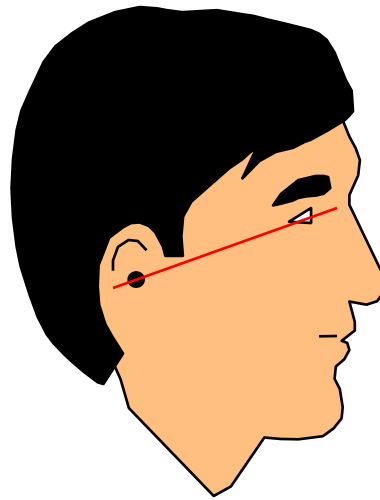
- It is critical to correctly and clearly label the right and left sides of the image.
- It is done by placing a metal marker of **R or L** on the outside of the cassette in corner in which the marker does not obstruct diagnostic information.
- The proper exposure parameters depend on the *patient's size, anatomy, and head orientation; image receptor speed; x-ray source-to receptor distance; and whether or not grids are used.*
- Proper positioning of the x-ray source, patient, and image receptor requires patience, attention to detail, and experience.



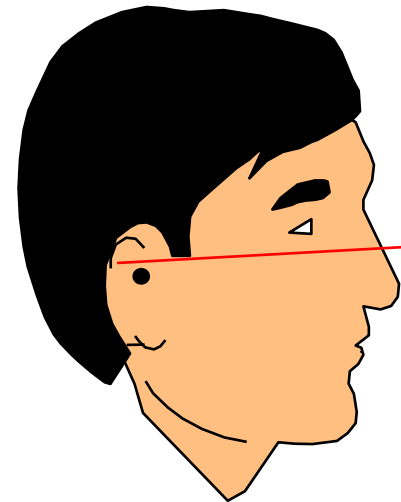
Important anatomical landmarks during patient positioning for extra oral radiography



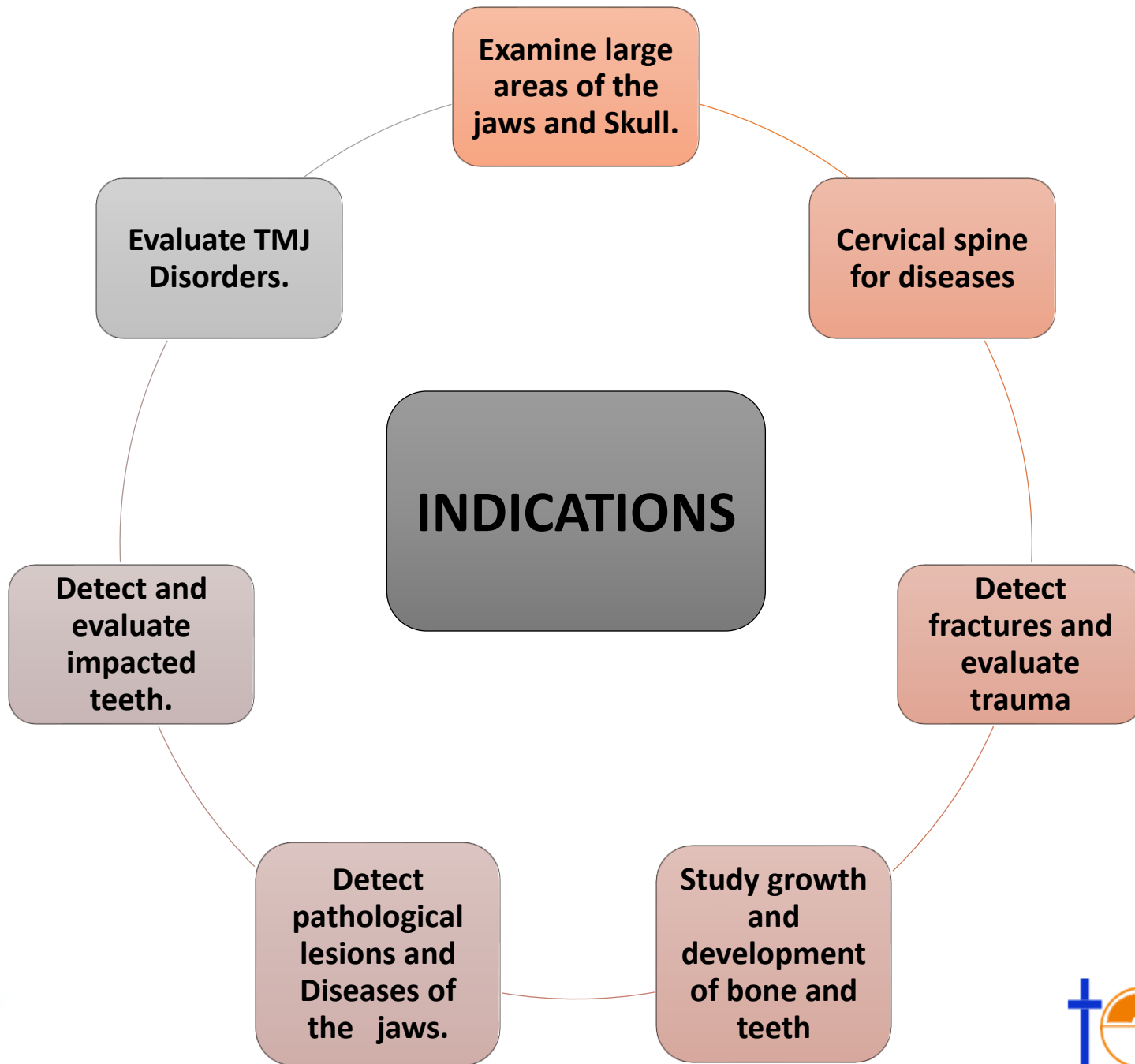
MSP



CM LINE



FHP



**Magnification
occurs due to
the greater
object to film**

DRAWBACKS

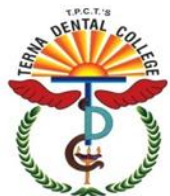
**Details are not
well-defined
due to the use
of cassettes
and intensifying
screens**

**Contrast is reduced
due to the
secondary radiation
produced
by the soft tissues**

PROCEDURE

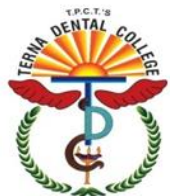
a. Equipment Preparation-

1. Load the extraoral cassette in the dark room under safe light conditions. Place one extraoral film between two intensifying screens and securely close the cassette.
2. Set the exposure factors (kilo voltage, milliamperage, time) according to the manufacturer's recommendations.
3. Load the cassette into the cassette carrier.
4. Print in the date, patient's name, age, sex and the case no.



b. Patient Preparation-

1. Explain to the patient the radiographic procedure about to be performed.
2. Place a lead apron without a lead collar over the patient and secure it. A double sided apron is recommended.
3. Remove all objects from the head and neck region that may interfere with film exposure.



Radiography of the Skull

1. Lateral cephalogram
2. PA cephalogram
3. PA Skull
4. Towne's Projection



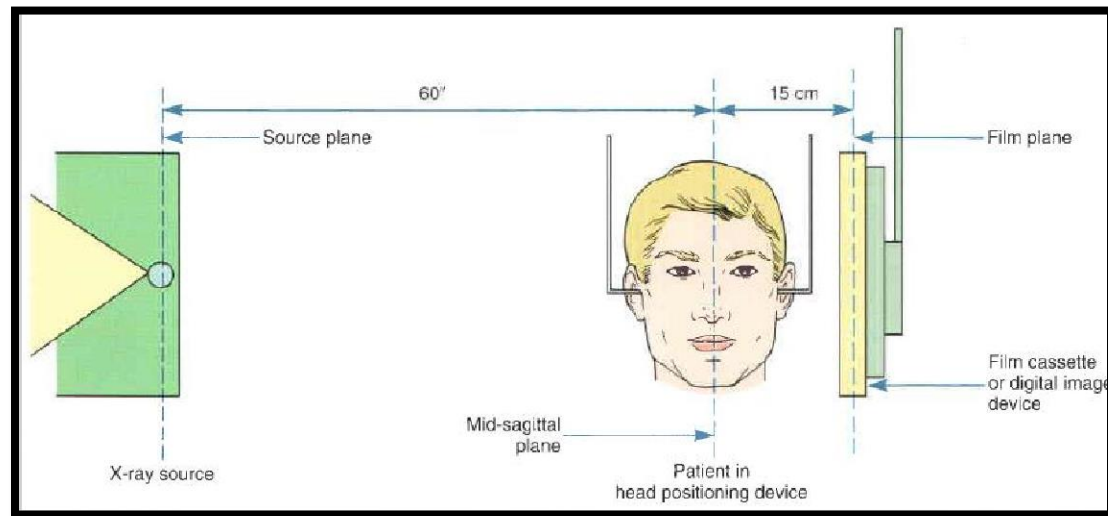
LATERAL SKULL PROJECTION (LATERAL CEPHALOMETRIC PROJECTION)

Film parallel to midsagittal plane

Beam perpendicular to film



- All cephalometric radiographs are made with the help of a cephalostat.
- Cephalostat helps maintain a constant relationship among the skull, film and the x-ray beam.



- For cephalometric applications the distance should be **60 inches** between the x-ray source and the midcoronal plane.
- This increased distance provides an resultant image *with a broader gray scale of the patient.*



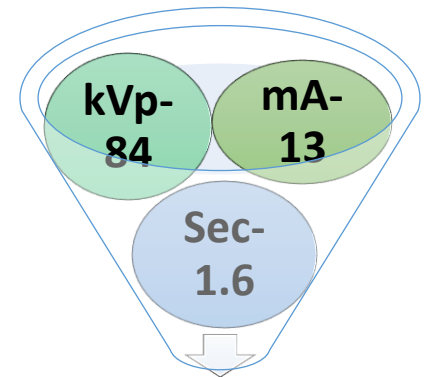
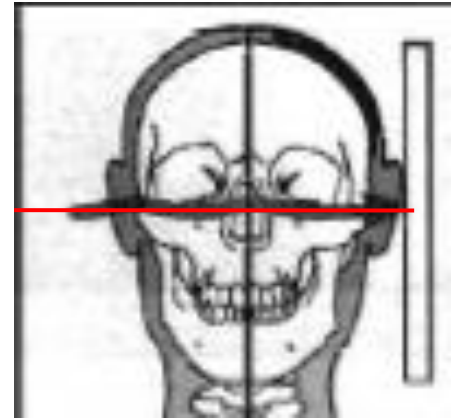
Image receptor and patient placement

- The image receptor is positioned parallel to the patient's midsagittal plane
- The site of interest is placed towards the image receptors to minimize distortion
- The patient is placed with the left side towards the image receptor
- A wedge filter at the tube head is positioned over the anterior aspect of the beam to absorb some of the radiation and to allow visualization of soft tissues of the face.



Position of the central x- ray beam

- The central beam is perpendicular to the midsagittal plane of the patient and the plane of the image receptor and is central over the external auditory meatus

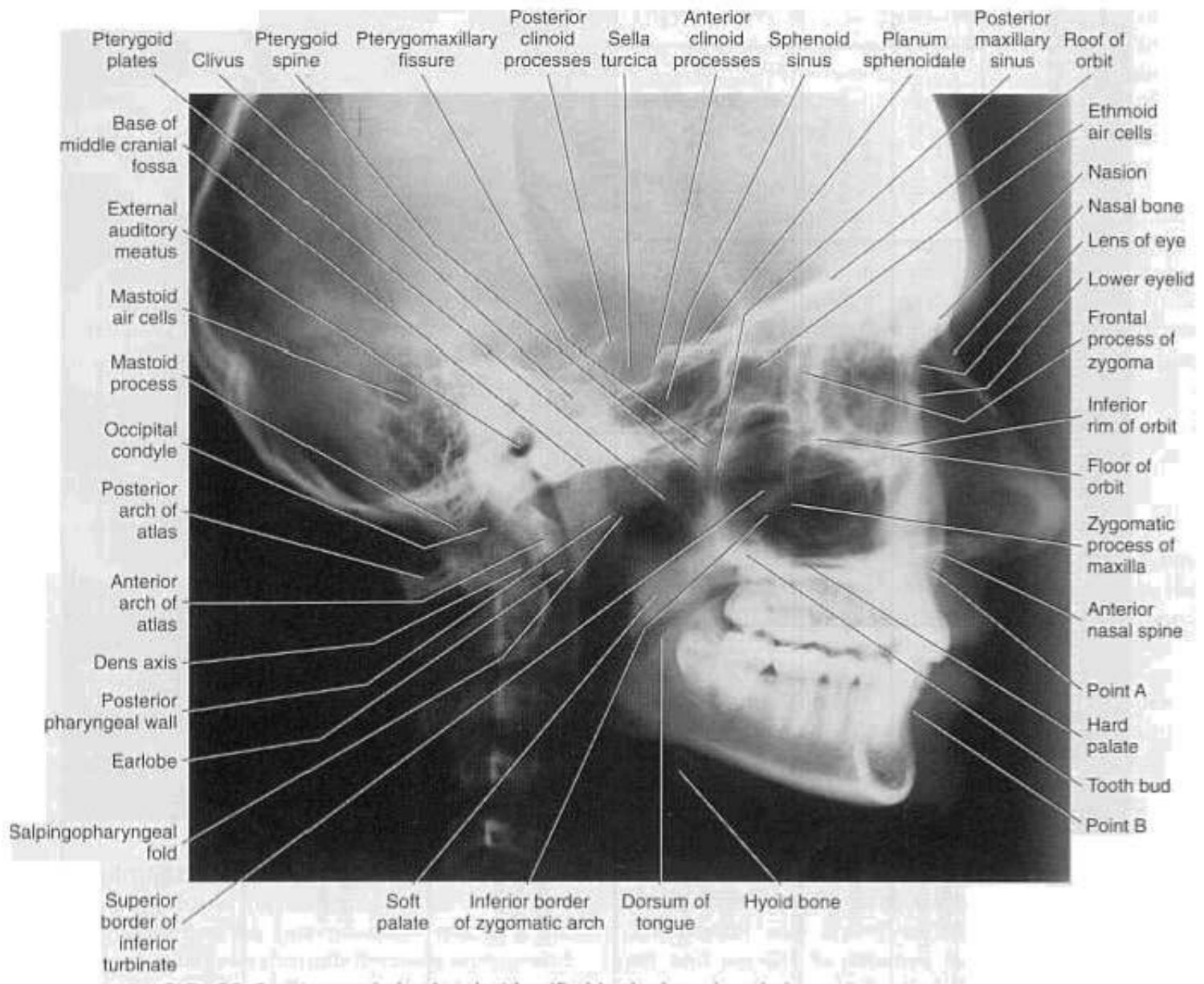


Exposure parameters

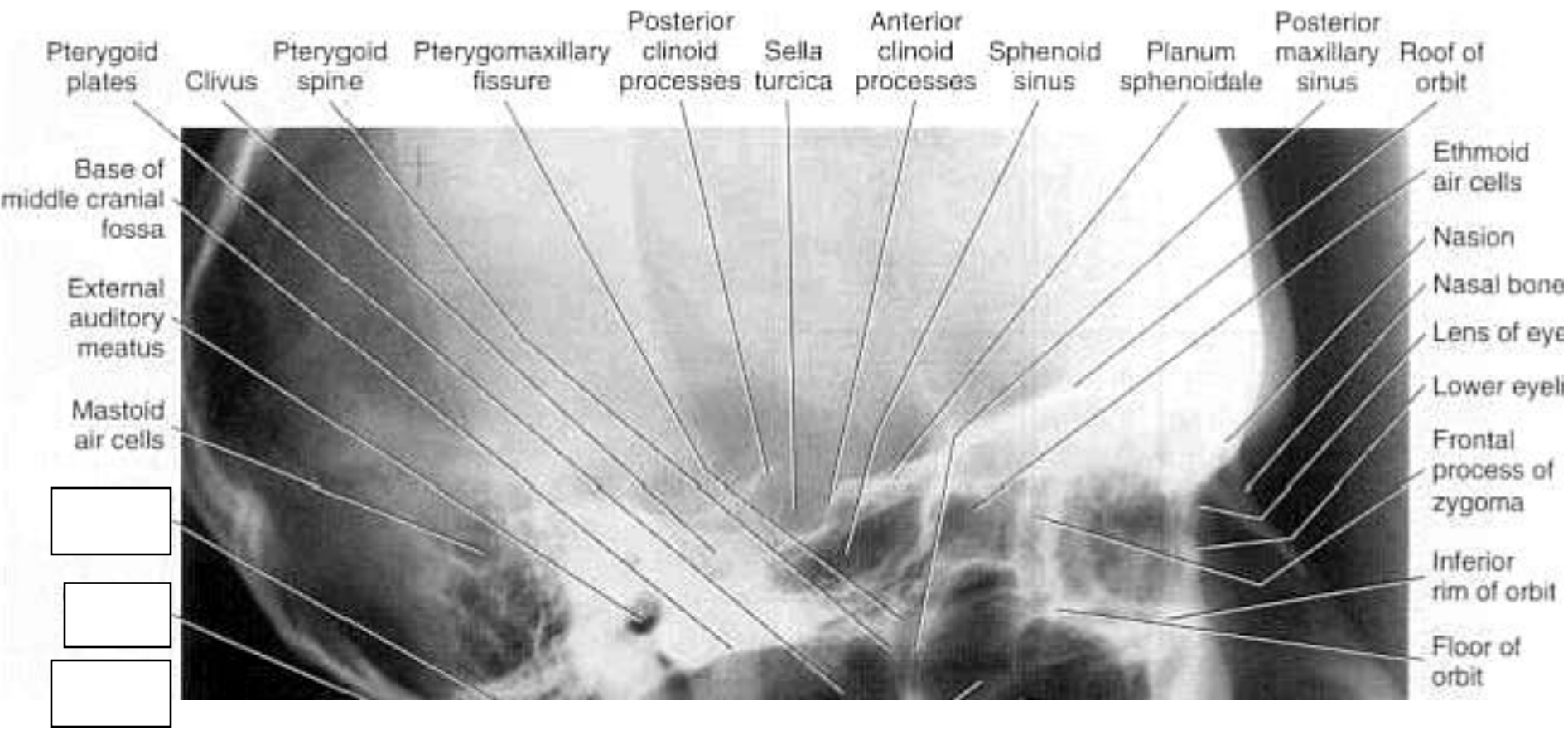
Resultant image

- Exact superimposition of right and left sides is impossible because structures on the side near the image receptor are magnified less than the same structure on the side far from the image receptor.
- Bilateral structures close to the midsagittal plane demonstrate less discrepancy in size compared with bilateral structures farther away from the midsagittal plane.
- Structures close to the midsagittal plane (e.g., the clinoid processes and inferior turbinate's) should be nearly superimposed.



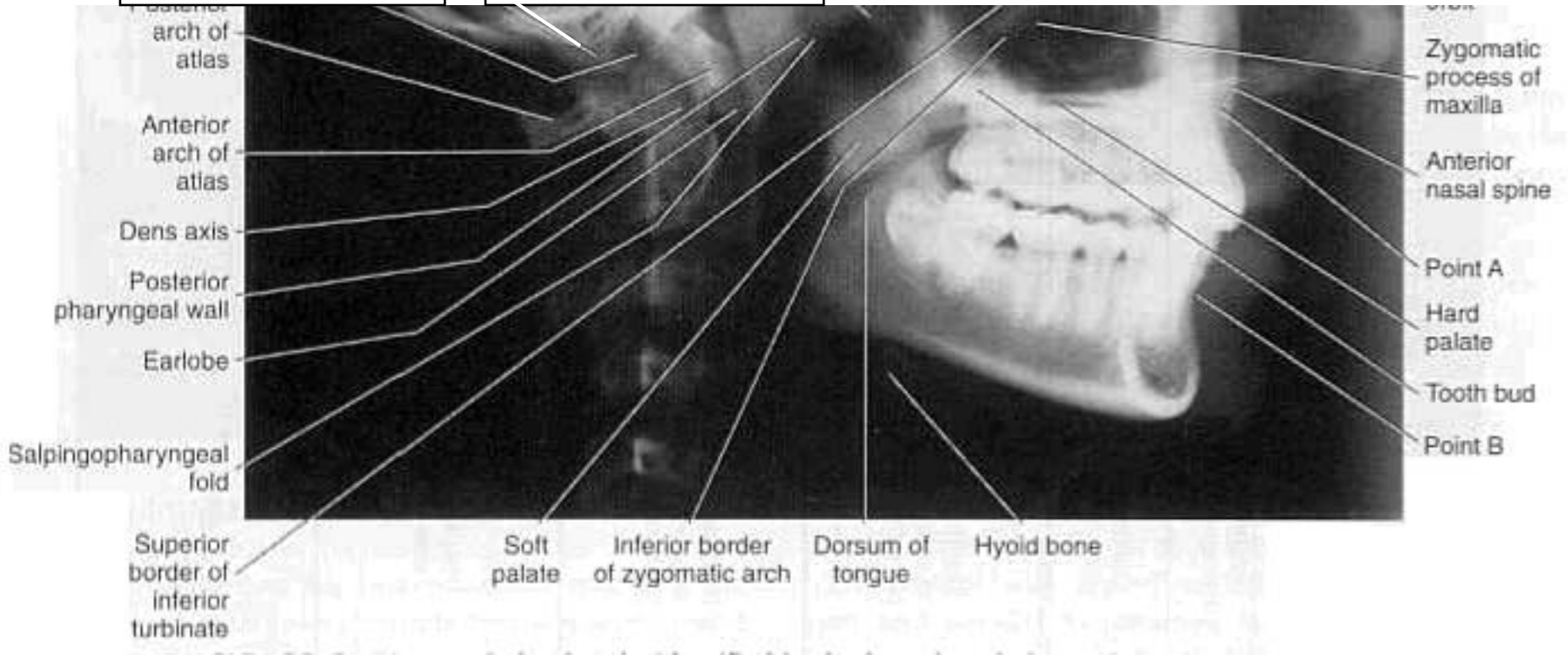


ANATOMICAL LANDMARKS



Occipital condyle

Mastoid process



INDICATIONS

Film parallel
to midsagittal
plane

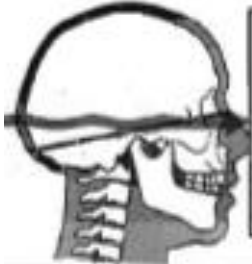
Beam
perpendicular
to film



- Measure and compare changes in Growth and development of bone and the teeth through pre & progress and post treatment records.
- Facial soft tissue profile of the face
- Evaluate trauma.
- To determine the location and extent of fractures.
- Malignancies.
- Injuries to TMJ

Canthomeatal
line
at 10° with film

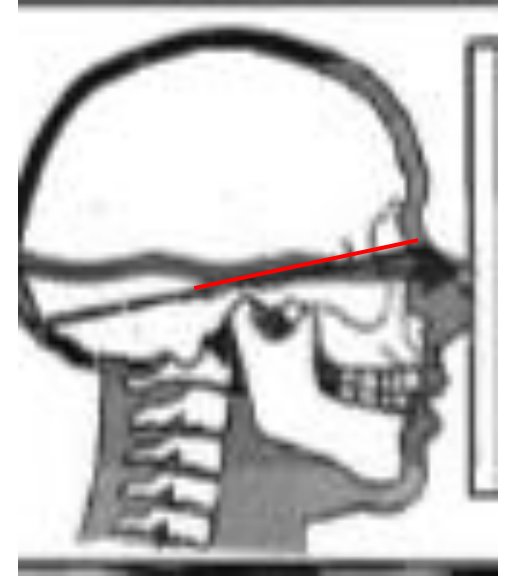
Beam
perpendicular
to film



POSTEROANTERIOR CEPHALOMETRIC PROJECTION (POSTEROANTERIOR SKULL PROJECTION)

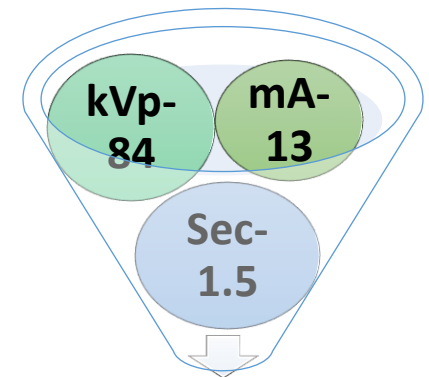
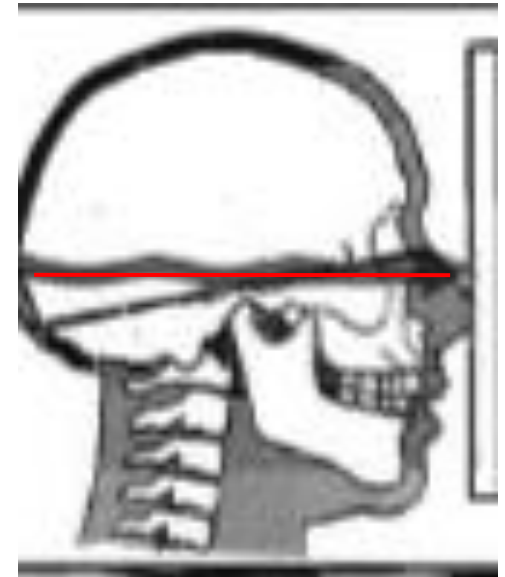
Image receptor and patient placement

- The image receptor is placed in front of the patient, perpendicular to the midsagittal plane and parallel to the coronal plane.
- The patient is positioned so that the canthomeatal line forms a 10-degree angle with the horizontal plane and the frankfort plane is perpendicular to the image receptor.



Position of the central x- ray beam

- The central beam is perpendicular to the image receptor, directed from the posterior to the anterior (hence the name postero-anterior) and is centred at the level of the bridge of the nose

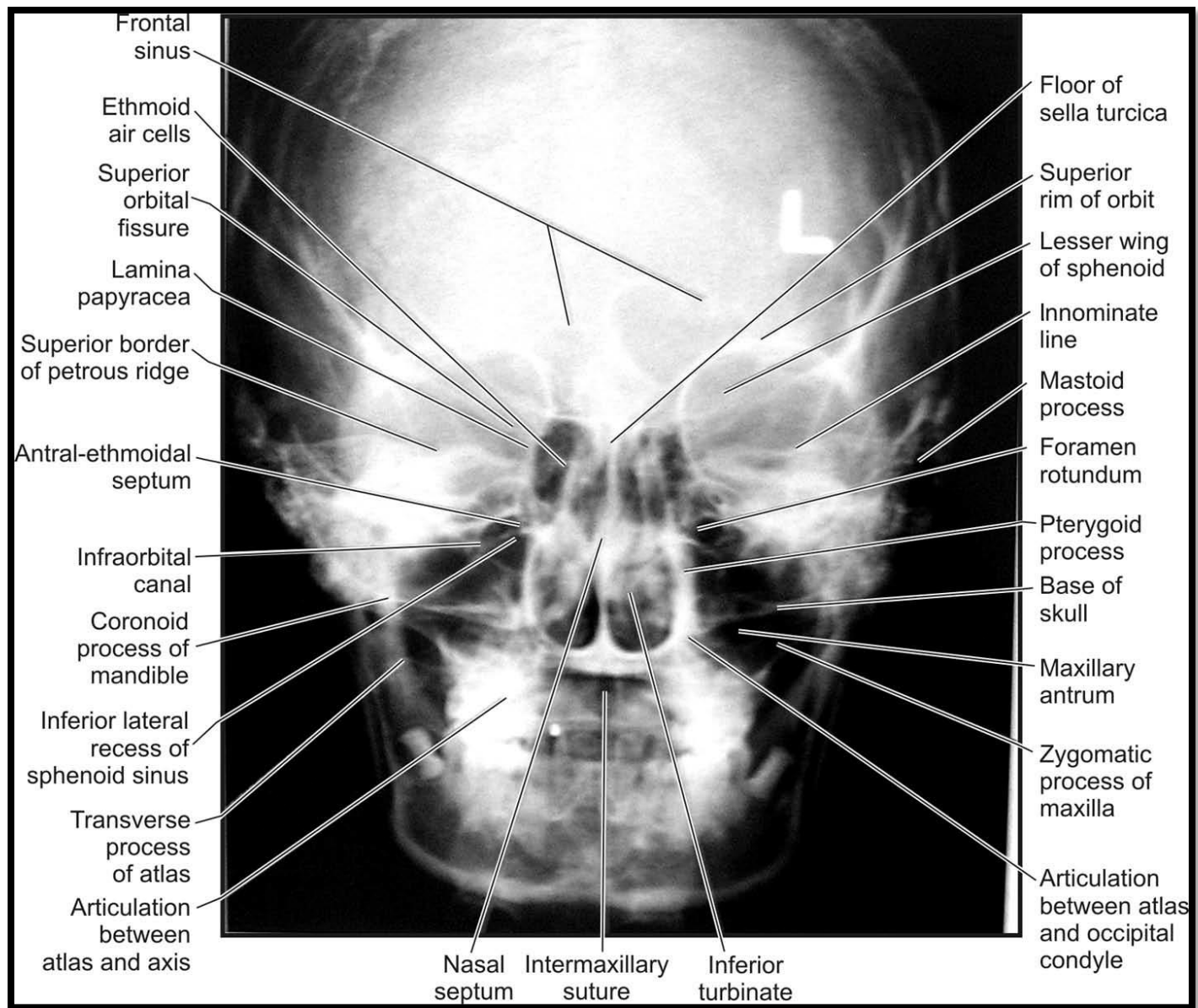


Exposure parameters

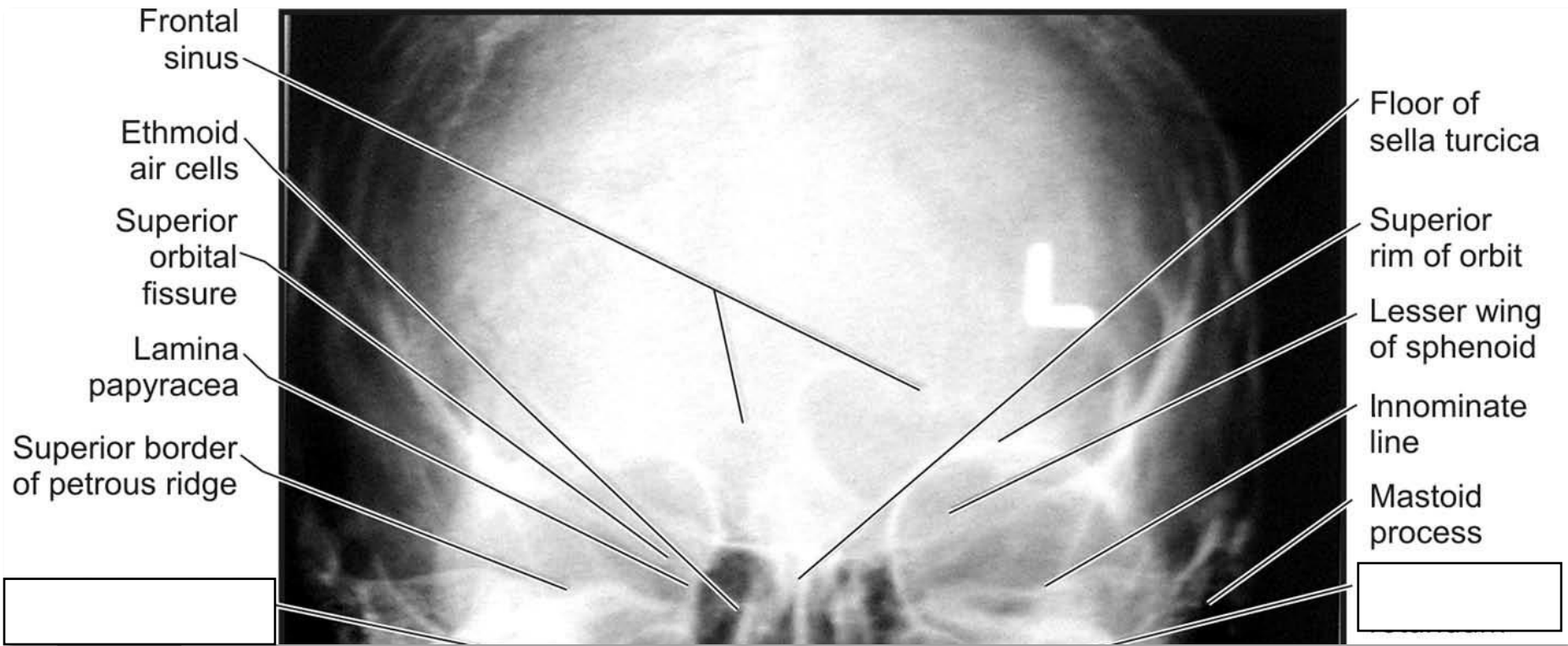
Resultant
image

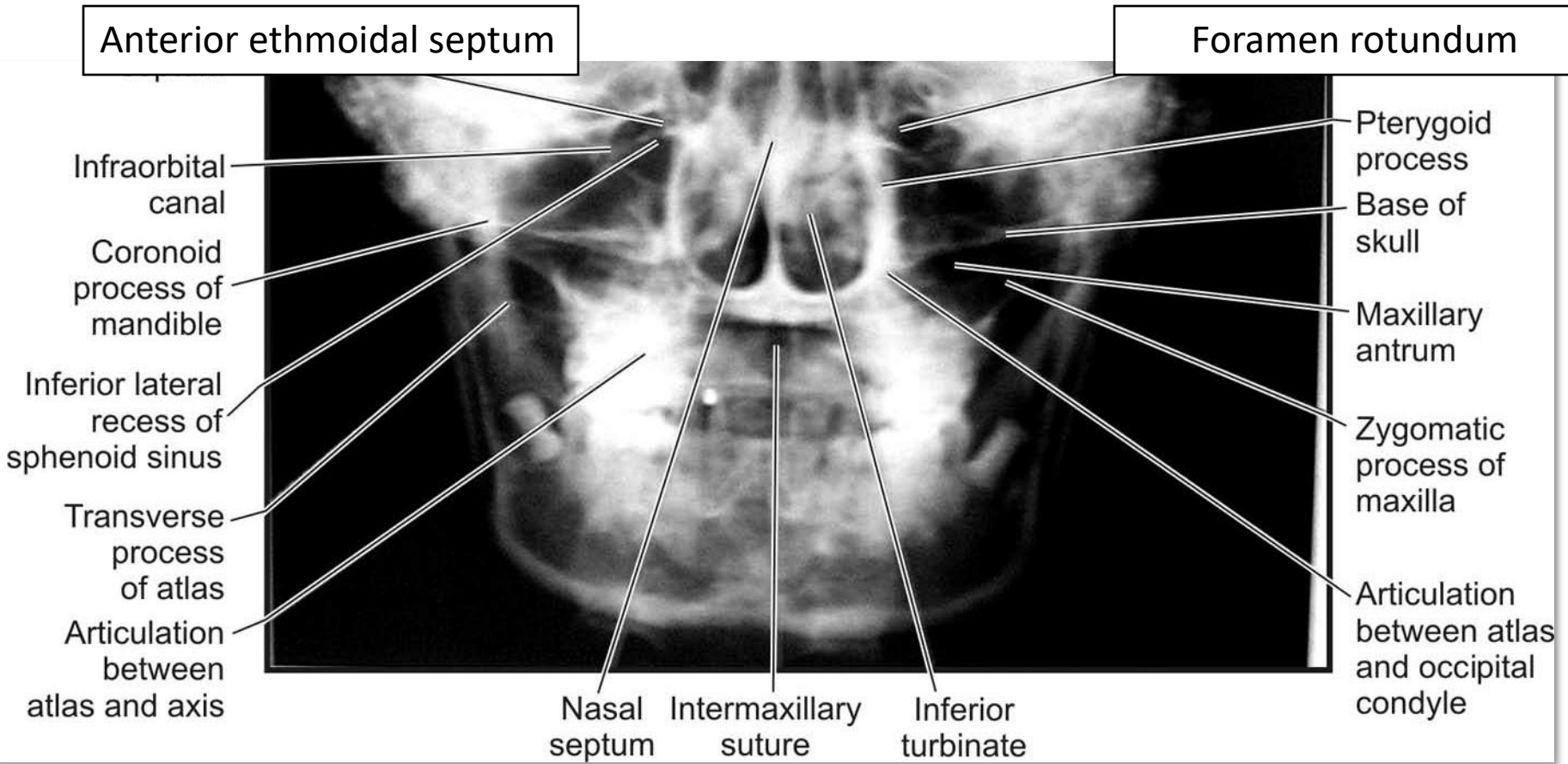
- The midsagittal plane should divide the skull into two symmetric halves.
- The superior border of the petrous ridge should lie in the lower third of the orbit.





ANATOMICAL LANDMARKS





PA SKULL

Film Position

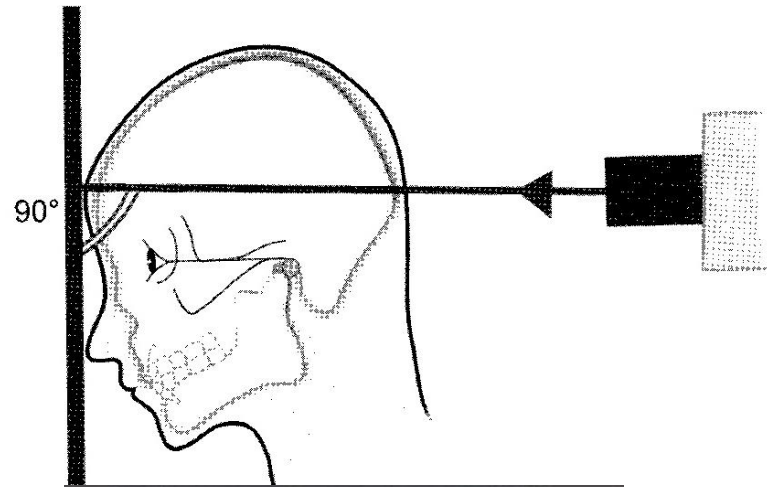
- The cassette is placed perpendicular to the floor in a cassette holding device.

Position of Patient

- The sagittal plane should be vertical and perpendicular to the film.
- The head is tipped downwards so that the forehead and nose touch the film. The film is adjusted so that the lips are centered to the film.

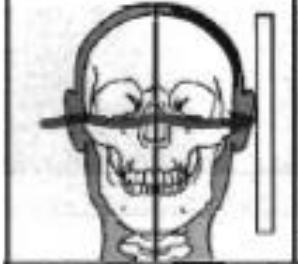
Central Ray

- It is directed at right angles to the film through the mid sagittal plane through the occiput.



Film parallel
to midsagittal
plane

Beam
perpendicular
to film



INDICATIONS

- **Asymmetry**
- **Trauma**
- **Developmental abnormalities**
- **Fractures of skull vault**
- **Investigation of frontal sinus**
- **Conditions affecting cranium(Paget's disease, multiple myeloma, hyperparathyroidism)**
- **Intracranial calcification**

TOWNE'S PROJECTION

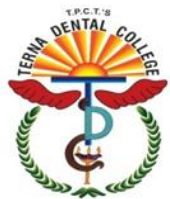
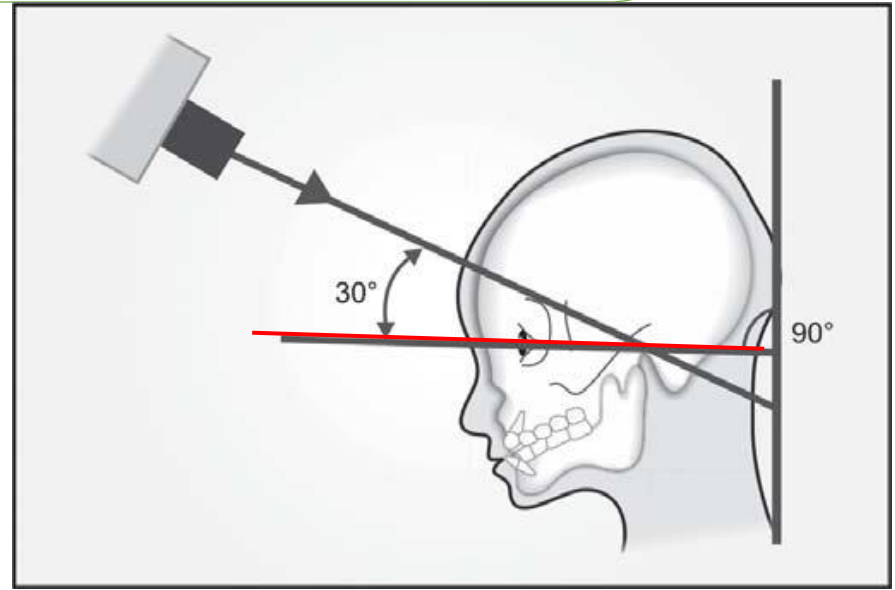


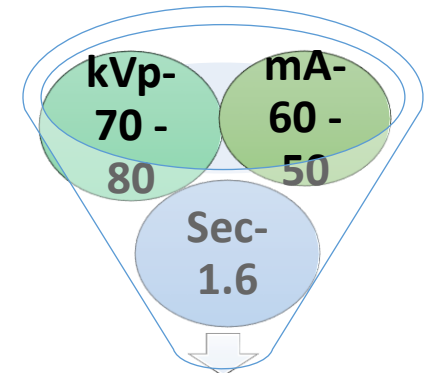
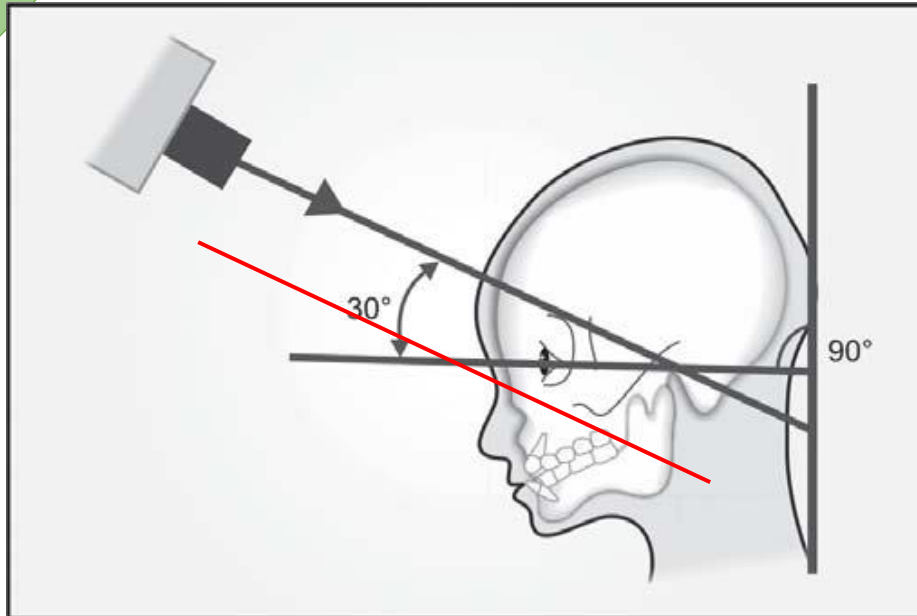
Image receptor and patient placement

- The cassette is placed perpendicular to the floor in a cassette holding device.
- This is an anteroposterior view, with the back of the patient's head touching the film. The canthomeatal line is perpendicular to the film.



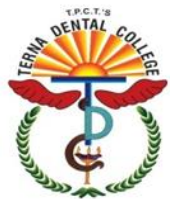
Position of the central x- ray beam

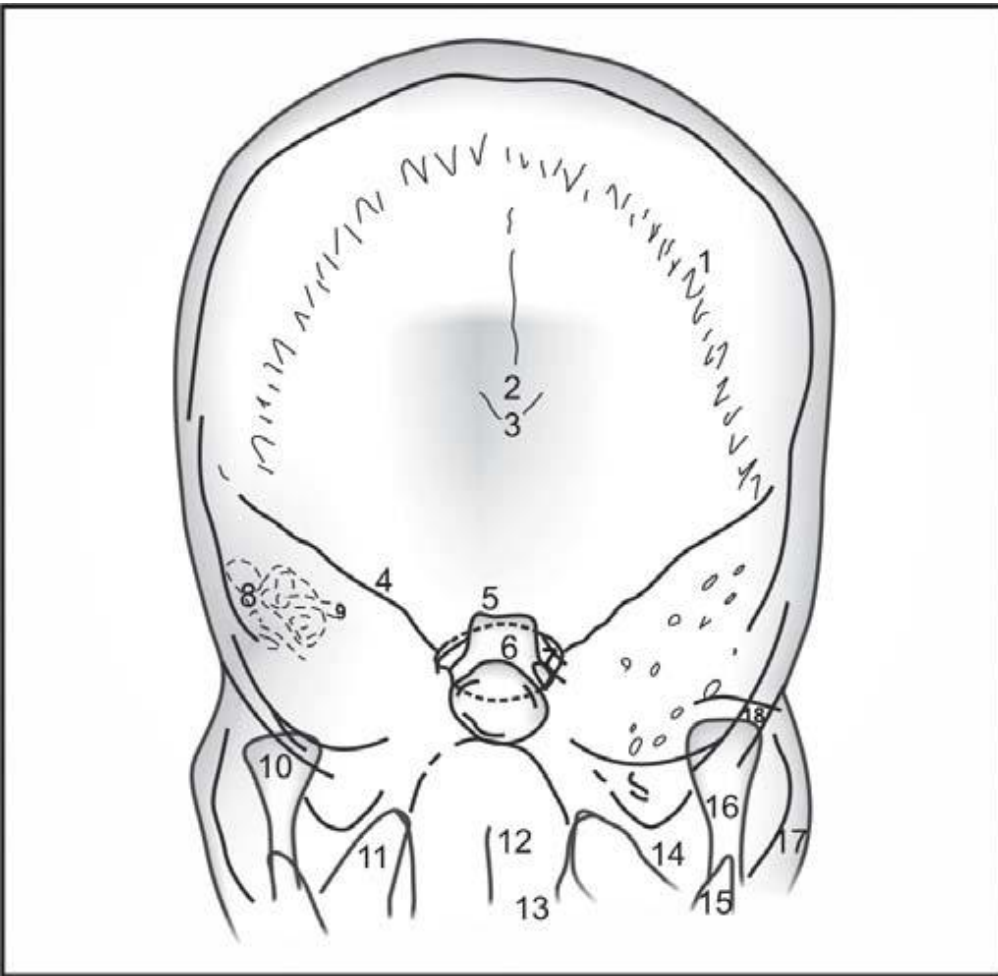
- It is directed at 30° to the cantho meatal line and passes through it at a point between the external auditory canals.



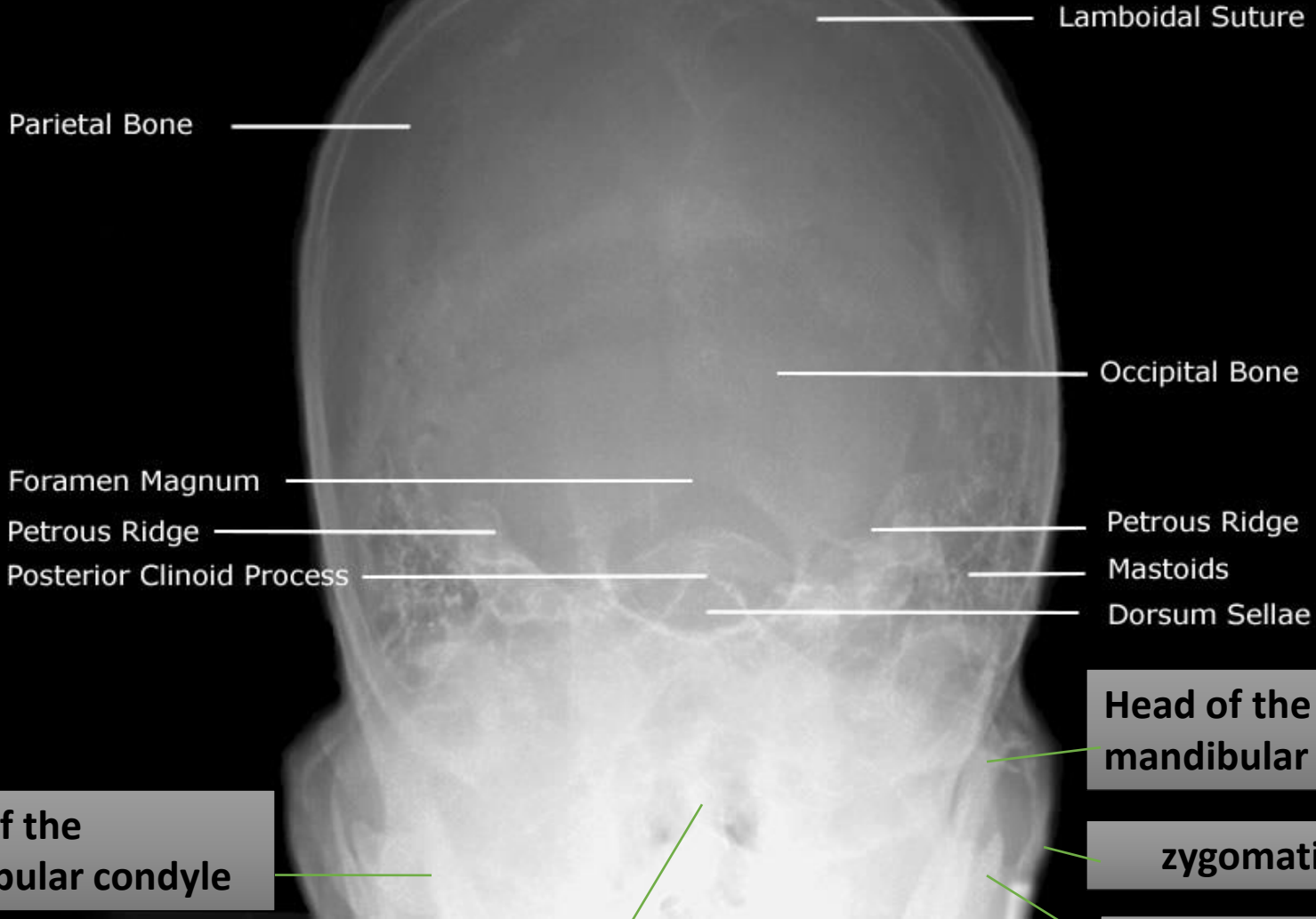
Exposure parameters

ANATOMICAL LANDMARKS





1. lambdoid suture; 2. internal occipital crest; 3. occiput; 4. petrous ridge of the temporal bone; 5. posterior clinoid process; 6. dorsum sellae; 7. foramen magnum; 8. mastoid air cells; 9. internal auditory canal; 10. head of the mandibular condyle; 11. maxillary antrum; 12. nasal septum; 13. mesial wall of the maxillary antrum; 14. roof and wall of the maxillary antrum; 15. neck of the mandibular condyle; 16. coronoid process of the mandible; 17. zygomatic arch; 18. temporomandibular joint space



Neck of the mandibular condyle

Head of the mandibular condyle

zygomatic arch

coronoid process of the mandible

nasal septum

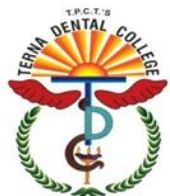


INDICATIONS

- Fractures of the skull vault, head and neck of condyle and zygomatic arches.

Posterioranterior Projection (also known as occipito frontal projection of Nasal Sinuses)-

- 1. Posterior Anterior (Granger Projection)**
- 2. Modified method, Inclined Posterior Anterior (Caldwell Projection)**

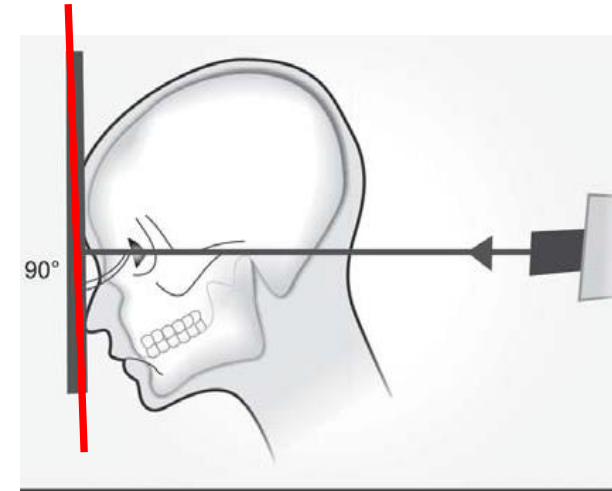


POSTERIOR ANTERIOR (GRANGER PROJECTION)



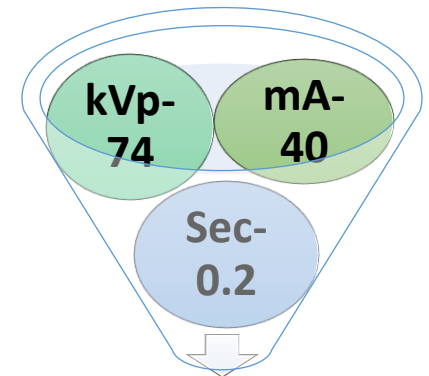
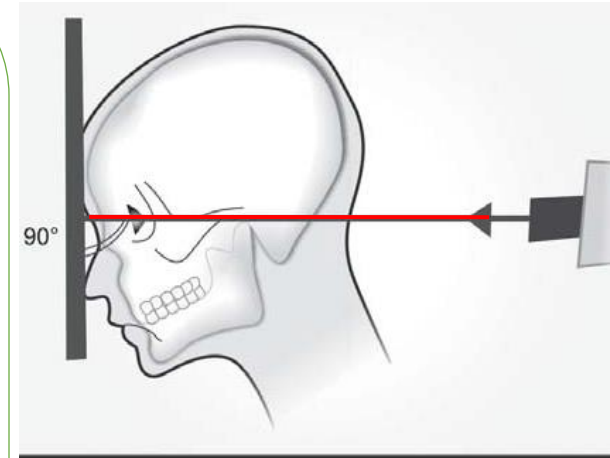
Image receptor and patient placement

- The cassette is placed perpendicular to the floor in a cassette holding device.
- The midsagittal plane should be vertical and perpendicular to the plane of the cassette.
- Only the forehead and nose should touch the cassette such that the radiographic baseline is at 90 degrees to the film.



Position of the central x- ray beam

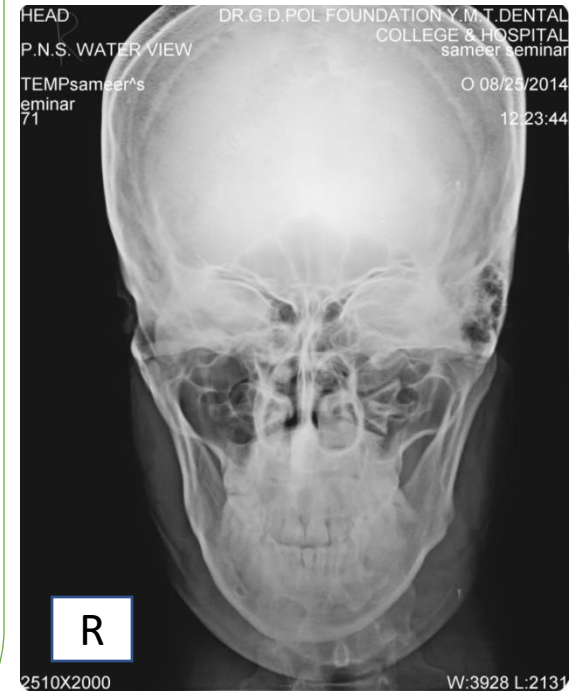
- It is directed to the midline of the skull so that the X-ray beam passes through the canthomeatal plane perpendicular to the film plane.



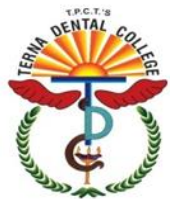
Exposure parameters

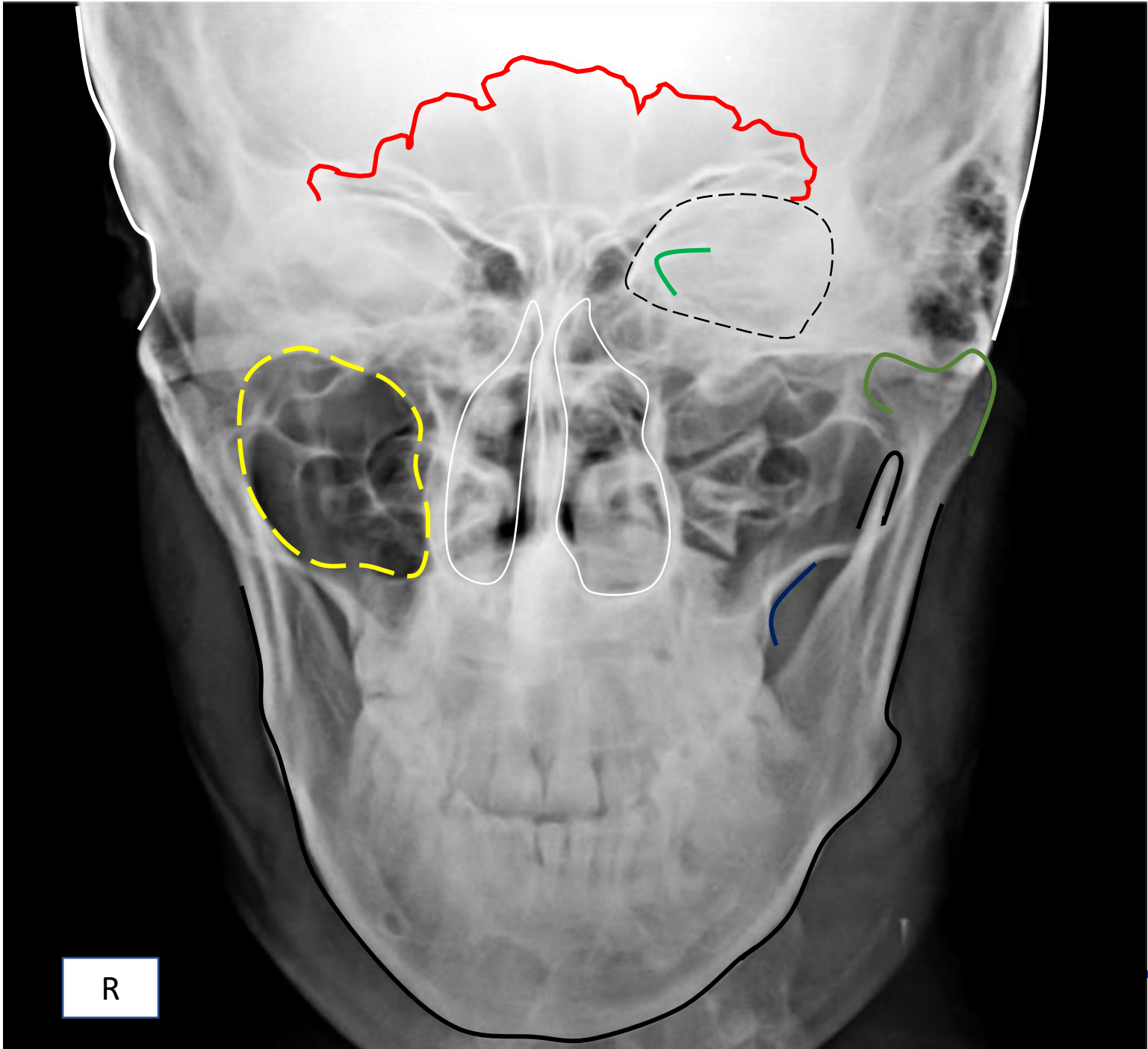
Resultant **image**

- Frontal sinuses should lie above the frontonasal suture.
- anterior ethmoidal cells should lie each on either side of the nasal fossa.
- sphenoidal sinuses should project through the nasal fossa just below or between the shadows of the ethmoids



ANATOMICAL LANDMARKS





R

INDICATIONS

- **To study the relationship of the sinuses to each other and to the surrounding structures.**
- **Evaluating the inner and middle ear.**

**MODIFIED METHOD, INCLINED
POSTERIOR ANTERIOR
(CALDWELL PROJECTION)**

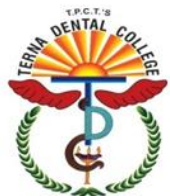
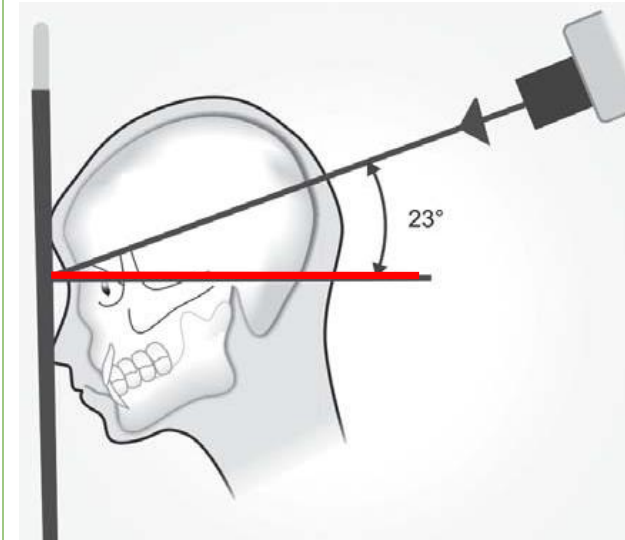


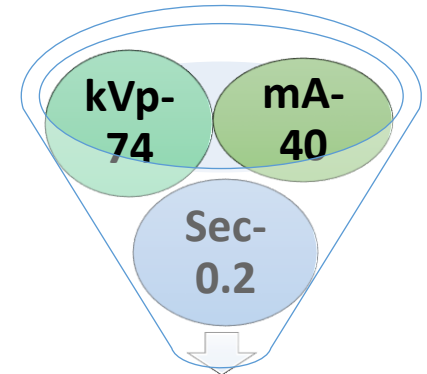
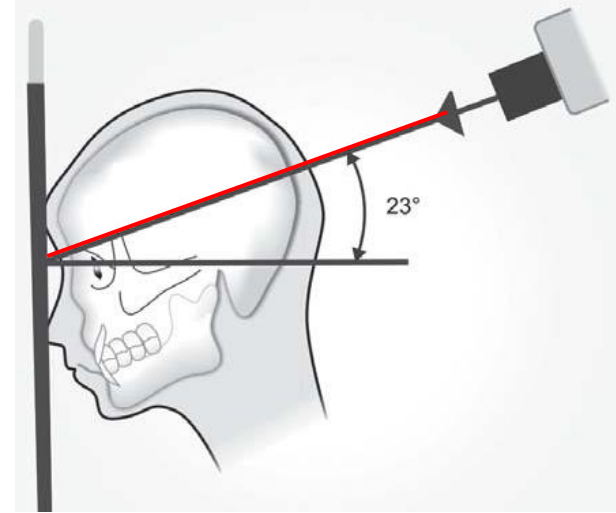
Image receptor and patient placement

- The cassette is placed perpendicular to the floor in a cassette holding device.
- The midsagittal plane should be vertical and perpendicular to the plane of the cassette.
- Only the forehead and nose should touch the cassette such that the canthomeatal line is perpendicular to the cassette



Position of the central x- ray beam

- It is directed 23° to the canthomeatal line, entering the skull about 3 cm above the external occipital protuberance and exiting at the glabella .



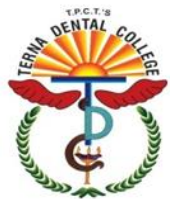
Exposure parameters

Resultant image

- The superior border of the petrous ridge should be projected in the lower third of the orbit.



ANATOMICAL LANDMARKS

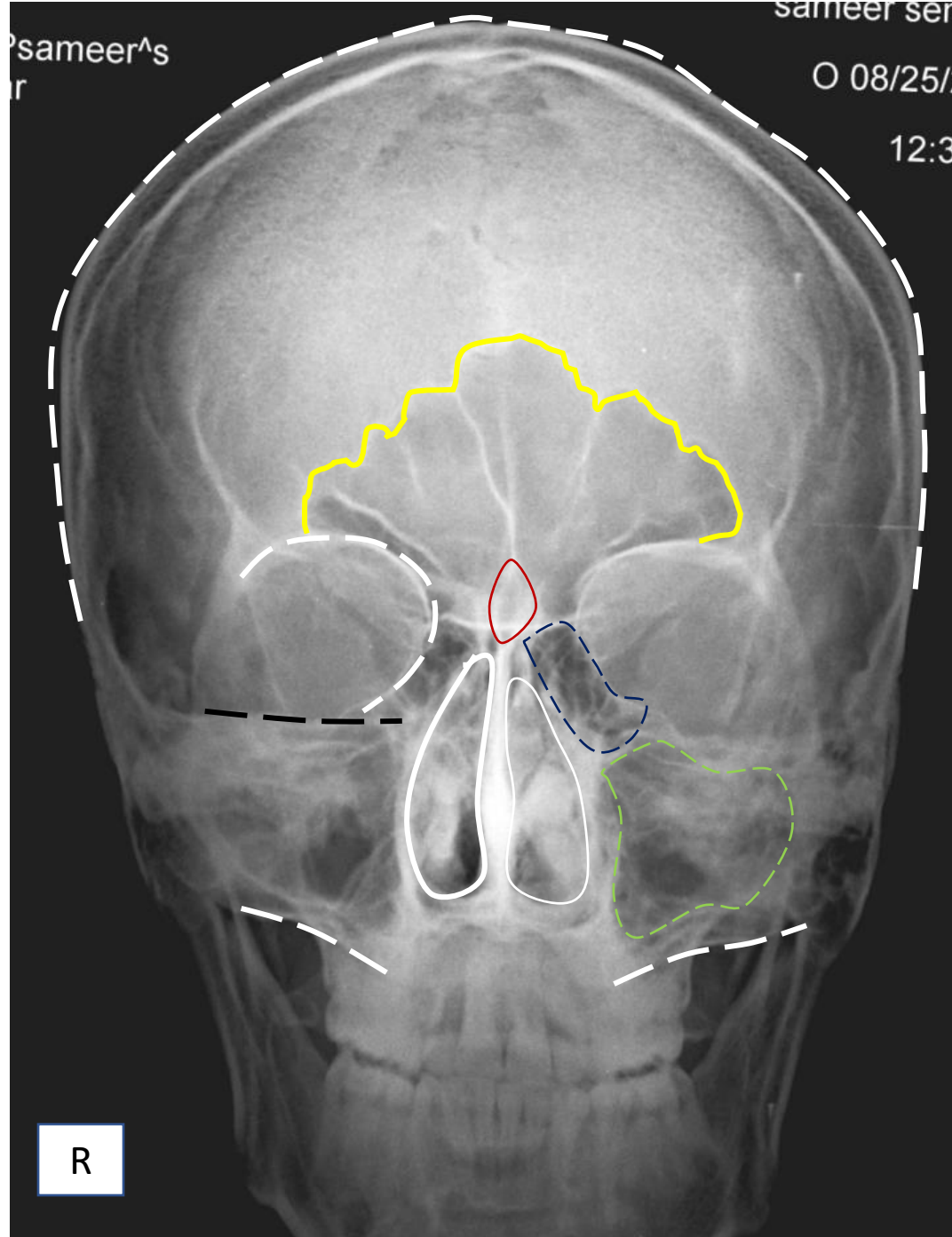


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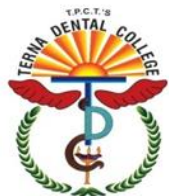
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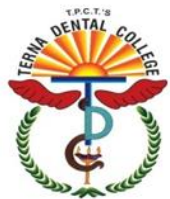


R



INDICATIONS

- To allow more accurate examination of the orbits and ethmoidal air cells.



Radiography of Base of the Skull- Submento Vertex projection

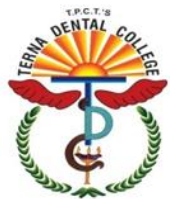
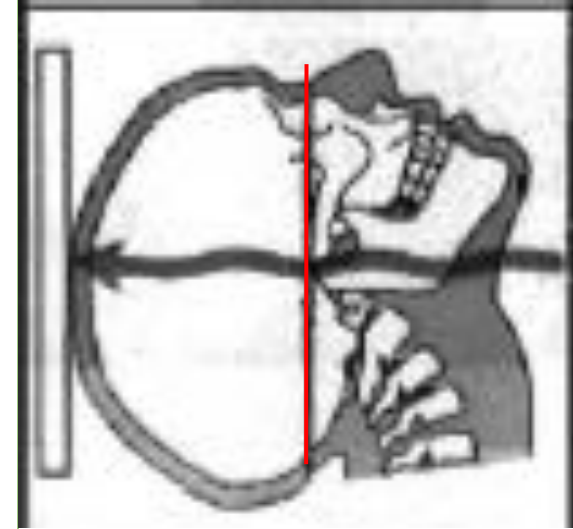


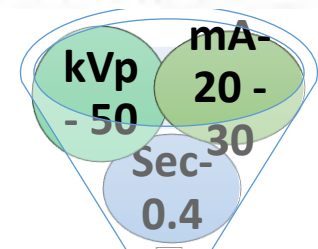
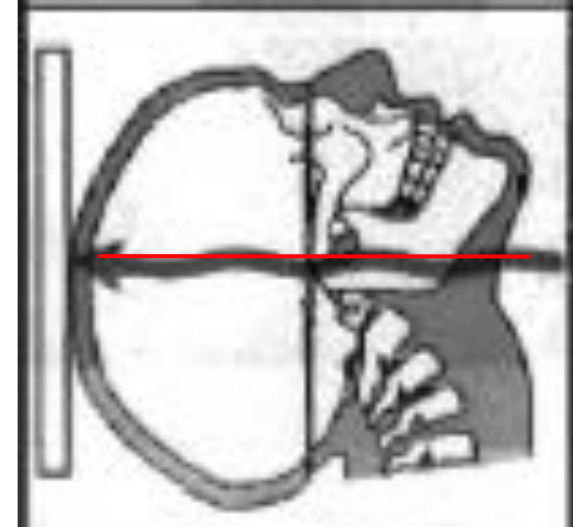
Image receptor and patient placement

- The image receptor is positioned parallel to patient's transverse plane and perpendicular to the midsagittal and coronal plane.
- To achieve this, the patient's neck is extended as far backward as possible with the canthomeatal line forming a 10-degree angle with the image receptor.



Position of the central x-ray beam

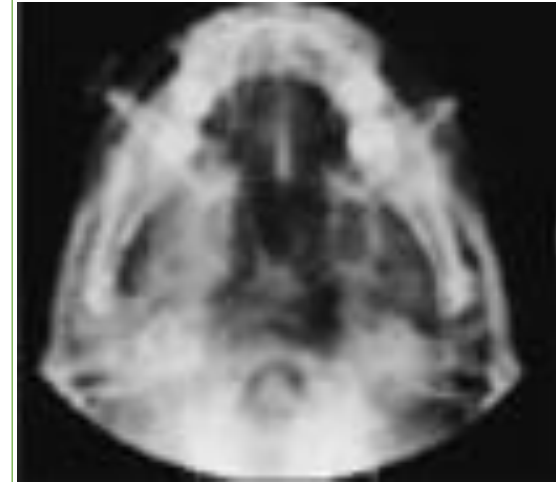
- The central beam is perpendicular to the image receptor, directed from below the mandible towards the vertex of the skull (hence the name) and centred about 2cm anterior to a line connecting the right and left condyles.



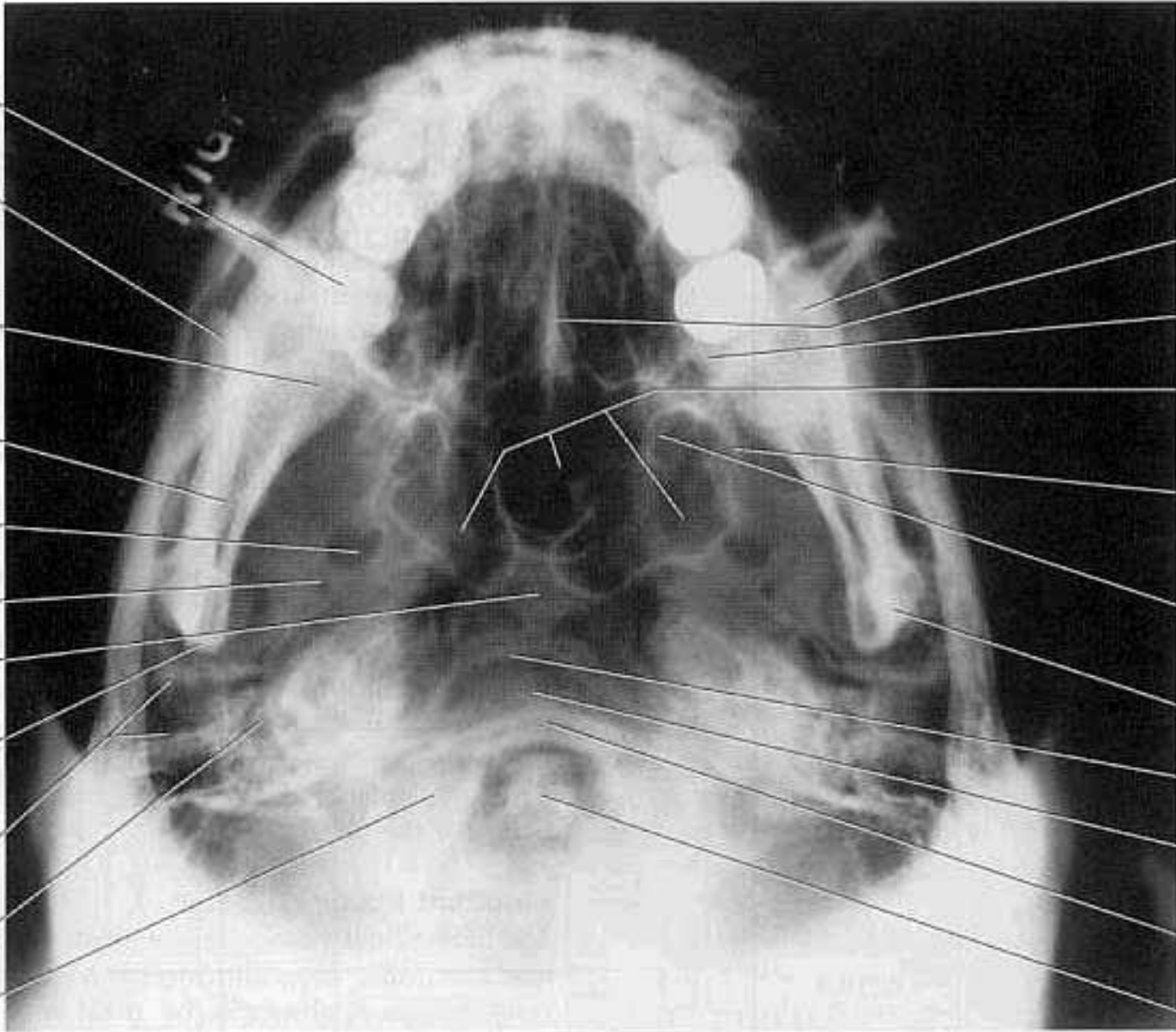
Exposure
parameters

Resultant **image**

- The midsagittal plane (represented by an imaginary line extending from the interproximal space of the maxillary central incisors through the nasal septum, to the middle of the anterior arch of the atlas, and to the dens) should divide the skull image in two symmetric halves.
- The buccal and lingual cortical plates of the mandible should be projected as uniform opaque lines.
- An underexposed view is required for the evaluation of the zygomatic arches as they will be overexposed or "burned out" on radiographs obtained with normal exposure factors.



Posterior wall of maxillary sinus
 Coronoid process of mandible
 Anterior wall of middle cranial fossa
 Ramus of mandible
 Foramen ovale
 Foramen spinosum
 Clivus
 Mandibular angle
 External auditory meatus
 Ossicles
 Occipital condyle

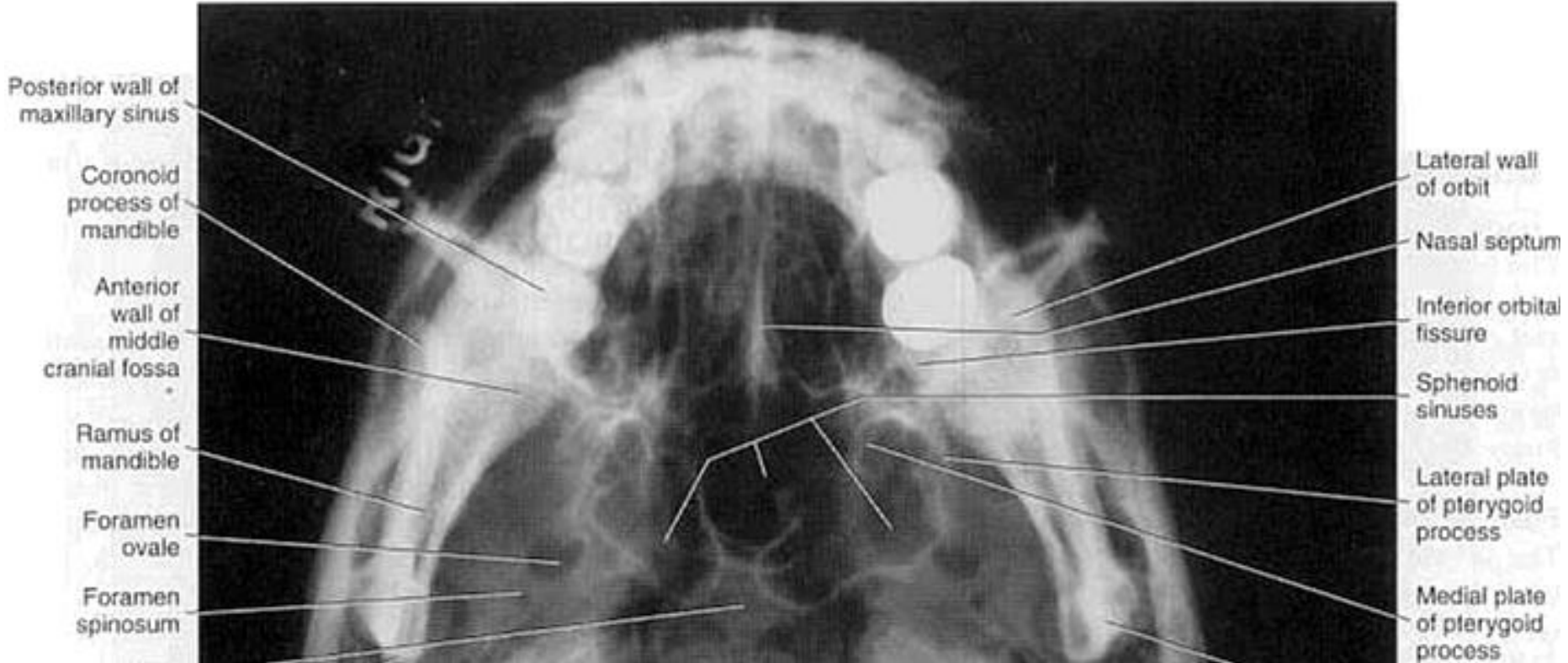


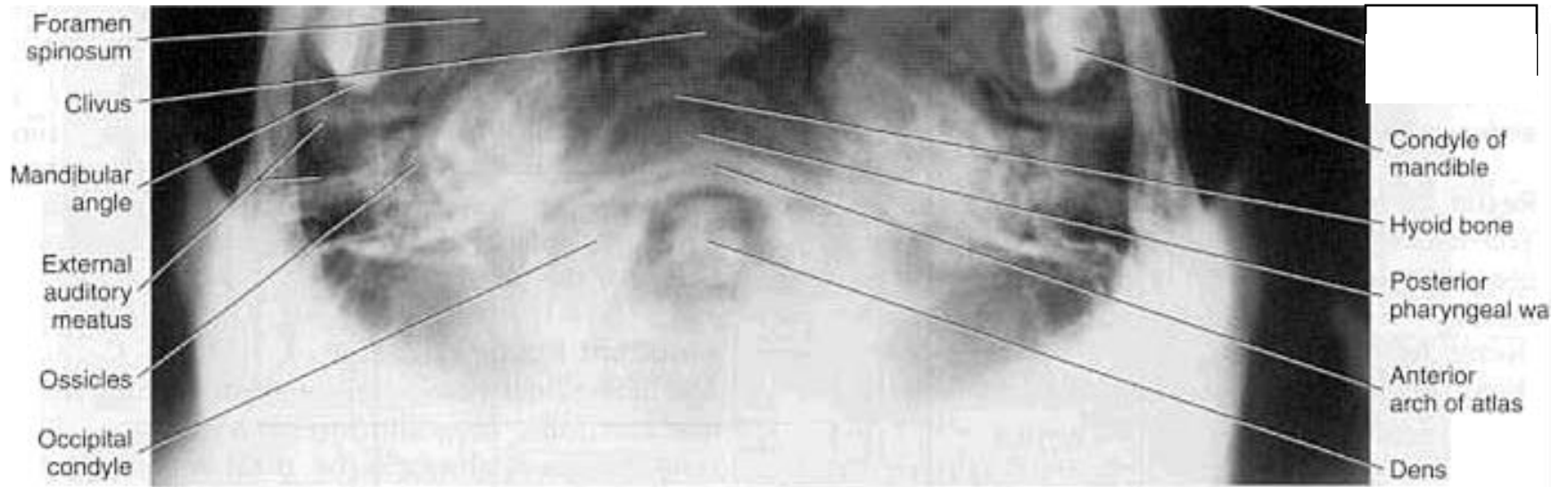
Lateral wall of orbit
 Nasal septum
 Inferior orbital fissure
 Sphenoid sinuses
 Lateral plate of pterygoid process
 Medial plate of pterygoid process
 Condyle of mandible
 Hyoid bone
 Posterior pharyngeal wall
 Anterior arch of atlas
 Dens



ANATOMICAL LANDMARKS

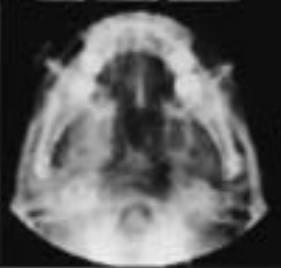






Canthomeatal
line
parallel to film

Beam
perpendicular
to film



RADIOGRAPHY OF THE ZYGOMATIC ARCHES

1. Jug Handle View
(A Modification of
the
Submentovertex
View)



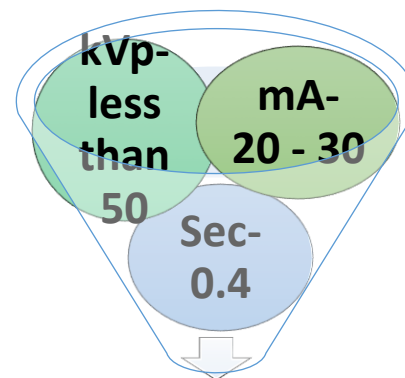
Image receptor and patient placement-
same as that of SMV

Central Ray

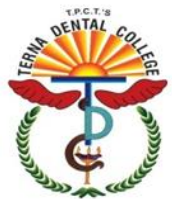
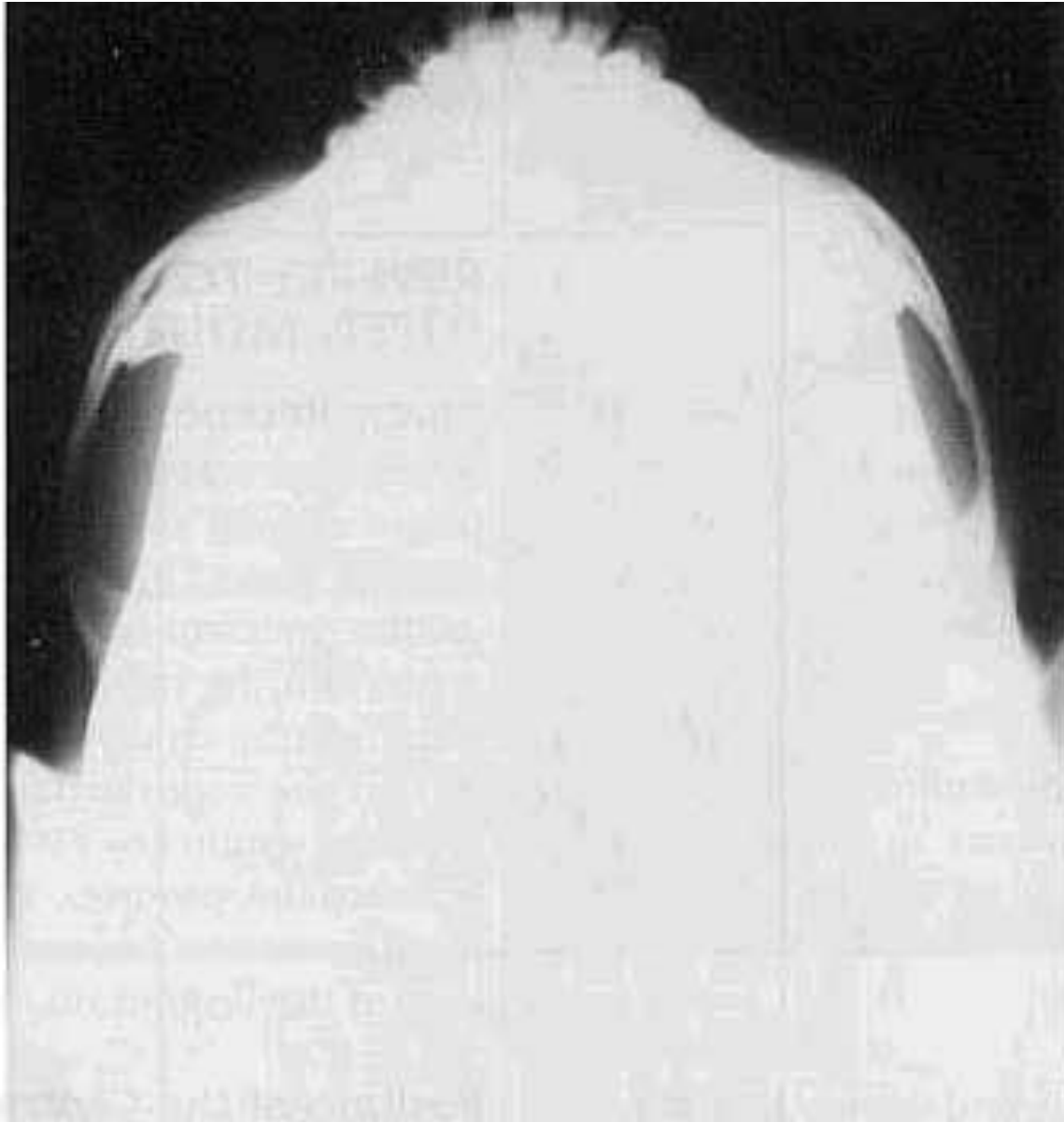
- The cone is brought as close as possible to the patient (which leads to magnification of the structures at the base of the skull).

Exposure Parameters

- The exposure time for the zygomatic arch is reduced to approximately one-third the normal exposure time for a submentovertex projection.

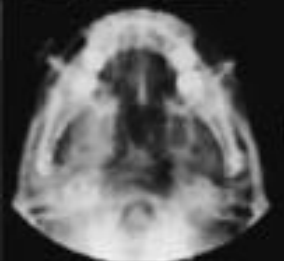
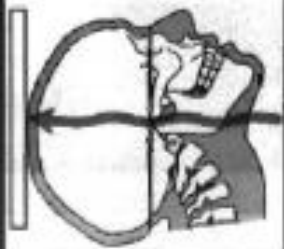


Exposure parameters



Canthomeatal
line
parallel to film

Beam
perpendicular
to film



INDICATIONS

- **Destructive/expansive lesions affecting the palate, pterygoid region or base of skull**
- **Investigation of the sphenoidal sinus**
- **Assessment of the thickness (medio-lateral) of the posterior part of the mandible before osteotomy**
- **Fracture of the zygomatic arches**

Radiography of the Mandible

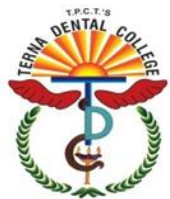
1. PA Mandible

2. Rotated PA Mandible

3. Lateral Oblique-

A. Body of mandible

B. Ramus of mandible



PA MANDIBLE PROJECTION

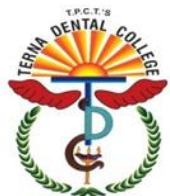
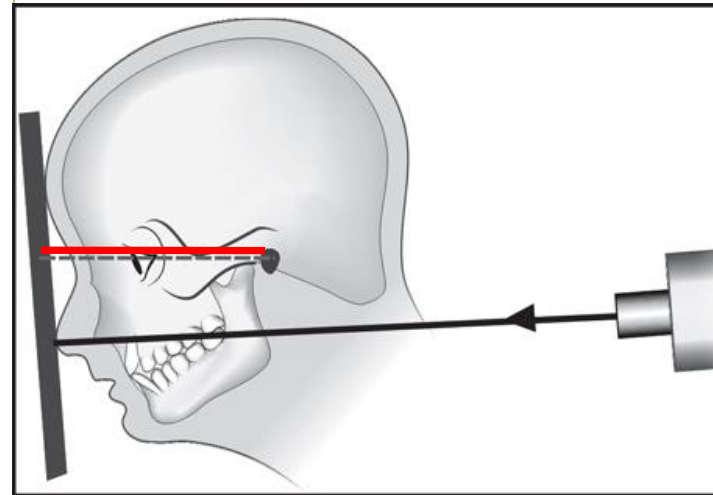


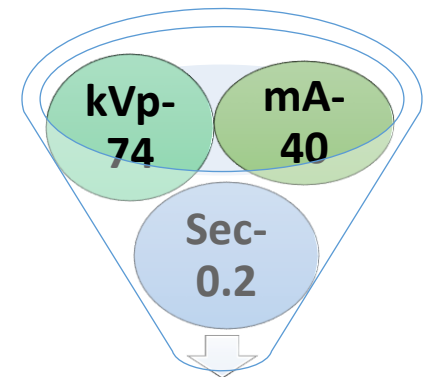
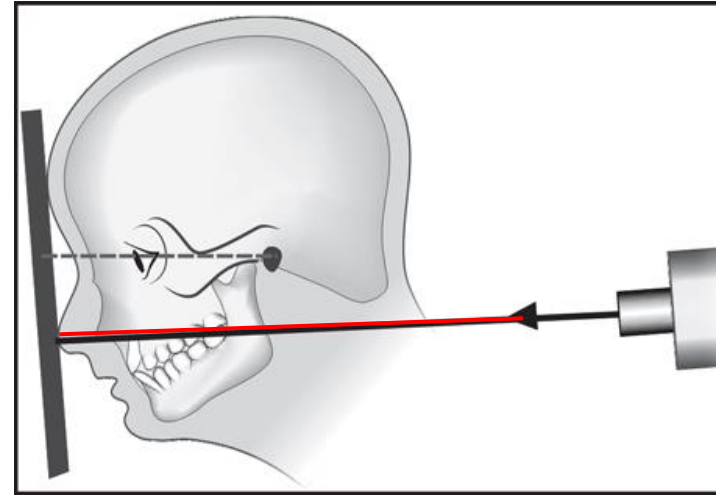
Image receptor and patient placement

- The cassette is placed parallel to the floor in a cassette holding device vertically.
- The sagittal plane should be vertical and perpendicular to the film.
- The head is tipped downwards so that the forehead and nose touch the film.
- The radiographic base line is horizontal and perpendicular to the film.



**Position
of the
central
x-ray
beam**

- The X-ray tubehead is again horizontal (0°).
- The central ray is centred through the cervical spine at the level of the rami of the mandible perpendicular to the film.



Exposure parameters

Resultant image

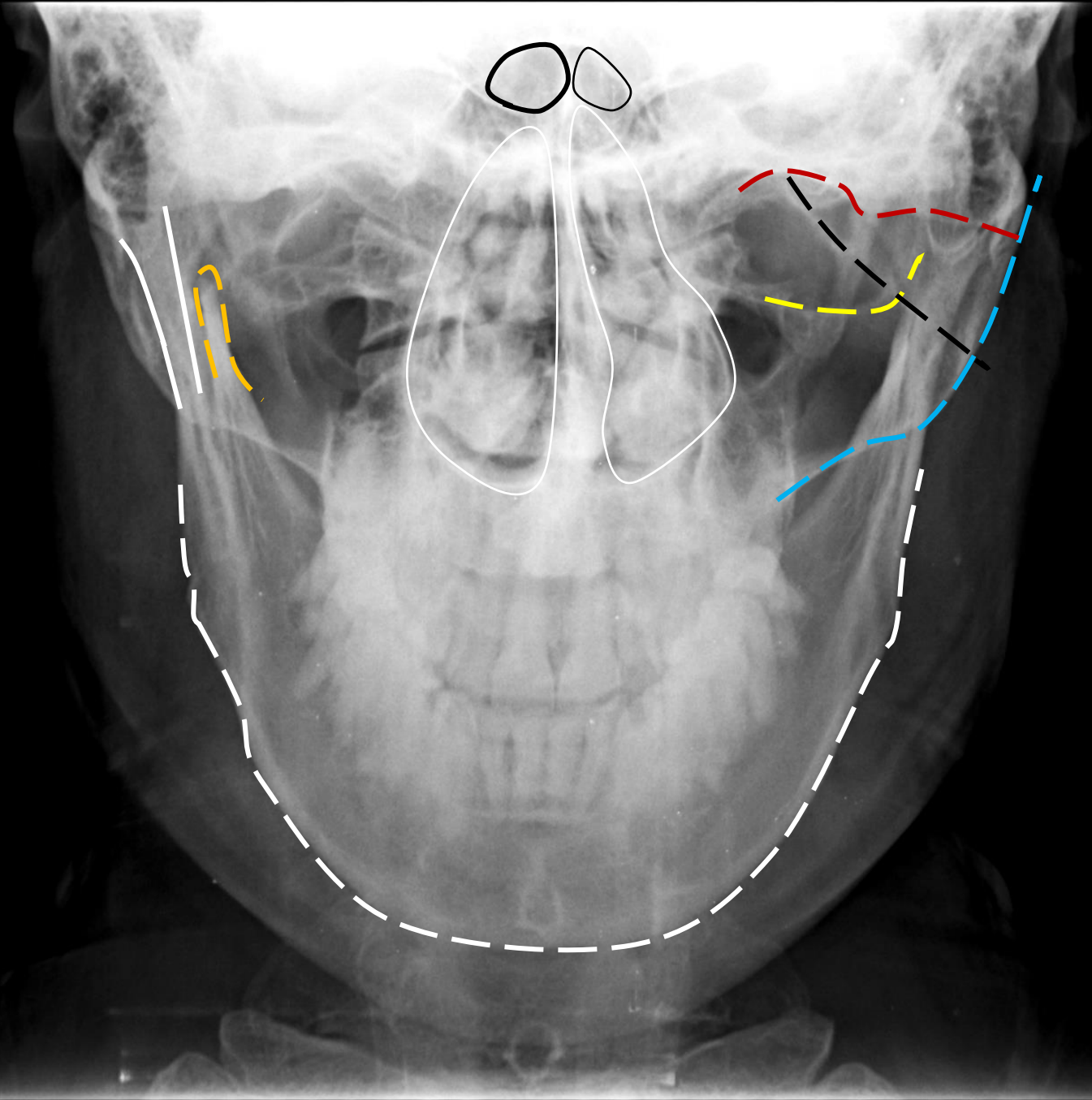
- The midsagittal plane should divide the skull image in two symmetric halves.



ANATOMICAL LANDMARKS



R



INDICATIONS

- **Fractures of the mandible involving the following sites:**
 - **Posterior third of the body**
 - **Angles**
 - **rami**
 - **Low condylar necks**
- **Lesions such as cysts or tumours in the posterior third of the body or rami to note any medio-lateral expansion.**
- **Mandibular hypoplasia or hyperplasia**
- **Maxillofacial deformities.**



ROTATED PA MANDIBULAR PROJECTION

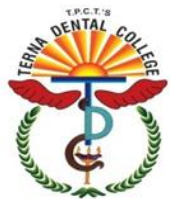
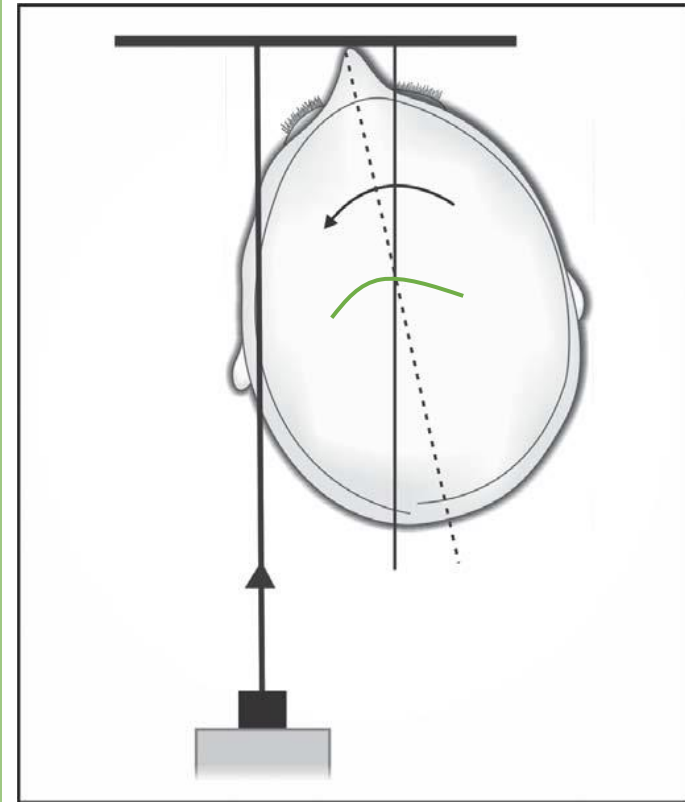


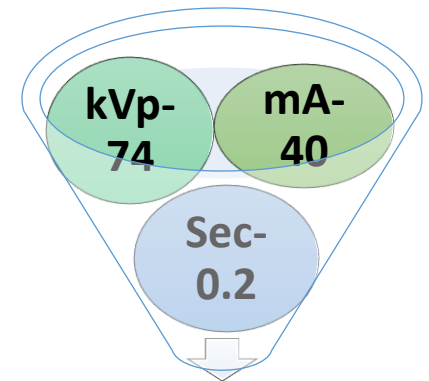
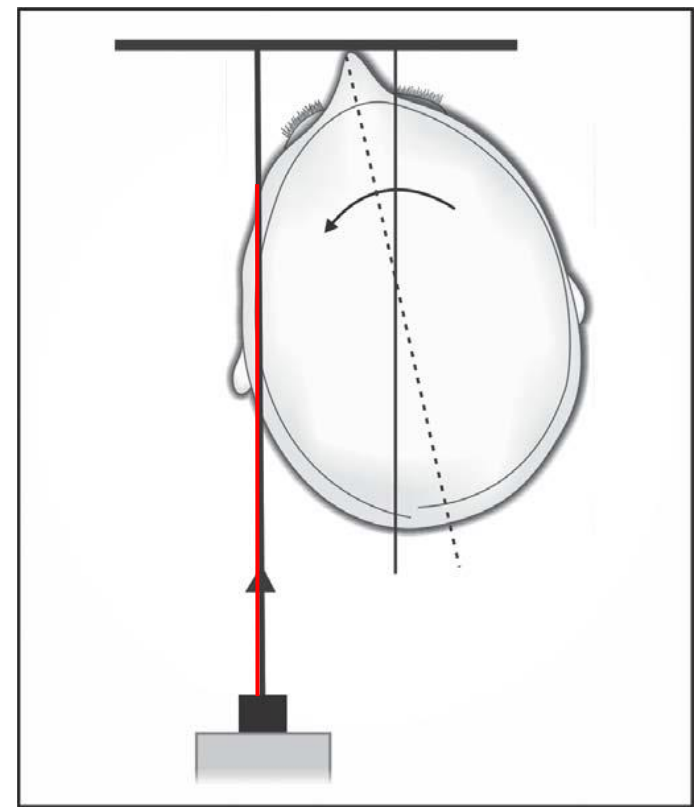
Image receptor and patient placement

- The cassette is placed parallel to the floor in a cassette holding device vertically.
- The patient is positioned facing the film, with the occlusal plane horizontal and the tip of the nose touching the film in the so-called normal head position.
- The head is then rotated 10° to the side of interest. This positioning rotates the bones of the back of the skull away from the side of the face under investigation.



Position of the central x-ray beam

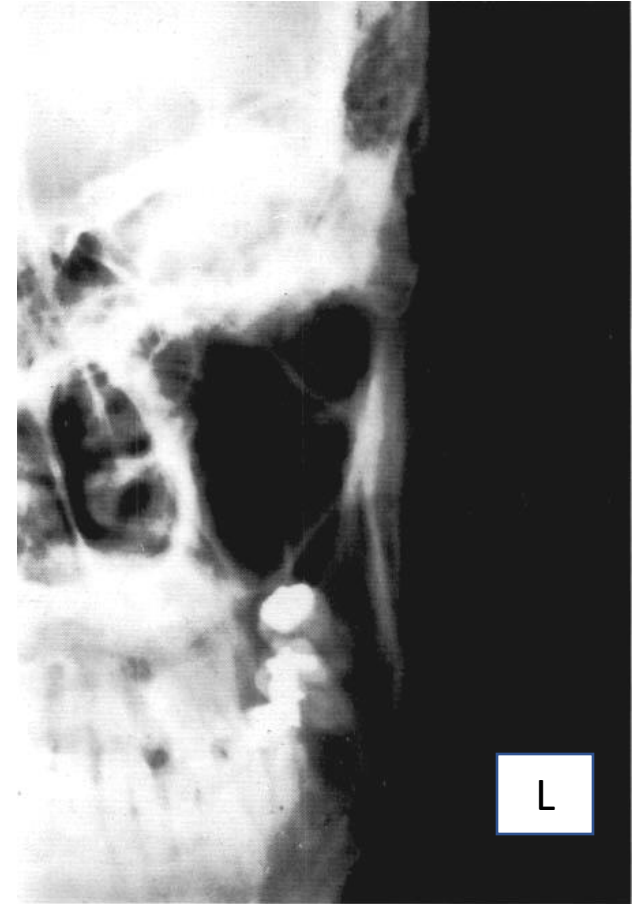
- The X-ray tubehead is positioned with the central ray horizontal (0°).
- It is directed at right angles to the film, aimed down the side of the face which is of interest.



Exposure parameters

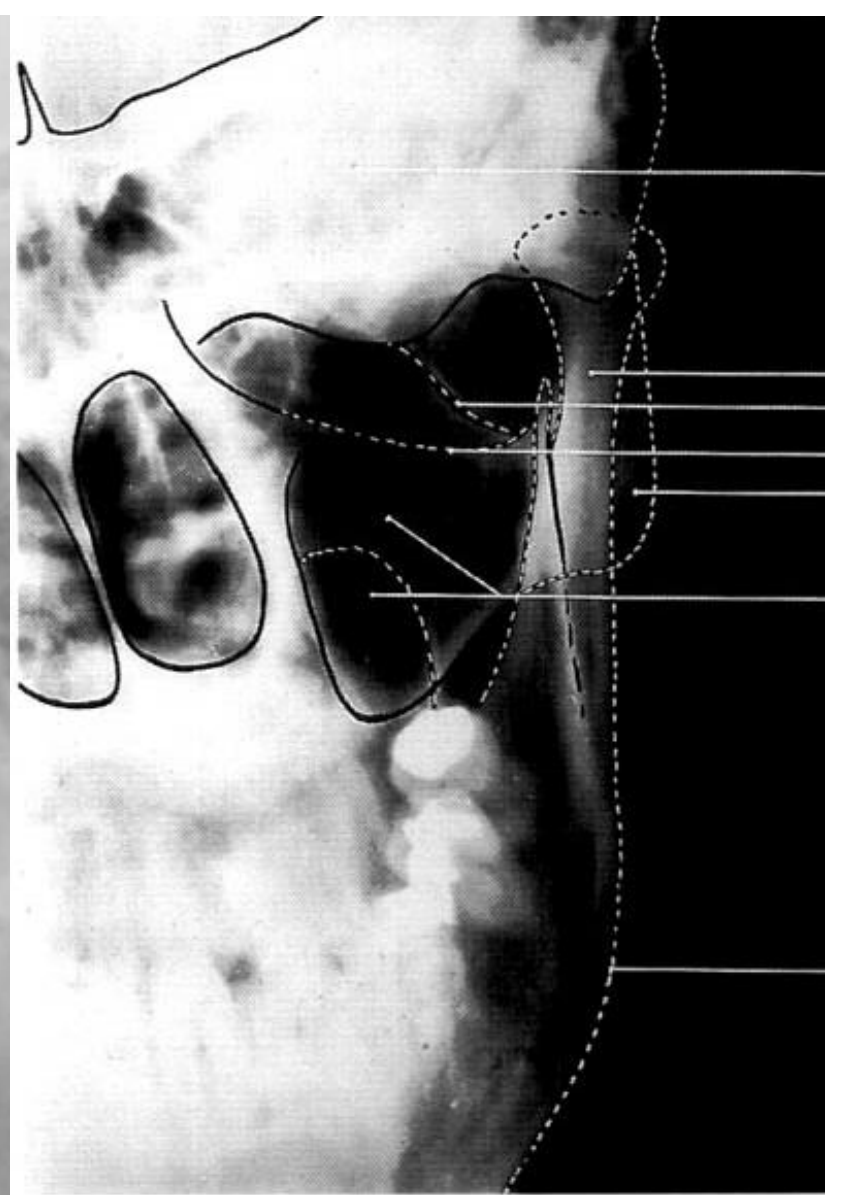
Resultant image

- It should show the tissues of one side of the face.



ANATOMICAL LANDMARKS





INDICATIONS

- **Stones/calculi in the parotid glands.**
- **Lesions such as cysts or tumours in the ramus to note any medio-lateral expansion.**
- **Submasseteric infection — to note new bone formation.**

Film in contact
with cheek at
molar area

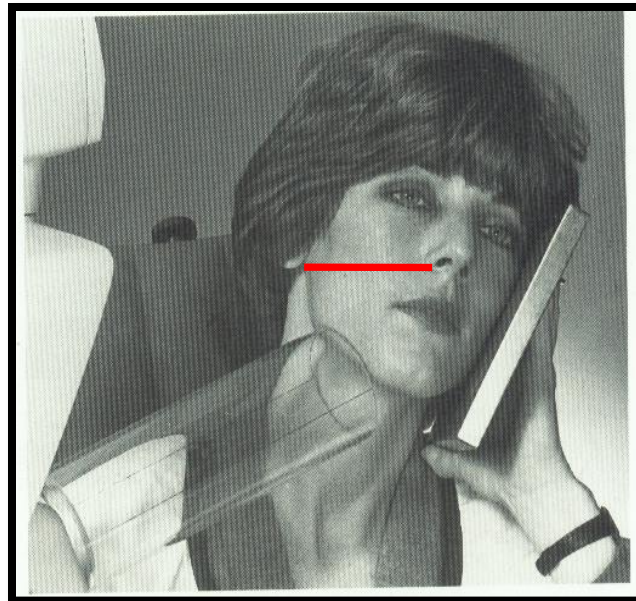
Beam aims at
the molar-
premolar area



LATERAL OBLIQUE MANDIBLE PROJECTION (BODY VIEW)

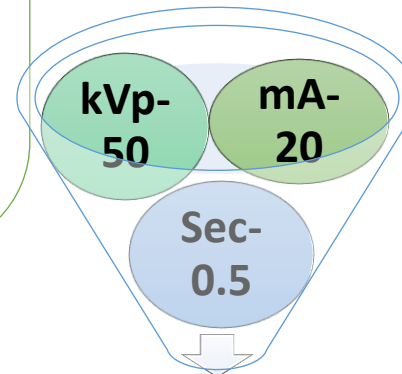
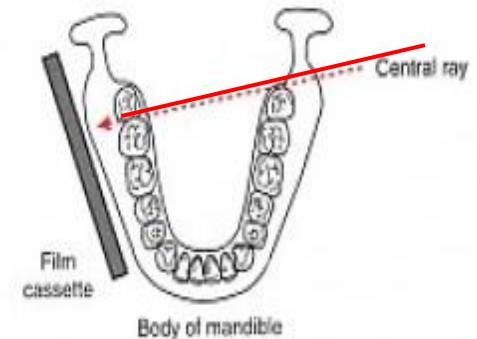
Image receptor **and patient** **placement**

- The cassette is placed against the patient's cheek on the side of interest and is centred over the body of mandible.
- The cassette should be parallel to the body of mandible and atleast 2 cm below inferior border of mandible.
- The head is tilted towards the side being examined such that the ala tragus line should be parallel to the floor.
- The mandible is protruded slightly to separate it from the vertebral column.



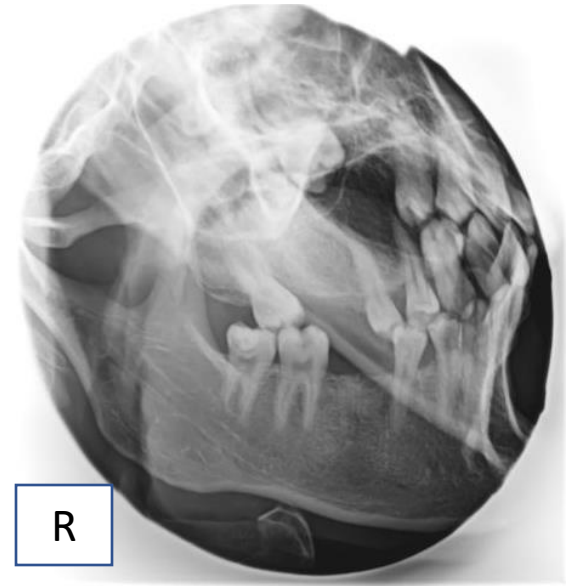
Position of the central x- ray beam

- The beam should be centred on the body of mandible (-10 to -15 degree).
- The beam is directed from a point 2cm below the angle of mandible of the opposite side.
- The beam must be directed perpendicular to the horizontal plane of the film.

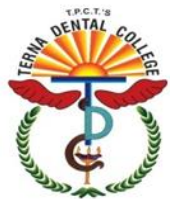


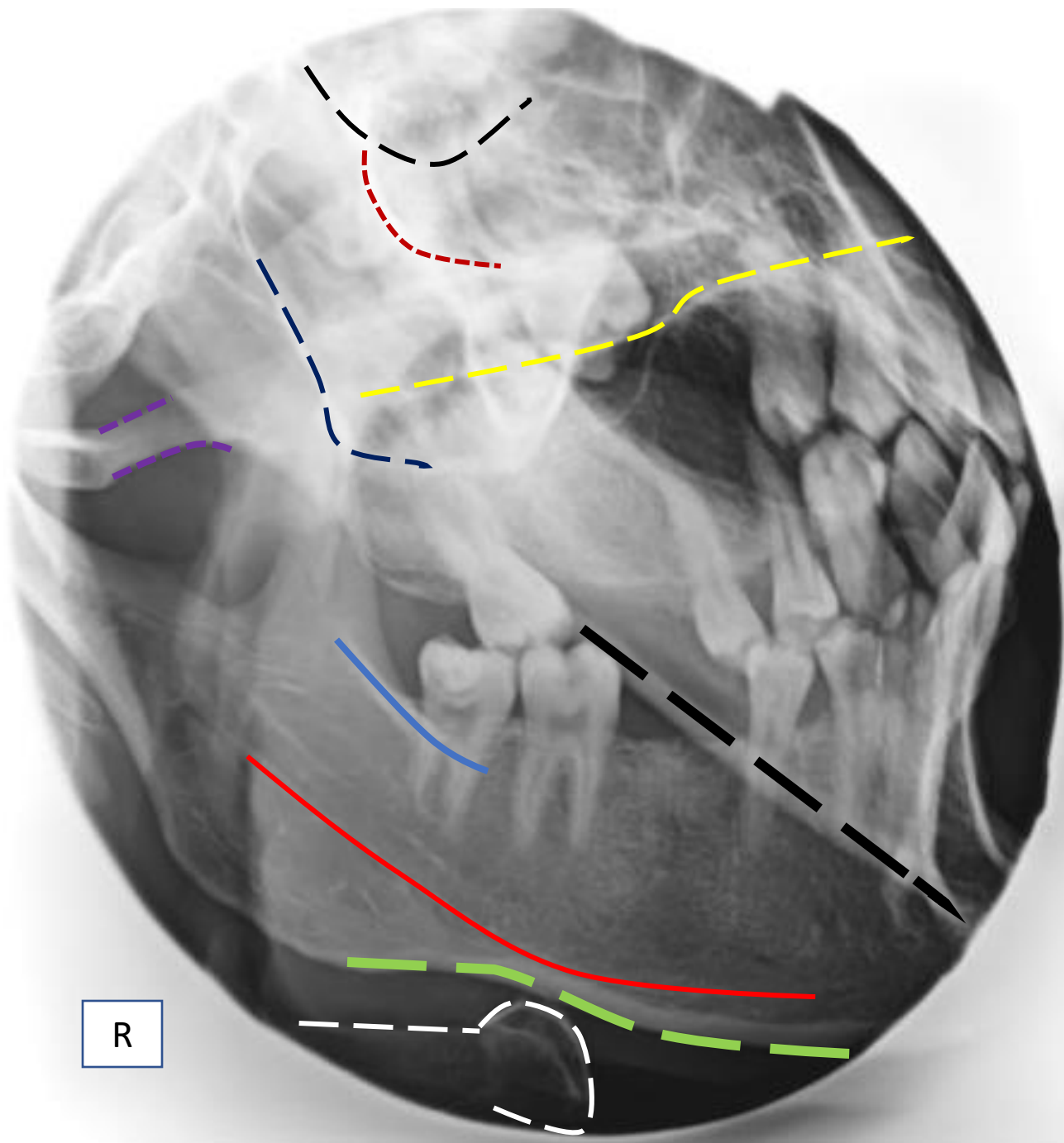
Resultant image

- A clear image of the teeth, the alveolar ridge, and the body of the mandible should be obtained.
- If significant distortion is present, the head was tilted excessively.
- If the contralateral side of the mandible is superimposed over the area of interest, the head was not tilted sufficiently.



ANATOMICAL LANDMARKS





R

Film in contact
with cheek at
molar area

Beam aims at
the molar-
premolar area



INDICATIONS

- To evaluate impacted teeth.
- To evaluate position of teeth, fractures and lesions located in the body of the mandible, ramus of the mandible and angle of the mandible.
- Fractures and lesions located in the inferior border of the mandible.

LATERAL OBLIQUE MANDIBLE PROJECTION (RAMUS VIEW)

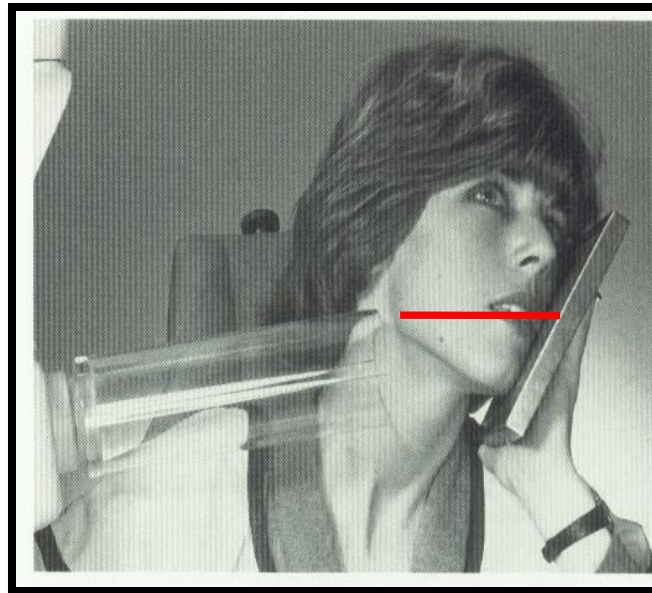
Film in contact
with cheek at
ramus area

Beam aims at
the ramus
area



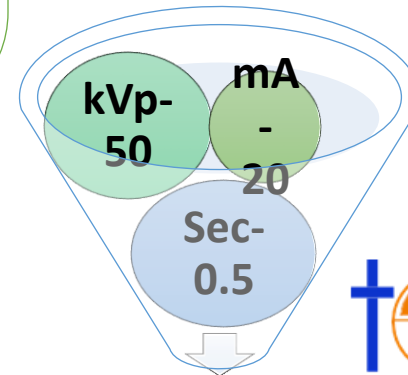
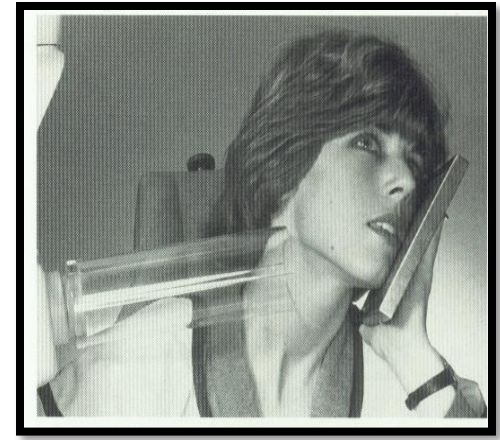
Image receptor **and patient** **placement**

- The cassette is placed over the ramus and more posteriorly to include the condyle on the side of interest.
- The cassette should be parallel to the body of mandible and atleast 2 cm below inferior border of mandible.
- The head is tilted towards the side being examined such that the condyle of the area of interest and the contralateral angle of the mandible form a horizontal line.
- The mandible is protruded slightly to separate it from the vertebral column.



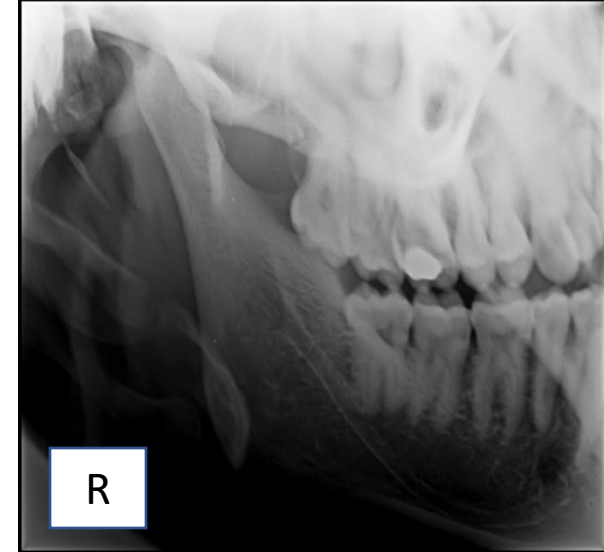
Position of the central x-ray beam

- The beam should be centred on the ramus of mandible (-10 to -15 degree).
- The central beam is directed 2 cm below the inferior border of the opposite side of the mandible at the area of the first molar.

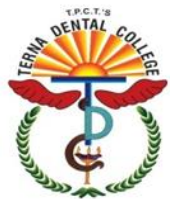


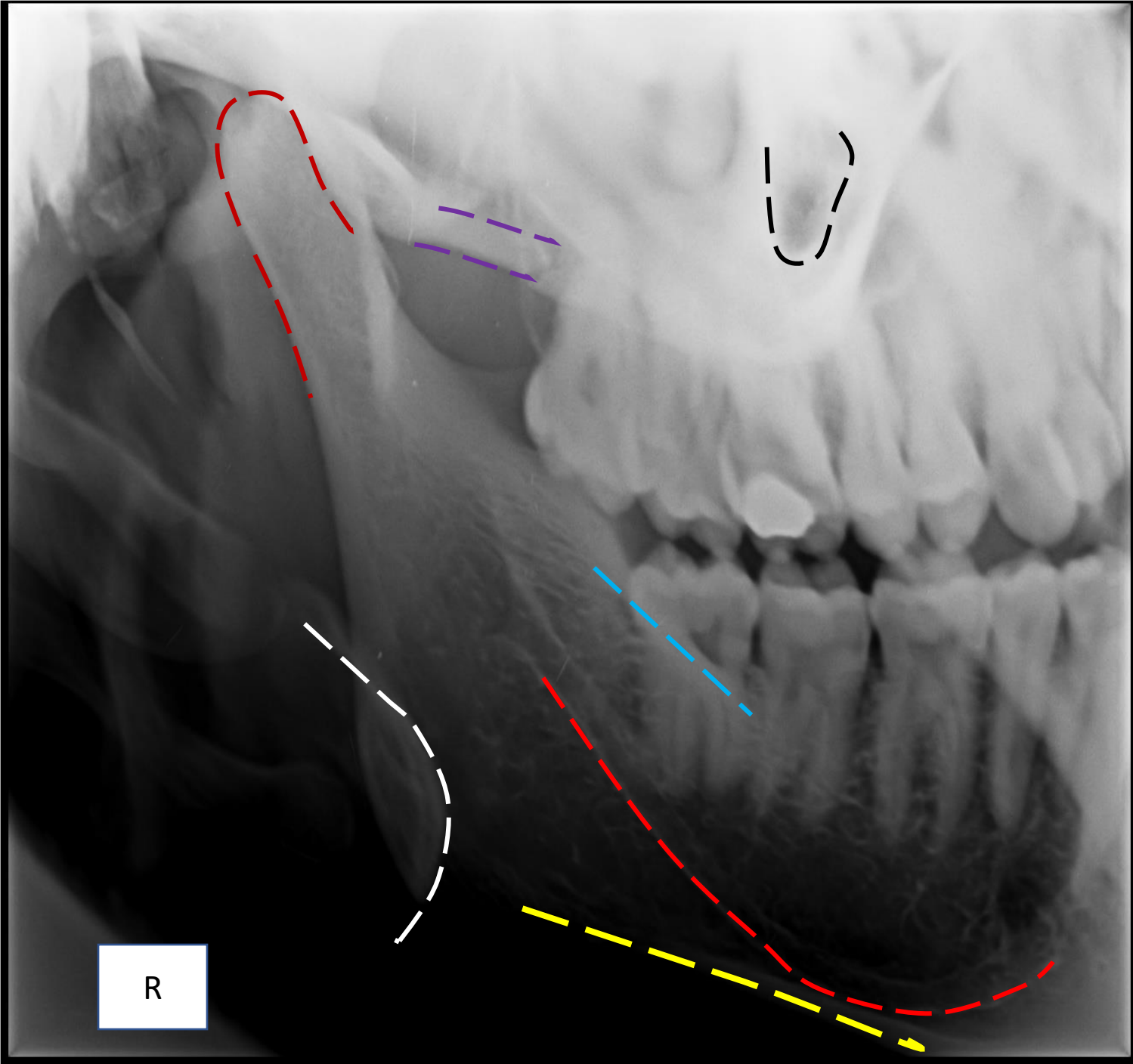
Resultant image

- A clear image of the third molar-retromolar area, angle of the mandible, ramus, and condyle head should be obtained.
- If significant distortion is present, the head was tilted excessively.
- If the contralateral side of the mandible is superimposed over the area of interest, the head was not tilted sufficiently.



ANATOMICAL LANDMARKS





R

Film in contact
with cheek at
ramus area

Beam aims at
the ramus
area

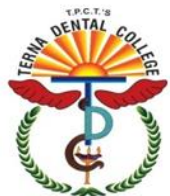


INDICATIONS

- To evaluate impacted third molars, large lesions, fractures that extend into the ramus of the mandible.
- **This projection demonstrates a view of the ramus from the angle of the mandible to the condyles.**

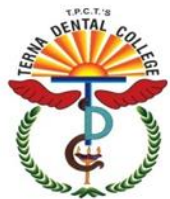
CONCLUSION

- Even though conventional intraoral radiography has been used widely in dental field, sometimes there are problems in taking the radiographs in pediatric patients, disabled patients, obtaining radiographs in endodontics.
- Further standardization of this technique is recommended for superior image quality.
- All these radiographic techniques are essential, but appropriate usage of the right technique at the right time to an particular condition becomes vital to the clinician to arrive at a specific diagnosis and the treatment plan.



TAKE HOME MESSAGE

- The extra oral techniques are not meant to replace conventional intraoral radiography, however it can be used for replacing intraoral periapical radiography when intraoral film is difficult to place in patient's mouth.



Probable SAQ's & LAQ's

SAQ's

- Indications of Extra Oral Radiography
- Drawbacks of Extra oral radiography.
- PA Cephalogram
- PA Skull
- Jug Handle View
- PA Mandible
- Submento Vertex Projection

LAQ's

- Explain extra oral radiography. Write a detailed note on skull radiography with their indications of use.
- Explain the views needed to visualize lesions of the mandible.

