**Extraoral radiography**

**Introduction:**
Extraoral radiographs (outside the mouth) are taken when large areas of the skull or jaw must be examined or when patients are unable to open their mouths for film placement. Extraoral radiographs do not show the details as well as intraoral films. Extraoral radiographs are very useful for evaluating large areas of the skull and jaws but are not adequate for detection of subtle changes such as the early stages of dental caries or periodontal disease. There are many type of extraoral radiographs, some types are used to view the entire skull, whereas other types focus on the maxilla and mandible. It makes use of intensifying screens. Cephalometric 8*10 inches image receptor, whereas oblique lateral projections of the mandible can be obtained with 5*7 inch.

**Skull views:**
1. Lateral cephalometric projection
2. Posteroanterior projection
3. Water's projection
4. Submentovertex projection
5. Reverse Towne's projection

**Main indications:**
- Fractures of maxillofacial skeleton
- Fractures of the skull
- Investigation of the antra
- Diseases affecting the skull base and vault
- TMJ disorders

**True lateral skull**
This projection shows the skull vault and facial skeleton from the lateral aspects. The main difference between the true lateral skull and the true cephalometric lateral skull is that the true lateral skull is not standardized or reproducible. This is used when a single lateral view of the skull is required but not in orthodontics or growth studies.

The image receptor is positioned parallel to the patient's midsagittal plane. The site of interest is placed toward the image receptor to minimize distortion. The film is adjusted so that the upper circumference of the skull is half inch below the upper border of the cassette. The central ray is directed perpendicular to the cassette and the midsagittal plane and towards the eternal auditory meatus.

**Indications:**
- Fractures of the cranium and the cranial ase
- Middle third facial fractures, to show possible downward and backward displacement of maxilla
- Investigation of the frontal, sphenoidal and maxillary sineses.
- Condition affecting the skull vault:
  - Paget's disease
  - Multiple myeloma
  - hyperparathyroidism
- Conditions affecting the sella turcica, as tumor of pituitary gland in acromegaly

**Postero-anterior of the skull (PA skull):**
This projection shows the skull vault, primarily the frontal bones and the jaws.
The image receptor is placed in front of the patient, perpendicular to the mid sagittal plane and parallel to coronal plan, so that the canthomeatal line is perpendicular to the image receptor. Central ray is directed at right angles to the film through the mid sagittal plane through the occiput.

Indications:

- Fractures of the skull vault.
- Investigation of the frontal sinuses.
- Conditions affecting the cranium:
  - Paget's disease
  - Multiple myeloma
  - Hyperparathyroidism
- Intracranial calcifications.

Towne's view (anteroposterior view):
It is primarily used to observe the occipital area of skull. The necks of the condylar process can also be viewed.

Submento-verte (SMV): This projection shows the base of the skull, sphenoidal. Sinuses and facial skeleton from below.
The image receptor is positioned parallel to patient's transverse plane and perpendicular to the mid sagittal and coronal planes. To achieve this, the patient's neck is extended as far backward as possible, with the canthomeatal line forming a 10° angle with the receptor. The central beam is perpendicular to the image receptor, directed from below the mandible toward the vertex of the skull, and centered about 2 cms anterior to a line connecting the right and left condyles.
The indications:

- Destructive/ expensive lesions affecting the palate, pterygoid region or base of skull.
- Investigation of the sphenoid sinus.
- Assessment of the thickness (medio-lateral) of the posterior part of the mandible before osteotomy.
- Fracture of the zygomatic arches, to show these thin bones the SMV is taken with reduced exposure factors.

Jug handle view:
Same as that in submentovertex, the exposure time for the zygomatic arch is reduced to approximately onethird the normal exposure time for SMV projection.

Projections for mandible
Lateral oblique projection:
Two views for mandibular projection:
1. Body projection: for demonstration premolar-molar region and inferior border of the body of the mandible. Head tilted to the side to be examined with the mandible protruded. Film is placed against the patient's cheek and centered over the first molar. The lower border of the cassette should be parallel to the inferior border of the mandible and at least 2cm below it. The X-ray tube 2cm below angle of the mandible directed toward the first molar region of cassette side.
Indications:
- Position of impacted third molars
- Fractures of the ramus, condyle, or body of the mandible (but not symphysis)

2. Lateral oblique (ramus of mandible), lateral ramus view, or mandibular ramus projection: to view the ramus from the mandibular angle to the condyle for examining the third molar region of both the maxilla and mandible. Head tilted towards the projected mandible where the mandibular angle to tube side and condyle of cassette side parallel to the floor. Film is placed over the ramus of the mandible to the far posterior to include the condyle. Lower border of the cassette 2cm below the inferior border of the mandible. The tube 2cm below the inferior border of the first molar region on the tube side toward the center of the ramus of the cassette side.

Postero-anterior of the jaws (PA jaws or PA mandible)
This projection shows the posterior parts of the mandible. It is not suitable for showing the facial skeleton because of superimposition of the base of the skull and the nasal bones.

The indications:
- Fractures of the mandible involving the following sites:
  - Posterior third of the body
  - Angles
  - Rami
  - Low condylar neck
- Lesions such as cysts or tumors in the posterior third of the body or rami to note any medio-lateral expansion
- Mandibular hypoplasia or hyperplasia
- Maxillofacial deformities

The cassette is placed in front of the patient, so that the median sagittal plane should be perpendicular to the cassette. The head is then adjusted to bring the orbito-meatal baseline perpendicular to the cassette. The cassette should be positioned such that the middle of cassette is centered at the level of the angles of the mandible. The central ray is directed perpendicular to the cassette and centered in the midline at the levels of the angles of the mandible.

Projections for maxillary sins
Standard occipitomental (0° OM)
This projection shows the facial skeleton and maxillary antrum, and avoid superimposition of the dense bones of the base of the skull.

The main clinical indications include:
- Investigation of maxillary sinus
- Detecting the following middle third facial fractures:
  - Le fort I
  - Le fort II
  - Le fort III
  - Zygomatic complex
  - Naso-ethmoidal complex
  - Orbital blow-out
- Coronoid process fractures
- Investigation of the frontal and ethmoidal sinuses
Investigation of the sphenoidal sinus when the patient's mouth open

The patient is positioned facing the film with the head tipped back so the radiographic baseline is at 45° to the film, the so calle nose-chin position. This positioning drops the dense of the base of the skull downwards and raises the facial bones so they can e seen. The -ray tube head is positioned wit the central ray horizontal (0°) centered through the occiput.

30° occipitomental (30° MO)

This projection also shows the facial skeleton, but from a different angle from the o°OM, enabling certain bony displacements to be detected.

The main clinical indications include:

- Detecting the following middle third facial fractures:
  - Le fort I
  - Le fort II
  - Le fort III
- Coronoid process fractures

The patient is in exactly the same position as for the o° OM, the head tipped back, radiographic baseline at 45° to the film, in the nose-chin position. The -ray tube head is aimed downwards from above the head, with the central ray at 30° to the horizontal, centered through the lower border of the orbit.

PA Water's view (PNS):
The image receptor is placed in front of the patient and perpendicular to the mid sagittal plane. The patient's head is tilted pward so that the canthometal line froms a 37° angle with the image receptor. If the patient's mouth open, the sphenoid sinus will be seen superimposed over the palate. The central beam is perpendicular to the image receptor and centered in the area of maxillary sinuses.

Occipeto-Menton Projection aka Waters View

Indications
- Evaluation of the maxillary sinus
- Evaluation of the frontal sinus
- View of orbit and nasal fossa

Caldwell's modification:

Caldwell's view (or Occipitofrontal view) is a radiographic view of skull, where X-ray plate is angled at 20° to orbitomeatal line orbitomeatal line. The rays pass from behind the head and are perpendicular to radiographic plate. It is commonly used to get better view of frontal sinuses.

**Patient position:** the patient's forehead is placed against the image detector petrous ridge is below orbits image size: 24 x 30 cm.

**X-ray beam features:** the beam travels posterior to anterior (PA) direction, caudally angulated by 15 degrees source-to-image distance: 40" (100 cm) 80-85 kVp at 25 mAs (or AEC) grid is used.

Structures seen: frontal sinus, ethmoidal sinus, orbital rim, medial orbital wall, zygomatic bone, nasal bone, nasal septum, and mandible.

**Tempromandiar imaging:**

**TMJ panoramic view:**

Indications:
- The panoramic projection serves as screening projection to identify odontogenic disorders and other disorders that may e the source of TMJ symptoms.
• Gross osseous changes in the condyles may be identified by such as asymmetries, extensive erosions, large osteophytes, tumos or fractures.
• Advances high condylar panoramic radiography.
• Sagittal (lateral) plane as several image slices.
• Closed (maximal intercuspatation) position and in maximal open position.
• Condylar long axis with respect to the mid sagittal plane, submentovertex.
• Patient's head is rotated to an angle permitting alignment of image slices perpendicular to the condylar long axis.
• Minimizes geometric distortion of joint-condylar position.
• Corrected tomographic technique is not available.
• 20° head rotation toward the side of interest is superior to image slices parallel to the mid sagittal plane.
• Bite block.

Coronal tomographs:
• Maximal open or protruded position.
• Condyle to the summit of the articular eminence.
• Free of superimposition of the posterior slope of eminence.
• Entire condylar head is visible in the mediolateral plane.

Conventional radiographs:
Transcranial view:
Indications:
1. TMJ pain dysfunction syndrome.
2. Internal derangement.

Area of joint seen:
   Lateral aspect of glenoid fossa.
   Articular eminence.
   Joint space.
   Condylar head.

The cassette is placed flat against the patient's ear and centered over the TMJ of interest against the facial skin parallel to the sagittal plane. The patient's head is adjusted so that the sagittal plane is vertical. The ala-tragus line is parallel to the floor. This view is taken with both open and closed position.

In Lindblom technique (1936), central ray entered half inch behind and 2 inches above external auditory meatus.

In Grewcock technique (1953), central ray entry point is 2 inches above external auditory meatus perpendicular to occlusal plane.

In Gillis technique (1939), central ray entry point is half inch in front and 2 inches above external auditory meatus parallel and perpendicular to occlusal plane.

It depicts the lateral aspect of the TMJ. It helps to evaluate the joint's bony relationship. Detecting arthritic changes on the articular surfaces.

Transpharyngeal view (infracranial, McQueen Dell)
Indications:
1. TMJ pain dysfunction syndrome.
2. Osteoarthritis and rheumatoid arthritis.
3. Pathology condylar head as cyst and tumor.
4. Fracture of neck and condyle.

Area of joint seen:
- Lateral view condylar head and neck.
- Articular surface.

The cassette is placed flat against the patient's ear, over the TMJ of interest, against the facial skin parallel to the sagittal plane. The patient is parallel so that the sagittal plane is vertical and parallel to the film. The patient is instructed to slowly inhale through the nose during exposure. The patient should open mouth. The central ray is directed from the opposite side cranially, at an angle of -5° to -10° posterily. It is directed through the mandibular notch, that is a window between the coronoid, condyle and zygomatic arch, of opposite side below the base of the skull to the TMJ of interest.

It is a lateral projection showing medial aspect of condylar head and neck.

Transorbital (Zimmer projection)

Indications:
1. Trauma
2. Fracture cases

Area of joint seen:
- Anterior view of TMJ
- Medial displacement of fractured condyle, fracture of neck of condyle

The film behind the patient's head at an angle of 45° to the sagittal plane. The patient is positioned so that the sagittal plane is vertical. The canthomeatal line should be 10° to the horizontal, with the head tipped downwards, the mouth should be wide open, the tube head is placed in front of patient's face. The central ray is directed to the joint of interest, at an angle of +20°, to strike the cassette at right angle. The point of entry may taken at:
  - Pupil of the same eye, asking the patient to look straight ahead.
  - Medial canthus of the same eye.
  - Medial canthus of the opposite eye.

The anterior view of the TMJ. Medial displacement of fractured condyle. Fracture of neck of condyle.

Reverse Towne's:
This projection shows the condylar heads and necks. The original Towne's view (an AP projection) was designed to show the occipital region, but also showed the condyles. However, since all skull views used in dentistry are taken conventionally in the PA direction, the reverse Towne's (a PA projection) is used.

The image receptor is placed in front of the patient perpendicular to the mid sagittal and parallel to the coronal plane. The patient's head is tilted downward so that the canthomeatal line forms a 25-30° angle with the image receptor. To improve visualization of the condyles, the patient's mouth is opened so that the condylar heads are located inferior to the articular eminence. The central beam is perpendicular to the image receptor and parallel to patient's mid sagittal plane and it is centered at the level of the condyles.

Indications are:
- High fractures of the condylar necks.
- Intra capsular fractures of the TMJ.
- Investigation of the quality of the articular surface of the condylar heads in TMJ disorders.
• Condylar hypoplasia or hyperplasia.