Skull

1. PA Skull (Caldwell)
- **CR:** 15° caudad, exiting at nasion
- **Position:** OML perpendicular to IR
- **Best seen:** Frontal bone, frontal sinuses, superior orbital margins
- **Petrous ridges:** Lower 1/3 of orbits

2. AP Axial (Towne)
- **CR:** 30° caudad to OML (or 37° to IOML), entering 2.5" above glabella
- **Position:** OML/IOML perpendicular
- **Best seen:** Occipital bone, dorsum sellae within foramen magnum

3. Lateral Skull
- **CR:** 2" superior to EAM
- **Position:** IPL perpendicular, IOML parallel to floor
- **Best seen:** Entire cranium, sella turcica, cranial walls superimposed

4. SMV (Submentovertex)
- **CR:** Perpendicular to IOML, entering midway between gonions
- **Position:** IOML parallel to IR
- **Best seen:** Base of skull, sphenoid sinus, foramen ovale/spinosum

Paranasal Sinuses

1. PA Caldwell (Sinuses)

- **CR:** Horizontal, exiting at nasion (no angle)
- **Position:** OML forms 15° angle with IR (nose and forehead touching not used because tilt would obscure sinuses)
- **Best seen:** Frontal and ethmoid sinuses
- **Petrous ridges:** Lower 1/3 of orbits

2. Waters (Parietoacanthial)

- **CR:** Horizontal, exiting at acanthion
- **Position:** MML perpendicular, OML forms 37° with IR
- **Best seen:** Maxillary sinuses (also orbits)
- **Petrous ridges:** Below maxillary sinuses

3. Lateral Sinuses

- **CR:** Horizontal, entering 1" posterior to outer canthus
- **Position:** IPL perpendicular, IOML parallel to floor
- **Best seen:** All 4 sinus groups (frontal, ethmoid, sphenoid, maxillary) in profile

4. SMV (Submentovertex)

- **CR:** Horizontal and perpendicular to IOML, entering midway between gonions (3/4" anterior to EAM)
- **Position:** IOML parallel to IR
- **Best seen:** Sphenoid and ethmoid sinuses, base of skull

☑ **Key Point:**

- Unlike skull projections, sinus exams always use a **horizontal beam** to demonstrate air-fluid levels.

Facial

1. Waters (Parietoacanthial)

- **CR:** Perpendicular, exiting at the **acanthion**
- **Position:** MML perpendicular, OML forms 37° angle with IR
- **Best seen:** Orbits, maxillae, maxillary sinuses
- **Petrous ridges:** Below the maxillary sinuses
- **Use:** General survey of orbits, orbital fractures ("blow-out")

2. Modified Waters

- **CR:** Perpendicular, exiting at the **acanthion**
- **Position:** OML forms 55° angle with IR (less extension than standard Waters)
- **Best seen:** Orbital floors and orbital rims (less distortion than standard Waters)
- **Use:** Good for foreign body localization in orbits

3. PA Axial (Caldwell) – Facial Bones

- **Patient Position:**
- Patient upright (preferred for air-fluid levels).
- Rest forehead and nose against IR.
- OML (orbitomeatal line) perpendicular to IR.
- MSP perpendicular to IR.
- **Central Ray (CR):**
- 15° caudad, exiting at nasion.
- **Best Demonstrated Anatomy:**
  - Orbital rims
  - Nasal septum
  - Zygomatic bones
  - Maxillae
  - Frontal bone
  - Anterior ethmoid sinuses
- **Petrous Ridge Placement:**
  - In the lower 1/3 of the orbits (with 15° caudad angle).

4. Lateral Orbit

- **CR:** Perpendicular, entering outer canthus
- **Position:** IPL perpendicular, IOML parallel
- **Best seen:** Lateral view of the orbit, orbital walls superimposed
- **Use:** Localizing foreign bodies, fractures

👉 Quick tip for exams:

- Waters = orbits + sinuses
- Modified Waters = orbital rims/floors
- Caldwell = orbital floors/rims
- Lateral = profile of orbit

📌 LMRT Nasal Bone Projections

1. Lateral Nasal Bones (Both Sides)

- **CR:** Perpendicular, directed ½" inferior to nasion
- **Position:** IPL perpendicular, IOML parallel to floor
- **Best seen:** Nasal bones (side closest to IR), anterior nasal spine, frontonasal suture
- **Use:** Most common projection for nasal fractures

2. PA Axial (Caldwell)

- **CR:** 15° caudad, exiting at nasion
- **Position:** OML perpendicular to IR
- **Best seen:** Nasal septum, frontal sinuses, anterior ethmoids
- **Use:** Useful for overall nasal and frontal bone evaluation

3. Superoinferior Axial (Tangential) Nasal Bones

- **CR:** Perpendicular, centered to nasion and directed along GAL (glabelloalveolar line)
- **Position:** Patient seated, chin extended, IR perpendicular to GAL
- **Best seen:** Nasal septum and nasal bones free of superimposition
- **Use:** Shows nasal bones in axial projection

✅ **Key Exam Tips:**

- **Lateral nasal bones** → always done bilaterally for fractures
- **Caldwell** → frontal/nasal bone overview
- **Tangential axial** → septum and nasal bones without overlap

📌 Optic Foramen Projections (LMRT)

1. Parieto-Orbital Oblique (Rhese Method)

Patient Position:

- Patient prone or upright.
- Chin, cheek, and nose against IR ("three-point landing").
- AML (acanthiomeatal line) perpendicular to IR.
- MSP rotated so orbit forms a 53° angle with IR.

Central Ray (CR):

- Perpendicular, directed to orbit closest to IR.

Best Demonstrated Anatomy:

- Optic foramen in the lower outer quadrant of the orbit.

Clinical Use:

- Evaluates optic canal and optic foramen for fractures, lesions, or foreign bodies.

2. Modified Rhese (For Trauma / Supine Patients)

- Similar setup but adapted for supine position, using angled CR if necessary.

✅ **Key Exam Tip:**

If the optic foramen is not in the lower outer quadrant, the head is rotated incorrectly.
Rhese = "53 degrees" & "lower outer quadrant."

📌 LMRT Zygomatic Arch Projections

1. Bilateral SMV (Submentovertex) – Zygomatic Arches
CR: Perpendicular to IOML, centered midway between zygomatic arches (1.5" posterior to mandibular symphysis)
Position:

- MSP perpendicular to IR
- IOML parallel to IR

Best seen: Both zygomatic arches in a single view, free of superimposition
Use: Routine survey of zygomatic arches, trauma evaluation

2. Tangential (Oblique Inferosuperior) – Single Zygomatic Arch
CR: Perpendicular to IOML, centered to arch of interest
Position:

- Head tilted 15° toward side examined
- Rotated 15° away

Best seen: Single arch
Use: Unilateral fractures or depressed arch

3. AP Axial (Modified Towne) – Zygomatic Arches
CR: 30° caudad to OML (or 37° to IOML), entering 1" above glabella at MSP
Position: OML (or IOML) perpendicular to IR
Best seen: Bilateral arches projected free of superimposition
Use: Alternative if patient cannot hyperextend for SMV

✅ Quick Exam Tips:

- **Bilateral SMV** → both arches clearly visible
- **Tangential** → single arch visualization
- **Modified Towne** → backup for SMV limitation

📌 LMRT TMJ Projections

1. Axiolateral (Modified Law) – TMJ
CR: 15° caudad, entering 1.5" superior to upside EAM
Patient Position:
- Head rotated 15° toward IR (MSP at 15° from IR)
- IOML parallel to floor

Best Seen: TMJ **closest to IR**, condyle in mandibular fossa
Use: Evaluates **joint space, condylar position**, fractures

2. Axiolateral (Schuller) – TMJ
CR: 25–30° caudad, entering ½" anterior and 2" superior to upside EAM
Patient Position:
- Head in true lateral (MSP parallel to IR)
- IOML parallel to floor

Best Seen: TMJ **closest to IR**, condyle and joint space
Use: Alternative to Modified Law; good for open/closed mouth comparison

Key Exam Tips:
- **Modified Law** → head rotated 15°
- **Schuller** → true lateral, more caudad CR
- Always do **both sides** for comparison
- Take **open and closed mouth** views to evaluate joint function