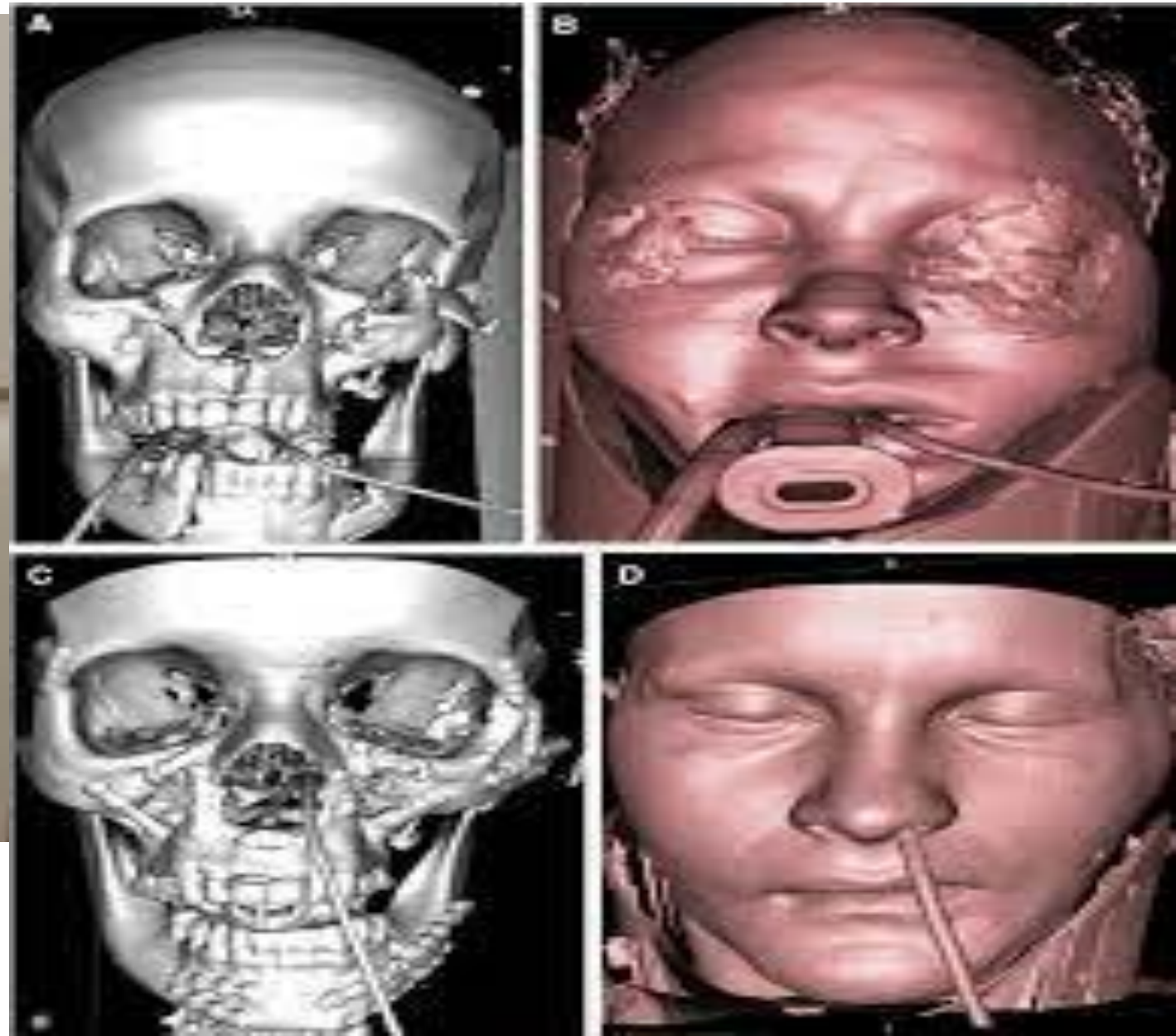
# Computerized Tomography (CT)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# Computerized Tomography (CT) :

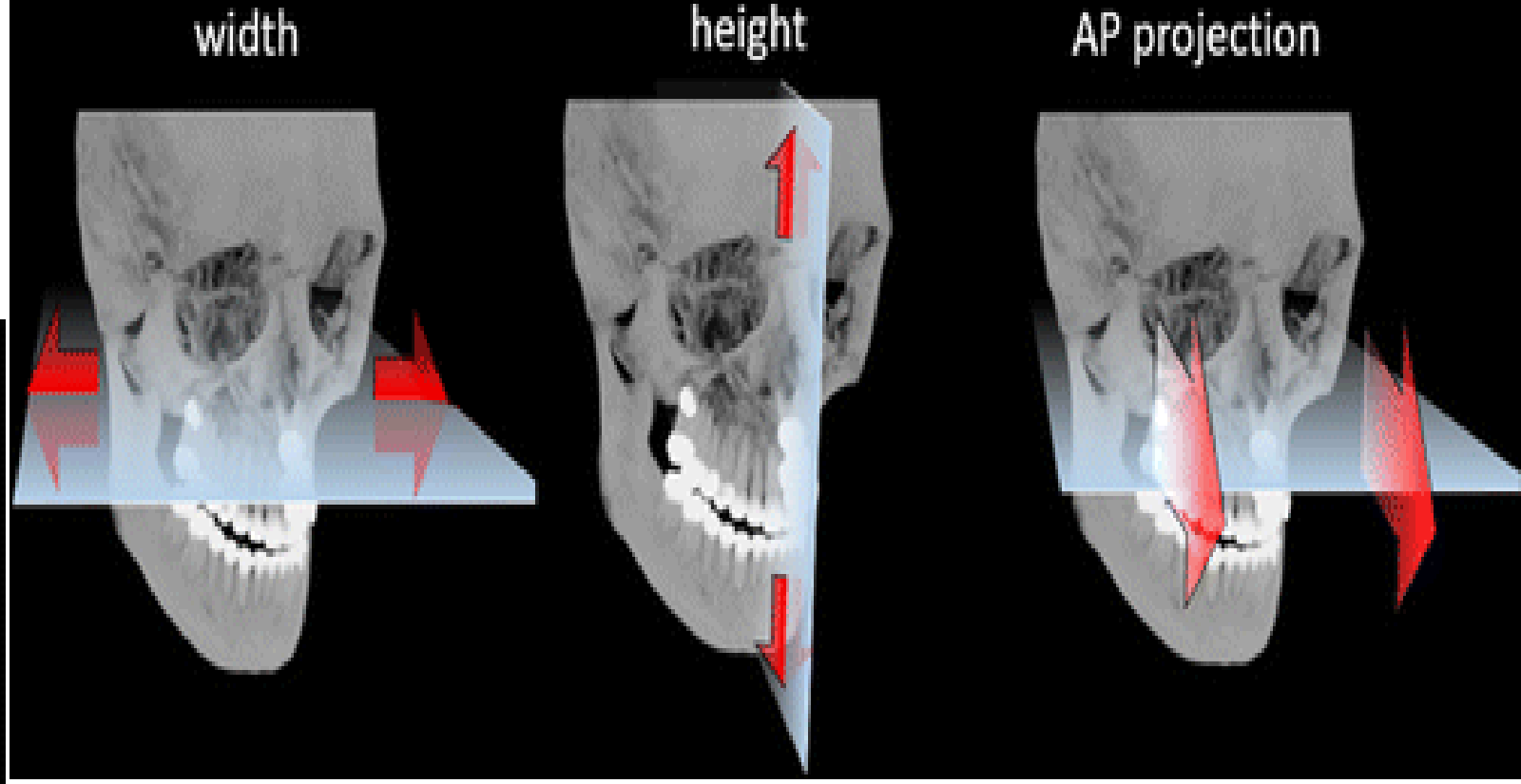
A computerized tomography (CT) scan combines a series of X-ray images taken from different angles around your body and uses computer processing to create cross-sectional images (slices) of the bones, blood vessels and soft tissues inside your body.

Computed tomography (CT) is today commonly used in imaging of the maxillofacial area. Conventional CT examinations are usually performed in medical X-ray departments. However, a relatively new technique named **cone-beam computed tomography (CBCT)** or **digital volume tomography (DVT)** has now also become available for dental purposes.

The advantage with this technique **is a lower radiation dose compared to conventional CT. Common examples when DVT is used are; for diagnosing the position of impacted canines and suspected root resorption of the adjacent lateral incisor**, **preoperative planning of implant treatment** and examination of periapical areas when intraoral radiography has given uncertain information. **Conventional CT is used for examination of larger areas in diagnosing** e.g. **facial anomalies**, **extensive traumata** and **tumours**

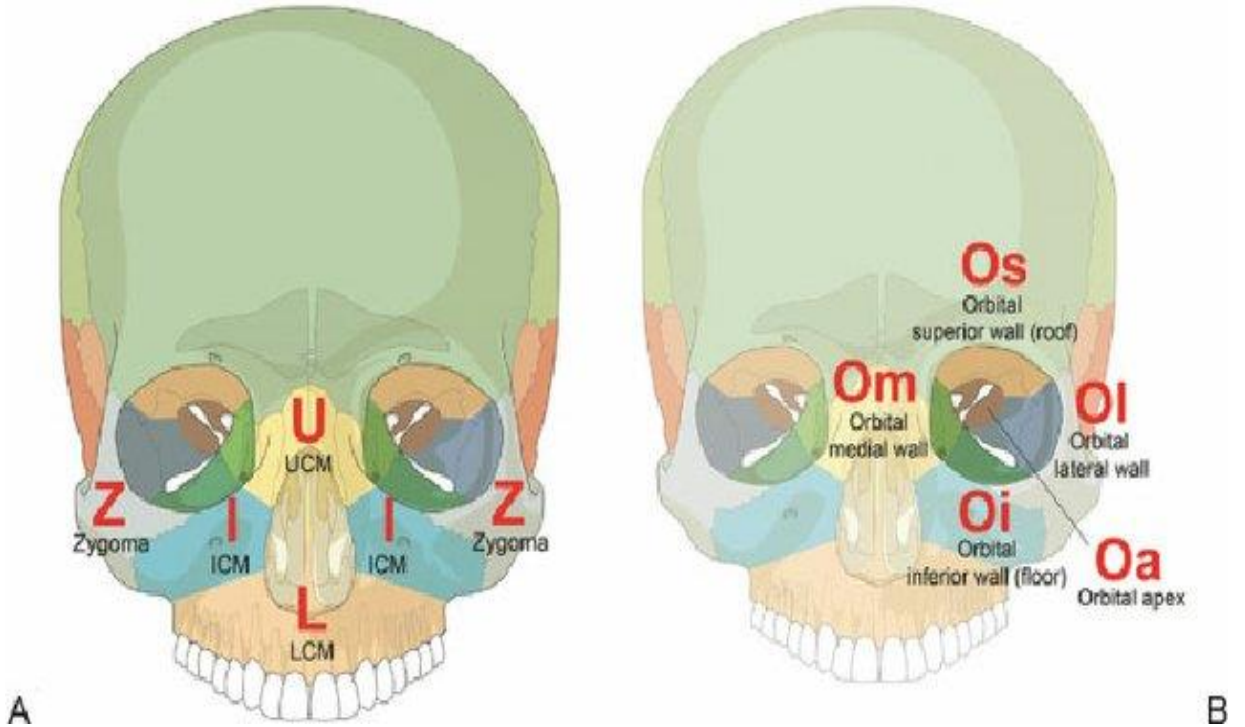
Normal imaging appearance of the anatomic structures frequently involved in NOE fractures. **(a)** Coronal CT image shows passage of the right and left nasolacrimal ducts (arrows) from the lacrimal fossae, through the frontal maxillary process, to the inferior meatus, which empties below the inferior turbinate (*).
**(b, c)** Coronal **(b)** and sagittal **(c)** CT images show the frontonasal ducts (thin solid arrow = left duct). On each side, the frontonasal duct extends from the frontal sinus floor to the infundibulum of the ostiomeatal complex, a confluence with the ostia of the maxillary sinus (* = left ostium) and the anterior and middle ethmoid air cells. The infundibulum extends posteriorly into the hiatus semilunaris, the final drainage pathway into the nasal cavity (thick open arrow on **c**). Sagittal CT images have the greatest utility for assessing the patency of the frontonasal duct after NOE fracture

Aesthetic management of midfacial fractures. Volume-rendered CT images show that the primary goal of aesthetic management is to restore the preinjury facial width, height, and anteroposterior *(AP)* projection

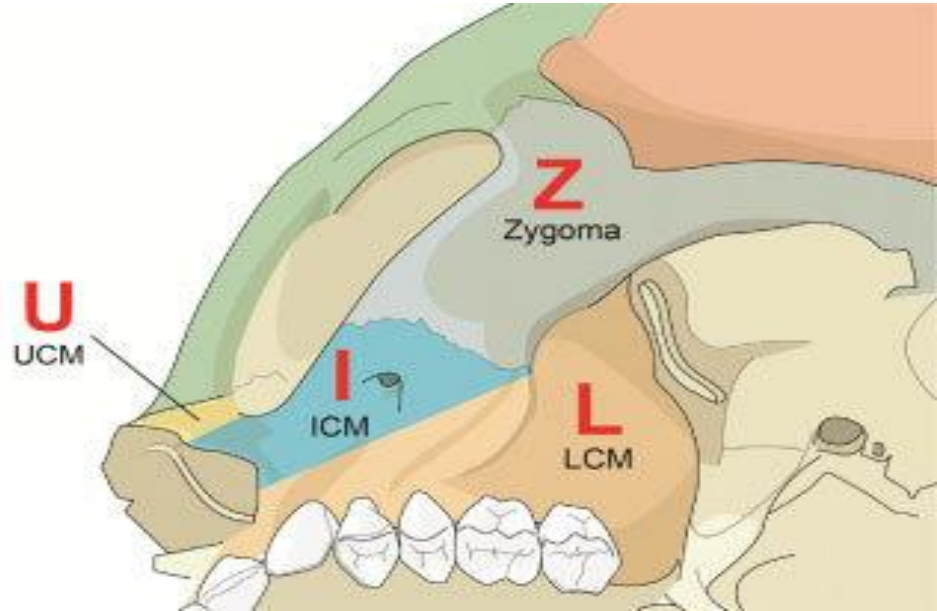



Anatomy of nasoseptal fractures. **(a)** Top: Coronal thick-slab CT image shows the three-dimensional anatomic structures of the bony nasal pyramid. The two nasal bones, which form the nasal bridge at the dorsum of the pyramid, articulate with the frontal processes of the maxilla at the nasomaxillary suture (*) and with the frontal bone at the frontonasal suture (solid black arrow). The frontal maxillary processes articulate with the frontal bone at the frontomaxillary suture (open white arrows). Bottom left: More-caudal axial collimated CT image shows the cross-sectional appearance of the frontal maxillary processes. Bottom right: More-cranial axial collimated CT image shows the cross-sectional appearance of the nasal bridge. **(b)** Sagittal thick-slab CT image with a diagrammatic overlay of the septal cartilage (light blue) shows its relationship to the anterior nasal spine of the maxilla, as well as the bony septum, which is comprised of the vomer inferiorly and the perpendicular plate of the ethmoid superiorly. **(c)** Volume-rendered CT image with diagrammatic overlays of the upper and lower lateral cartilages (light blue) in a 34-year-old man with frontal maxillary process and nasal bone fractures after anassault. The upper lateral cartilages are maintained in symmetric alignment by the cartilaginous nasal septum and articulate with the bony nasal pyramid. The upper lateral cartilages promote anatomic alignment during healing but can exert deforming forces when disrupted or malaligned.

Midface mapping of anatomical subdivisions on the caudal (A) and lateral (B) skull. UCM, upper central midface – nasal skeleton including bone and nasofrontal maxilla; ICM, intermediate central midface – parapiriform maxilla and infraorbital maxilla; LCM, lower central midface – maxillary bodies including infra zygomatic maxilla; Z, zygoma/zygomatic arch.




Lower central midface extension in the maxillary tuberosity region. UCM, upper central midface; ICM, intermediate central midface; LCM, lower central midface; Z, zygoma/zygomatic arch



# Conventional computed tomography:

Trauma

**CT is the standard of care for the evaluation of suspected facial fractures** because it is **readily available**, **rapidly acquired**, and **highly accurate in detecting even subtle fractures**.

**Importantly,** it is also used to **simultaneously evaluate for acute intracranial pathology**, which may be more urgent

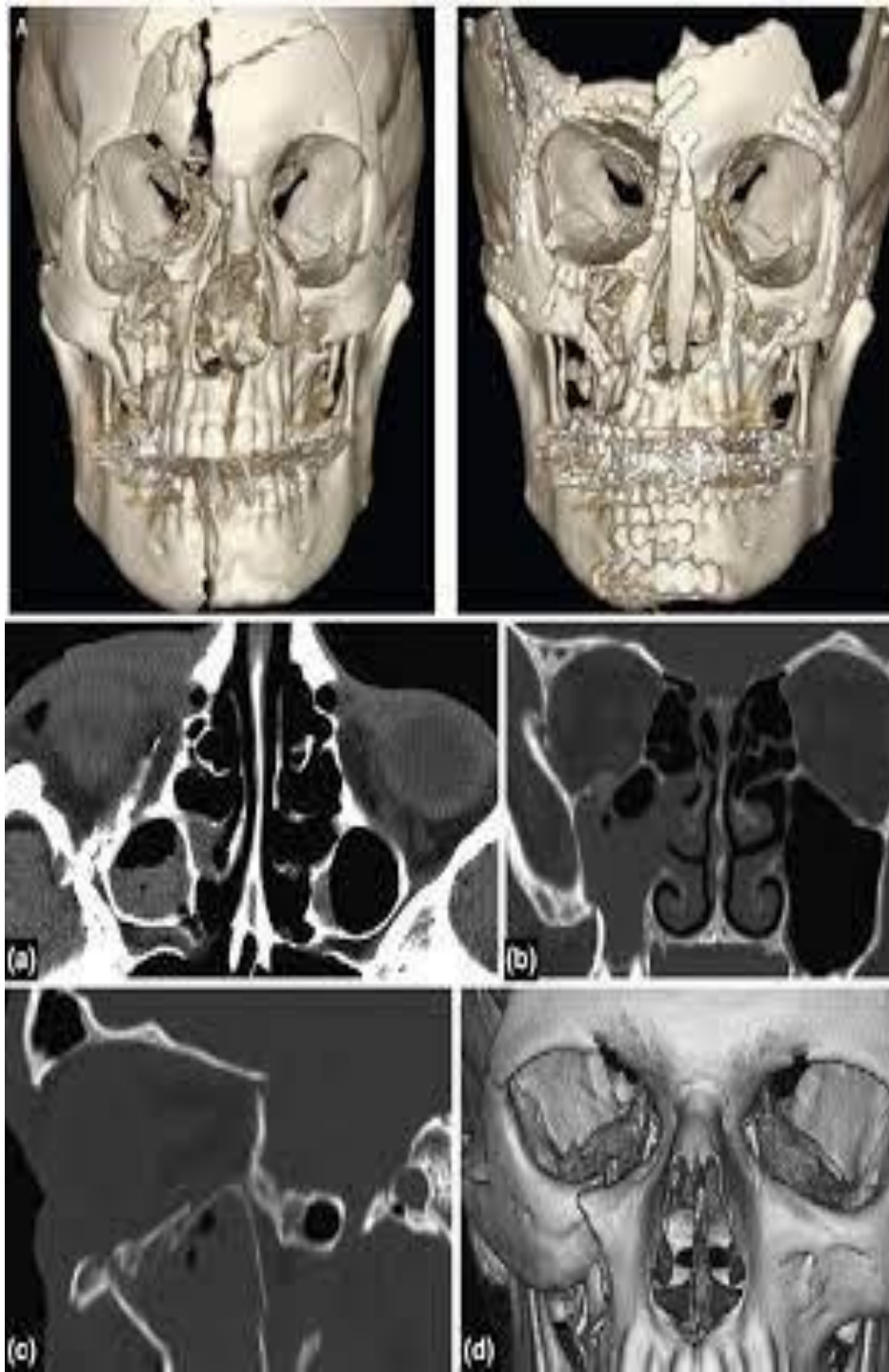
CT is the imaging modality of choice for extensive maxillofacial trauma cases .

Postoperative CT examination is needed when the extreme precision of reconstruction has to be confirmed, for example in reconstructions of the orbitae.

Thin sections in the axial plane, parallel to the **Frankfurt Horizontal (FH),** are taken.

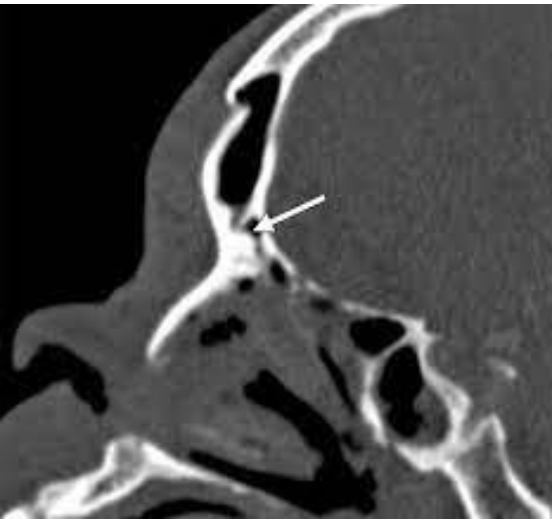
Coronal reformations, orthogonal to the FH plane, are nearly routinely made.

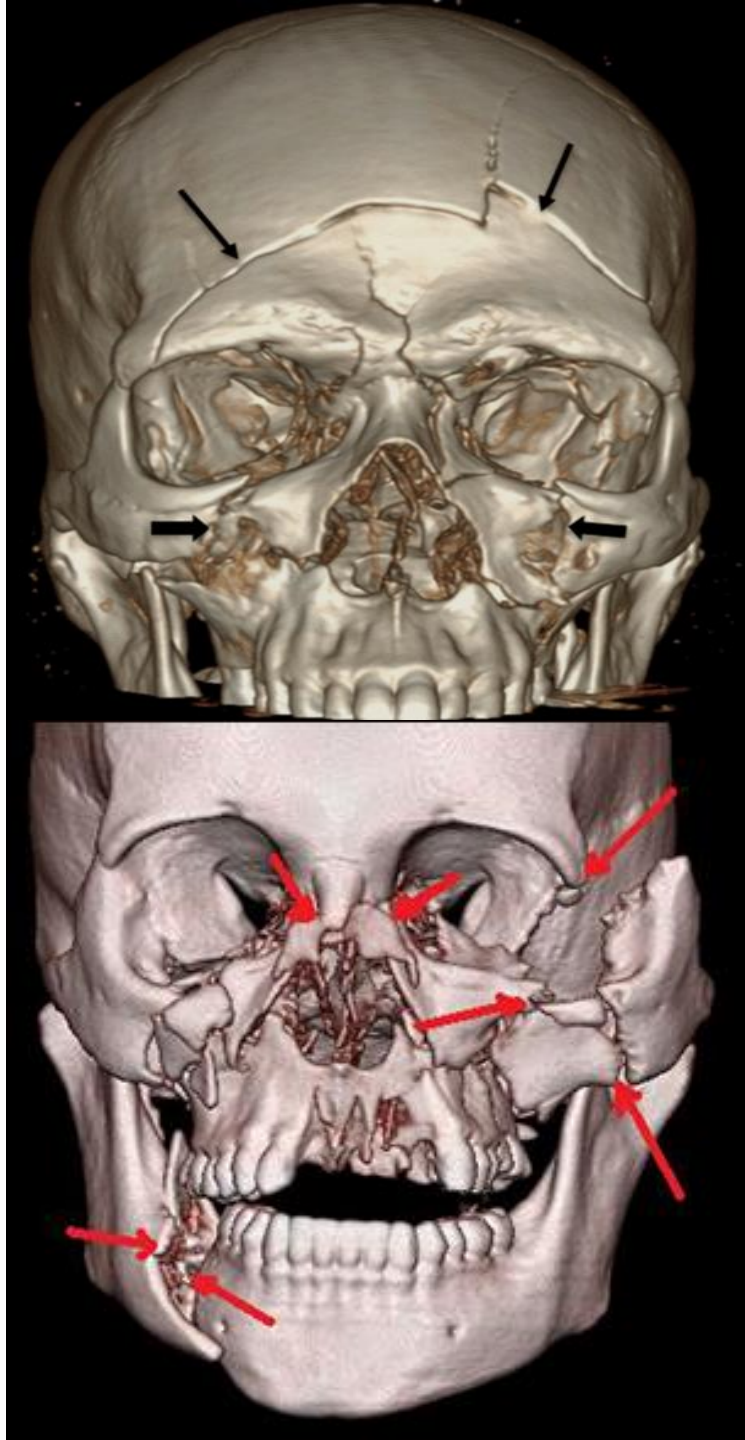
Sagittal reconstructions, parallel to the optic nerve, are used when orbital floor fractures are suspected. Images are reconstructed using both soft tissue and bone algorithms and viewed using both soft tissue and bone windowing .



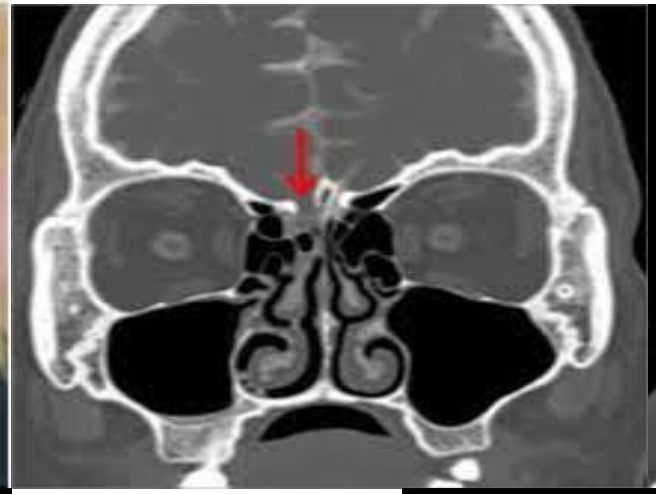
**In particular,** fractures of the **orbital region** must be evaluated with soft tissue window and for that reason **DVT examinations are not suitable**.

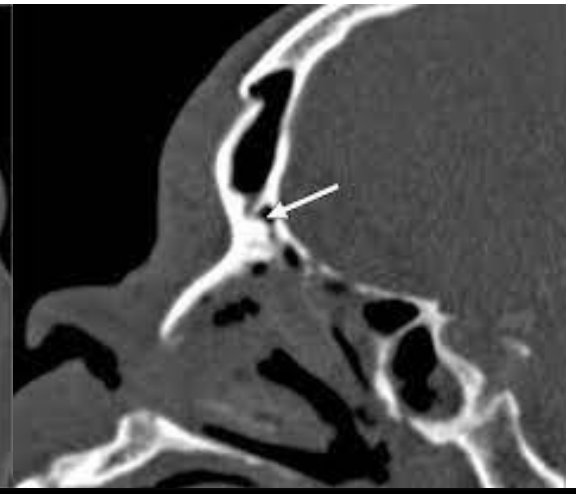
Three-dimensional (3D) images help to visualize the fractures (Fig. 10). CT studies are rarely used to evaluate isolated mandibular fractures. However, CT is of value in the evaluation of complex mandibular – including condylar – fractures
.
DVT should be considered an alternative imaging method. Maxillofacial fractures are often associated with dento-alveolar fractures that should be observed in the CT examination. This is, however, not a method of choice for isolated dentoalveolar traumata. Trauma of the head and the cervical spine often coexist with large maxillofacial fractures. For that reason, where multitrauma or high energy trauma patients are concerned, CT examination of the head and the cervical spine should be done to find out neurosurgically significant lesions





Any tear or hole in the membrane that allows the cerebrospinal fluid to leak can cause a drop in pressure around the brain and spinal cord. **When the fluid leaks from the nose**, this condition is called CSF rhinorrhea

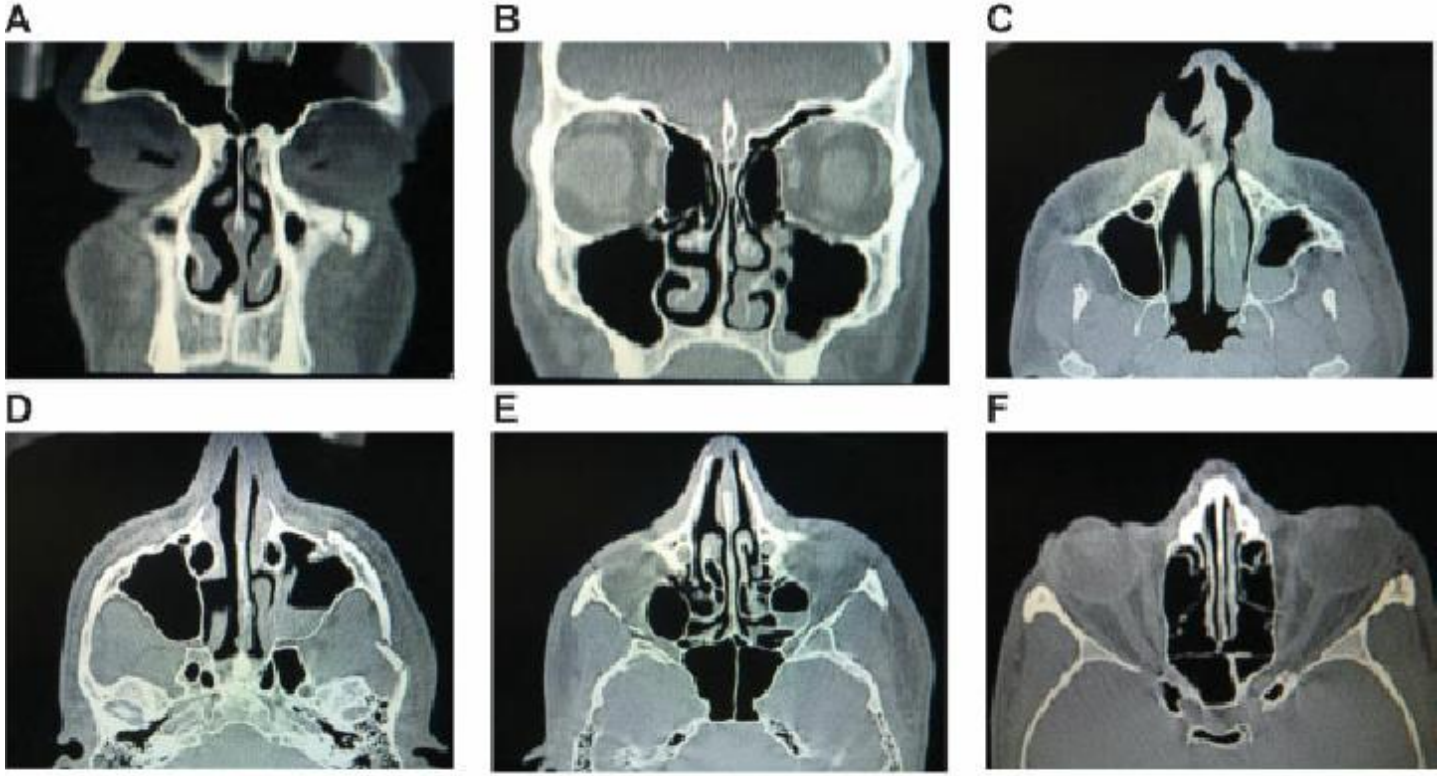


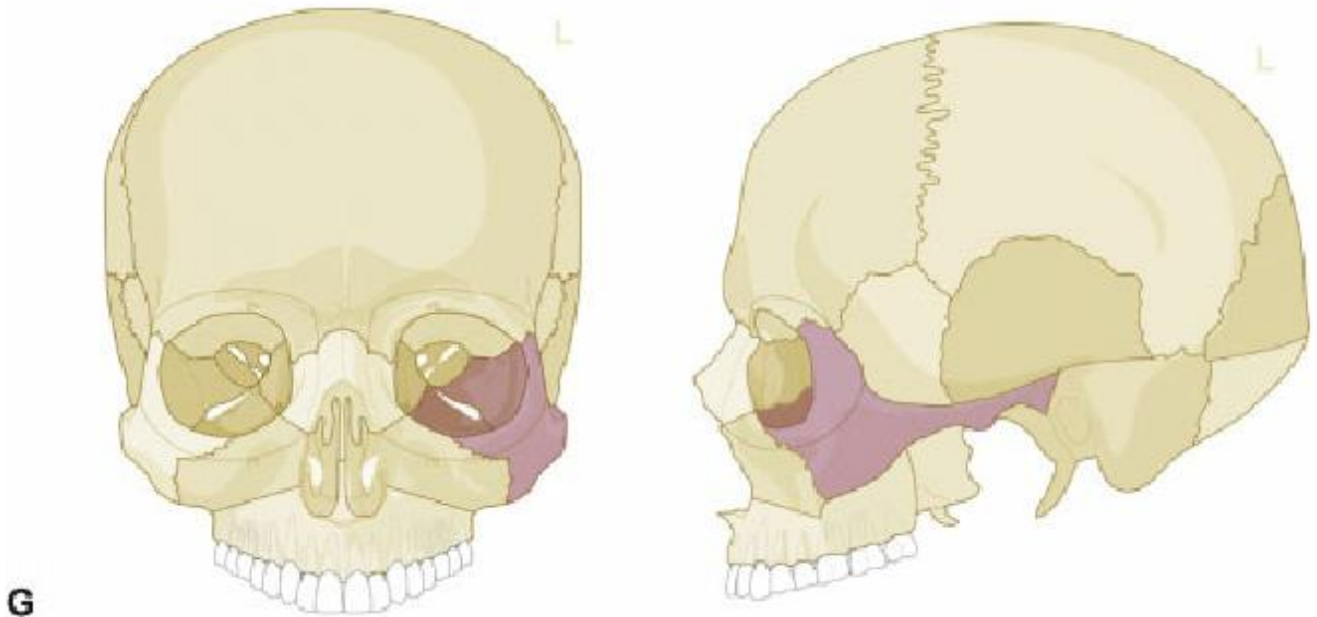


Subtle fracture in a 34-year-old man with frontal maxillary process and nasal bone fractures after an assault
Axial CT image shows a subtle fracture (arrow) through the anterior nasal spine

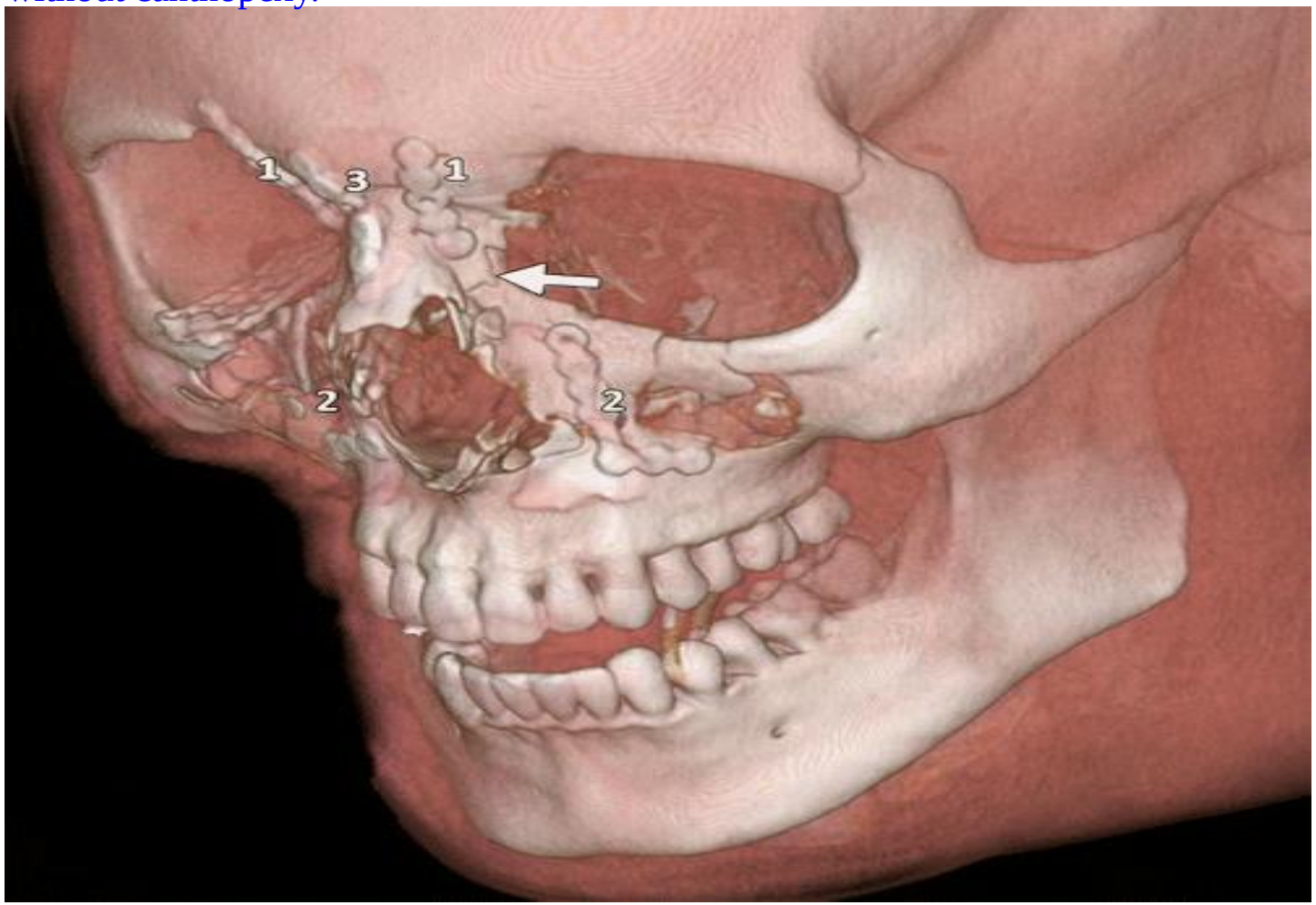
Axial CT image shows bilateral fracture-dislocation of the frontal maxillary processes, with lateral displacement (arrows). Severe septal bowing was present on coronal CT images (not shown), a finding consistent with a Rhee grade 3 septal injury. Closed reduction was performed by using a nasal fracture elevator and a septum-straightening forceps

**Fracture of the upper central midface.**
Imaging: CT scan axial view (A – D) and coronal view (E, F).
Description: Nasoorbitoethmoidal (NOE) fracture with involvement of nasal bones bilaterally (UCM), medial orbital and inferior orbital rim left side (UCM and ICM), the anterior medial wall (OM) and the orbital floor (Oi) are fractured. (G) Level 2 Code: 92 U.Omi.Ii. This case example CMTR-92-001 is made available electronically for viewing using the AOCOIAC software at www.aocmf.org/classi fi cation



Bilateral grade 2 NOE fractures and right orbital floor fracture in a 21-year-old man after a motor vehicle collision. Three-dimensional volume-rendered CT image shows that the fractures were repaired with a combination of coronal, transoral, and transconjunctival approaches. Plates transfix the frontomaxillary sutures *(1)*, the nasomaxillary buttresses *(2)*, and the frontonasal suture *(3)*. Note the fracture line (arrow) extending to the anterior lacrimal crest. Fragments were sufficiently large to allow indirect stabilization of the medial canthal tendon without canthopexy.



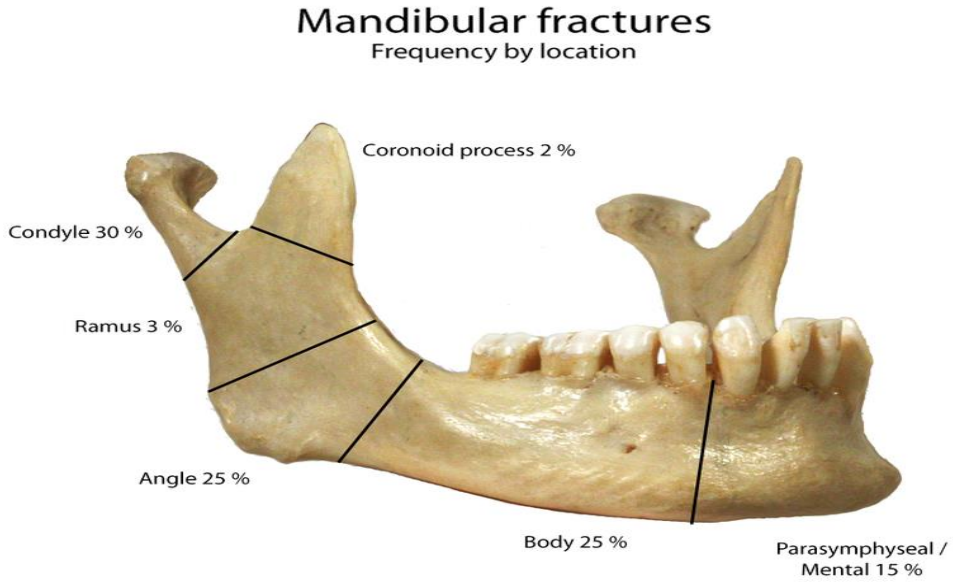

**Mandibular fracture**, also known as **fracture of the jaw**, is a break through the mandibular bone. In about 60% of cases the break occurs in two places.[1] It may result in a decreased ability to fully open the mouth.
Often the teeth will not feel properly aligned or there may be bleeding of the gums.Mandibular fractures occur most commonly among males in their 30s

# Mandibular fracture, also known as **fracture of the jaw**, is a break through the mandibular bone. In about 60% of cases the break occurs in two places.It may result in a decreased ability to fully open the mouth.Often the teeth will not feel properly aligned or there may be bleeding of the gums.[1] Mandibular fractures occur most commonly among males in their 30s.

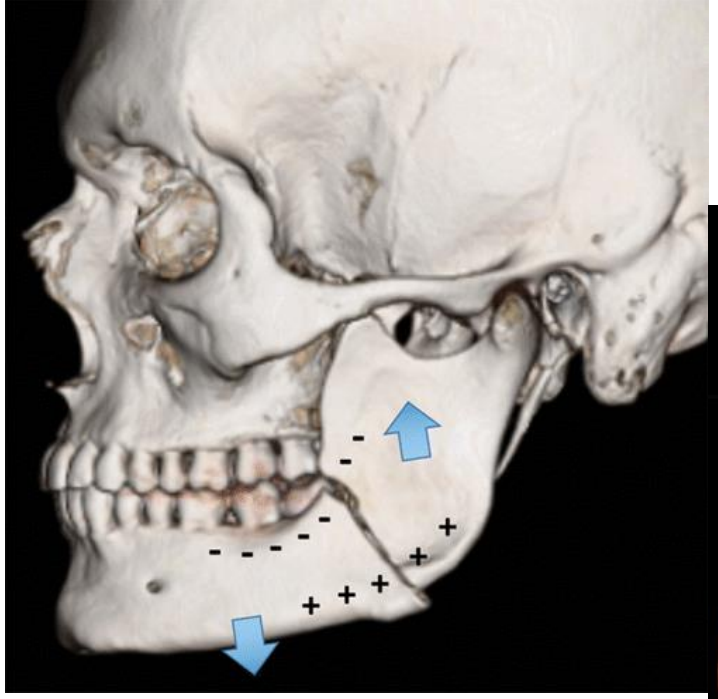
Mandibular fractures are typically the result of trauma.This can include a fall onto the chin or a hit from the side.Rarely they may be due to osteonecrosis or tumors in the bone.[1] The most common area of fracture is at the condyle (36%), body (21%), angle (20%) and symphysis (14%).While a diagnosis can occasionally be made with plain X-ray, modern CT scans are more accurate.

Immediate surgery is not necessarily required.Occasionally people may go home and follow up for surgery in the next few days.A number of surgical techniques may be used including maxillomandibular fixation and open reduction internal fixation (ORIF).[2][1] People are often put on antibiotics such as penicillin for a brief period of time.The evidence to support this practice; however, is poor

Nondisplaced fracture of the mandible




**The most frequent locations of a mandibular fracture**



Fractures through the left angle of the mandible

**Three-dimensional computed tomography (3D CT) of the head and facial bone showing a fracture of the right side of the mandible (arrow)**

Mandibular Fractures,

Computed tomography (CT) is the most common technique used for examination of maxillofacial neoplasms because it permits the visualization of soft tissues and bone structures in the same examination. It has become the modality of choice for the evaluation of maxillofacial neoplasms.
Multiple overlapping slices can be reconstructed from a single examination permitting higher quality multiplanar (MPR) and three-dimensional reconstructed (3D) images without additional patient irradiationRecently, we presented a new methodology using a 3D vascular setting protocol for quantitative analysis of mandibular neoplasms, which was validated in cadavers. That study showed that 3D interactive computer graphics make possible a more complete assessment of maxillofacial lesions, assisting the preoperative planning and the evaluation of postoperative outcomes

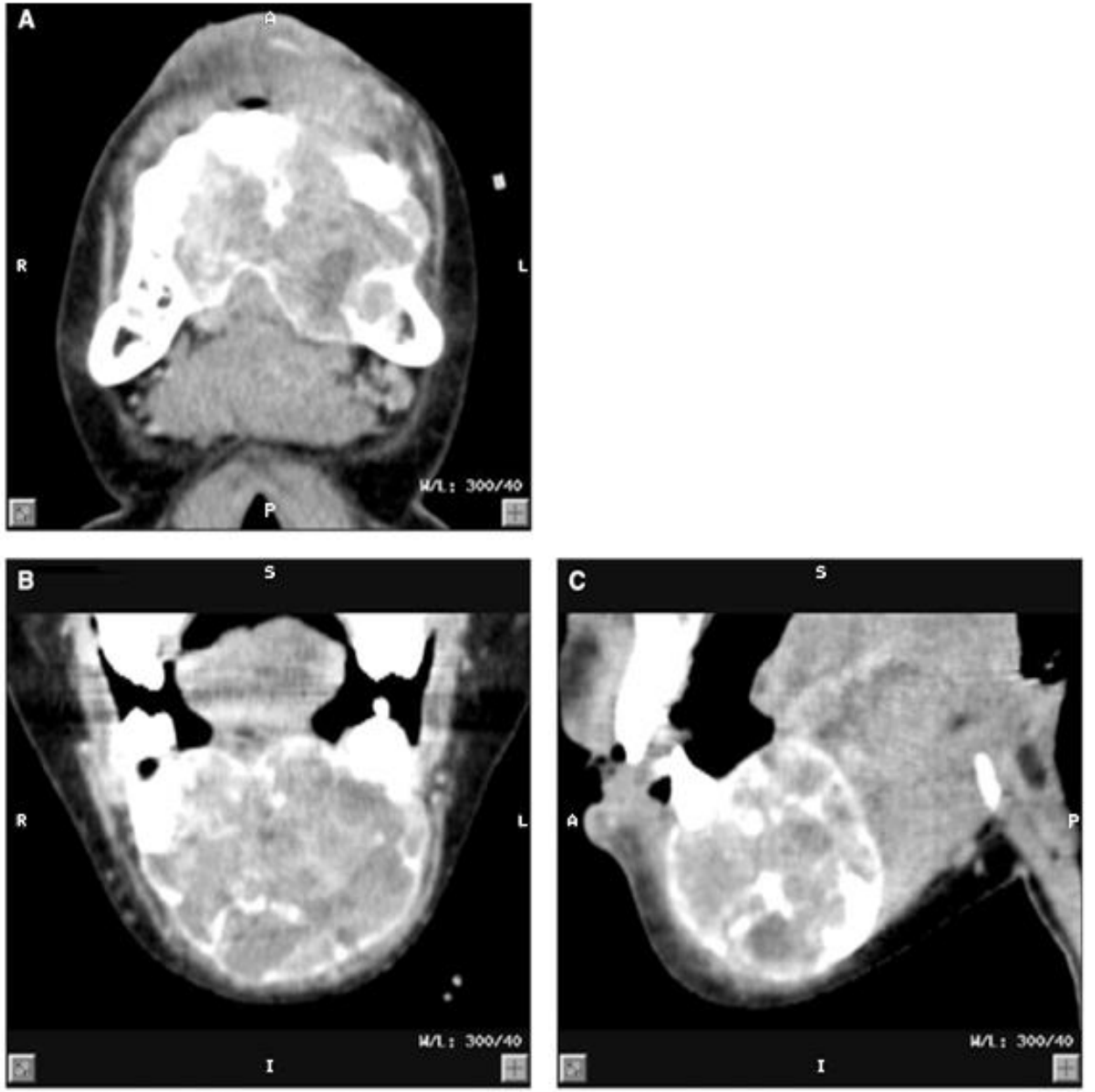



**FIGURE 1 -** MPR-CT images: axial (A), coronal (B) and sagittal (C) views demonstrate the degree of bucco-lingual and inferior expansion of the lesion in the body of the mandible, as well as the internal trabeculae. The CT images show a large well-demarcated multilocular mass with multiple foci of calcification, involving from the right to the left side of the mandibular body, including the region of the menton.

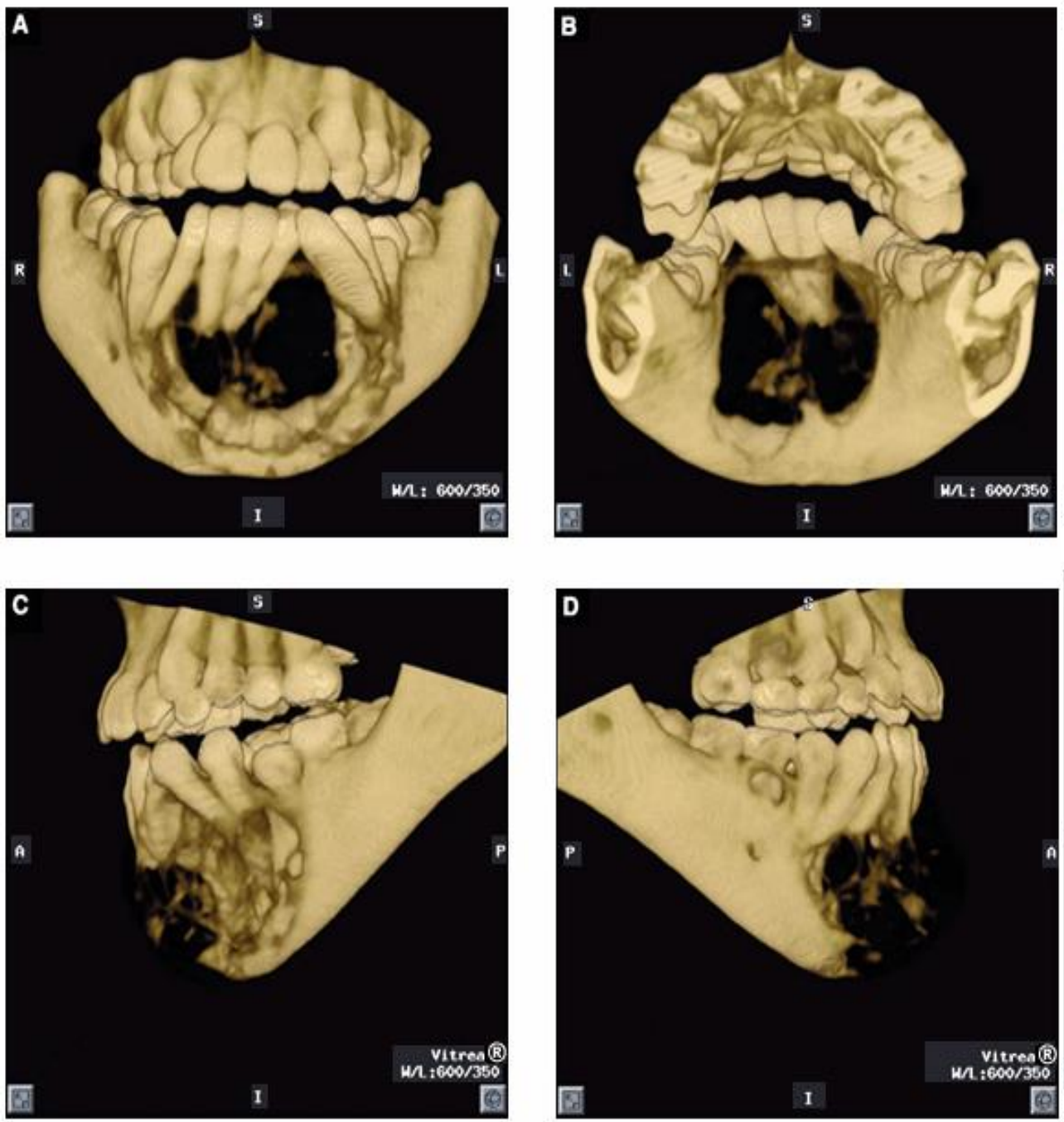
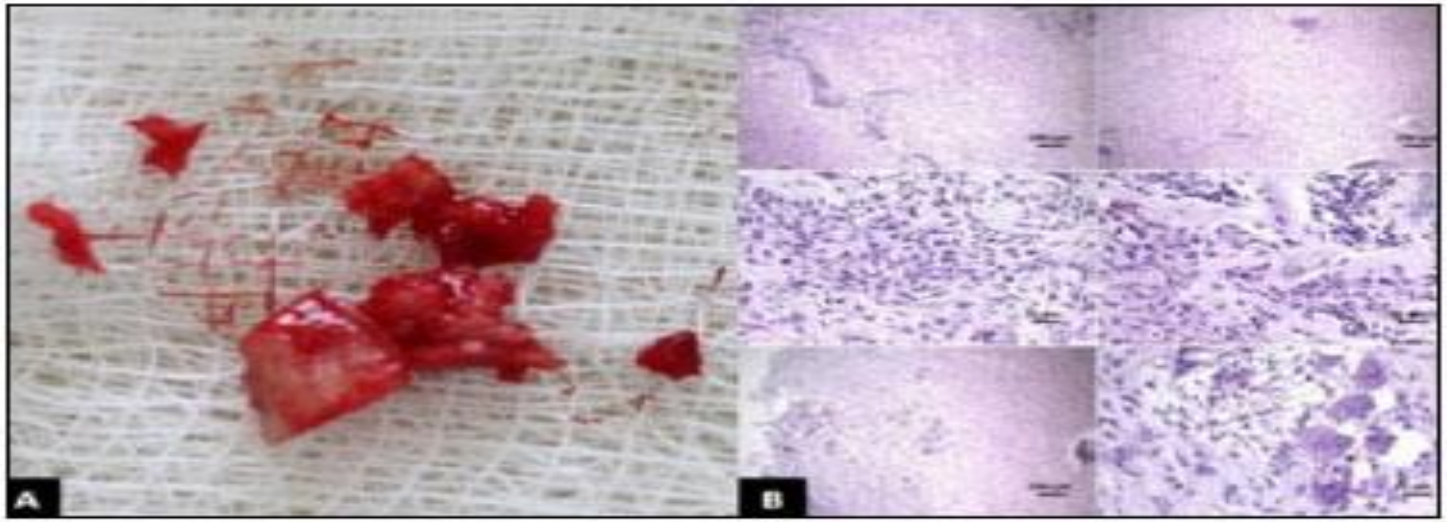



**FIGURE 2 -** The 3D-CT bone protocol shows the destruction of bone caused by the lesion and the aspect of the mandible from the anterior (A), posterior (B), left (C) and right (D) views.


**FIGURE 3 -** The 3D-CT vascular protocol depicts in red the soft tissue of the lesion in relationship with the mandible, demonstrating all its components, extension and dimensions in anterior (A), posterior (B), left (C) and right (D) views.

Extraoral and intraoral clinical aspects.
A: swelling in the left periorbicular/paranasal region.
B: swelling increase in the bottom of the maxillary vestibule.
C: swelling in the anterior region of the hard palate


3D reconstruction of cone beam tomography showing the limits of the lesion and its relationship with noble structures.


A: lesion fragments removed for microscopic examination. B: HE-stained histological sections revealing connective tissue fragments made up of elongated bundles of collagen fibers, of variable density, interposed by fibroblasts of either ovoid or fusiform shape, arranged in storiform arrangement. The parenchymal component is associated with deposition areas of bone trabeculae at maturation different degrees. Focal clusters of multinucleated giant cells are also evident. Such findings closed the diagnosis of trabecular juvenile ossifying fibroma.


Thank You !