CBCT

Anatomy and Incidental Findings

Disclosures: I have nothing to disclose.

Tuesday, April 12, 2019

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Objectives

CBCT

Consider features for selecting a unit

Develop a plan for managing images

Identify basic anatomy

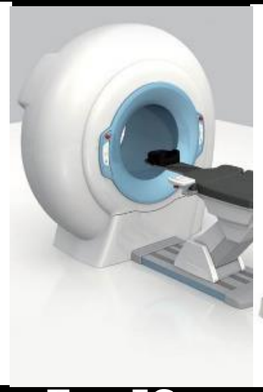
Recognize common incidental findings

CBCT

FEATURES

Morita Veraviewpocs

VaTech Master 3DS



NewTom 5G

iCAT Next Generation

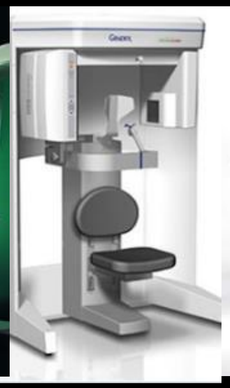
Iluma

ProMax 3D Max

Orthophos SL

Pax-Reve 3D

Accuitomo 170



CB 500

Galileos

Scanora 3D

NewTom VGi

Skyview

Suni 3D

Veraviewepocs

Picasso Trio

Orion

CS 9300

Orthophos XG 3D

Prexion

Promax 3D

Compliments Dr. Don Tyndall

Important Principle

Spend time investigating the company and services offered.

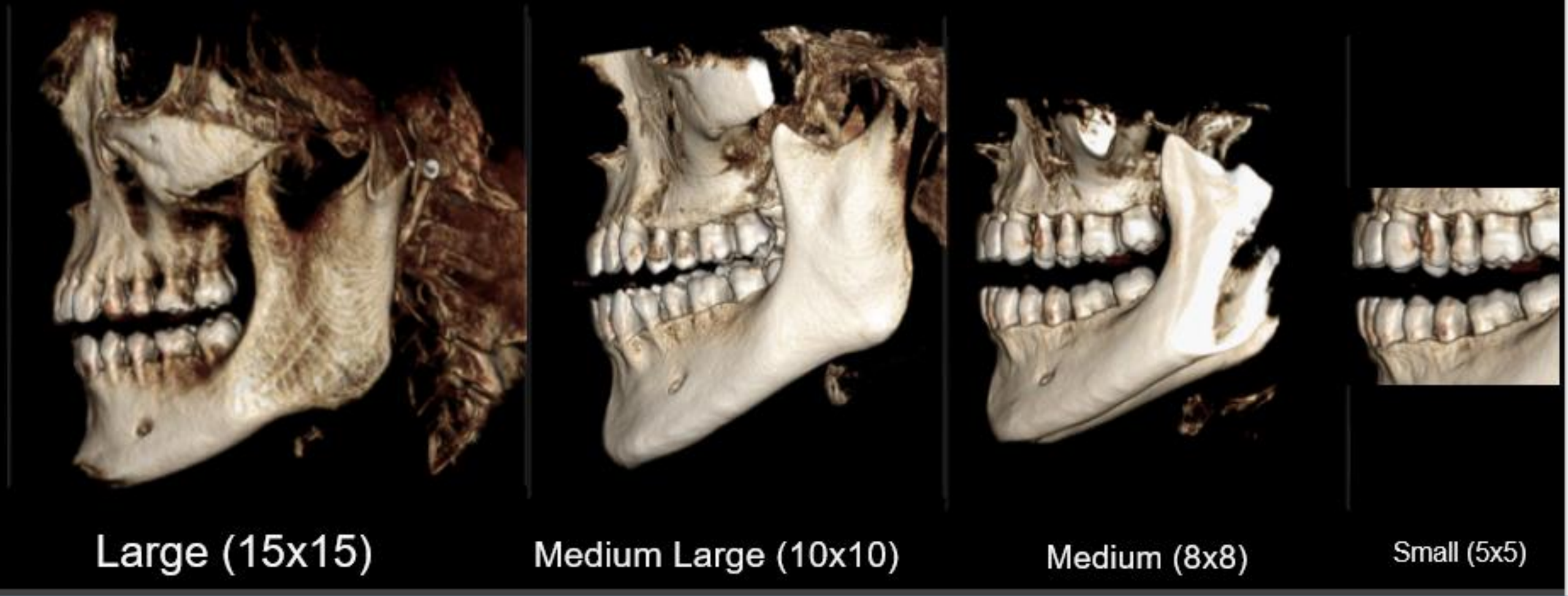
Support is crucial.

There are BIG differences.

What will you use the unit for in your practice?

Implant therapy	50%
Endodontics	15%
Craniofacial Assessment	11%
Pathology	10%
TMJ Assessment	6%
Impacted Teeth	5%
Other	3%

What fields of view will you need?



Compliments Dr. Don Tyndall

15 x 15 cm

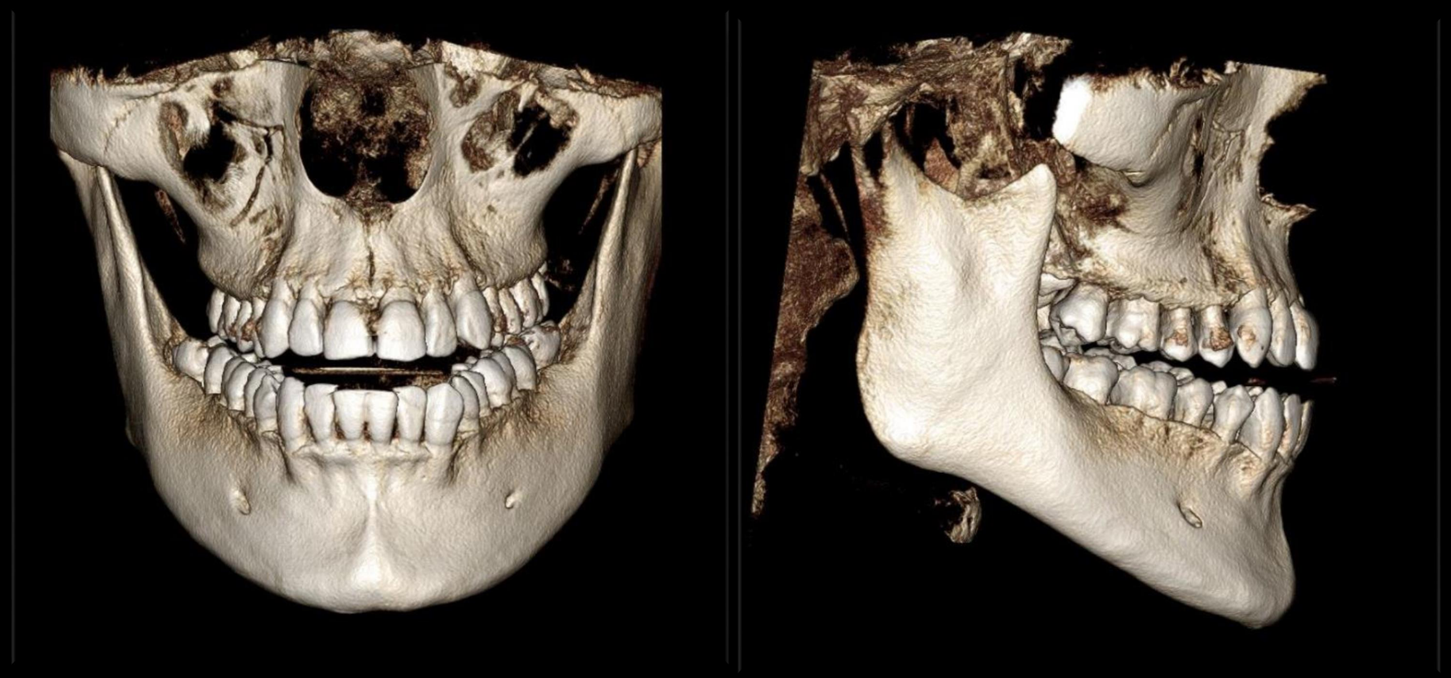
Large FOV

Orthodontics

Jaw pathologies

TMJ evaluation

Maxillofacial trauma assessment



11 x 10 cm

Medium FOV

Entire Arch of Interest

Surgical Guide Fabrication

Overall Nice Size for General Dentistry

8 x 8 cm

Medium FOV

Entire Arch of Interest

Surgical Guide Fabrication

Lacks condyles

Overall Nice Size for General Dentistry

5 x 5 cm

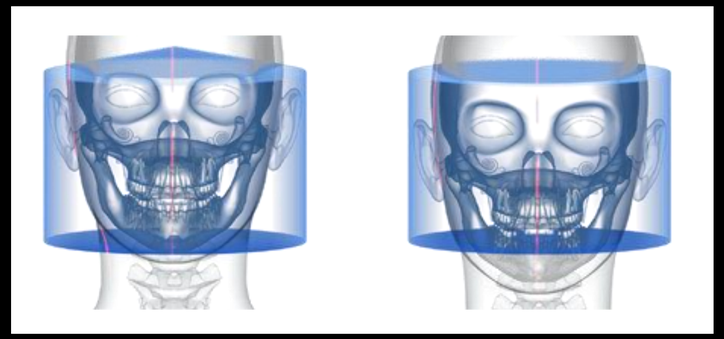
Small FOV

Great for single implant

High resolution

Limited anatomy to evaluate

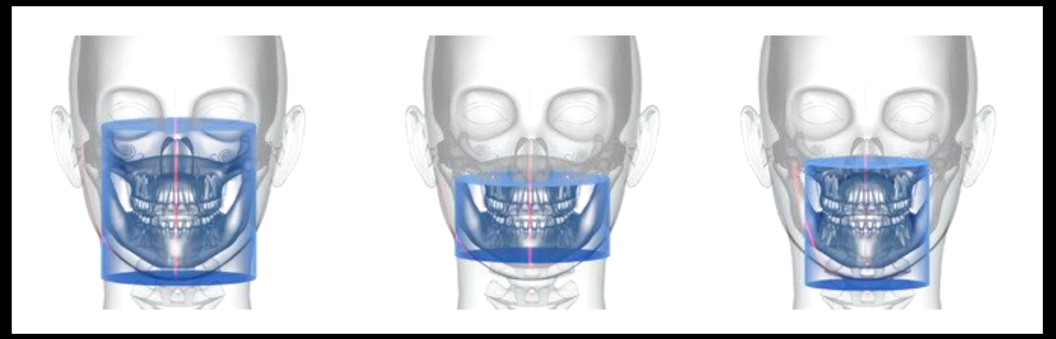
Maxillofacial / Orthodontics / Sinus modes



Facial Φ17x13.5cm
20s -– 300µm

Sinus Φ17x11cm
12s – 250µm

Jaw modes

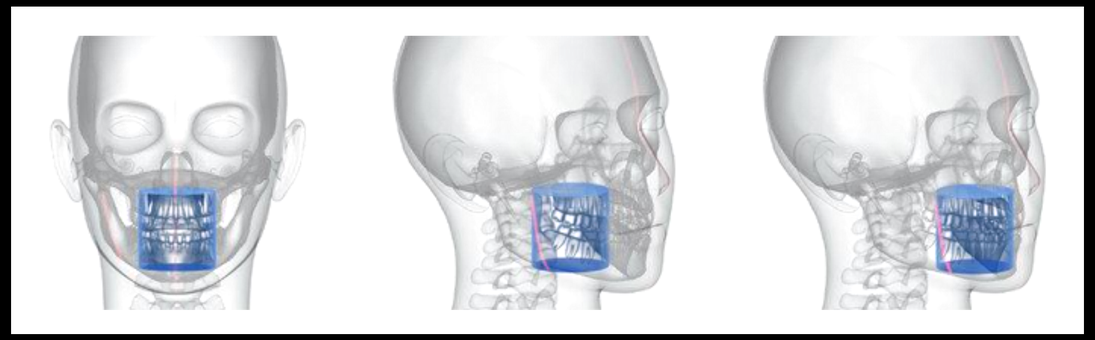


Dual jaw Φ10x10cm 12s – 183µm

Single jaw Φ10x5 cm
12s – 183µm

Dual jaw Φ8x8cm
20s – 200µm

Focused modes / Teeth modes

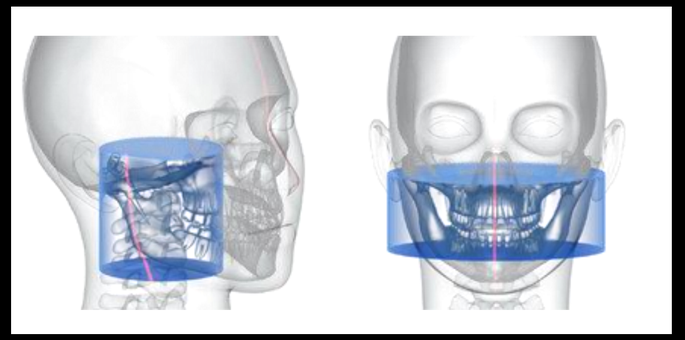


Incisive Φ5x5cm
12 or 20s – 90µm

Molar Φ5x5cm
12 or 20s – 90µm

Premolar Φ5x5cm
12 or 20s – 90µm

TMJ modes

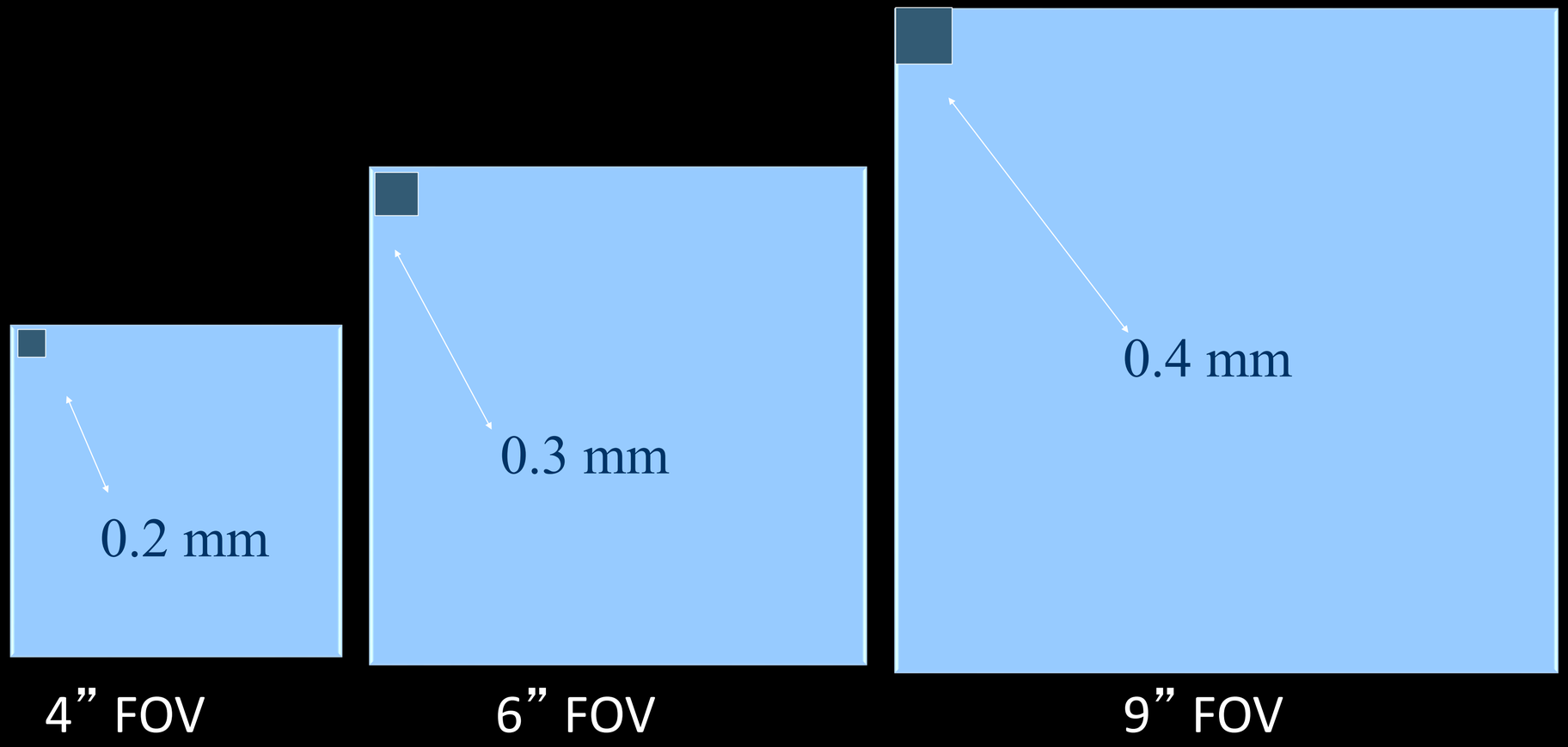


Single TMJ Φ8x8cm 20s – 200µ

Dual TMJ Φ17x6cm
12s – 183µm

Compliments Dr. Don Tyndall

Pixel size versus FOV - 512 x 512 matrix



Compliments Dr. Andre Mol

Medium FOV CBCT-Dose Calculations

Medium FOV Techniques	Effective Dose in µSv	Dose as multiple of average† Panoramic Dose	Days of per capita back-ground*	Probability of x in a million fatal cancer‡
CB Mercuray – "Panoramic" FOV	560	35	68	30.8
Classic i-CAT – Standard scan	69	4	8	3.8
Next Generation i-CAT Landscape mode	87	5	11	4.8
Galileos – (default exposure)	70	4	9	3.9
SCANORA 3D – large FOV	76	5	9	4.2
Newtom VG	109	7	13	6.0
CB-500 – extended diameter scan	89	6	11	4.9
Kodak 9500 9 cm x 15 cm (medium adult)	98	6	12	5
Somaton 64 MDCT	860	53	105	47.3
Somaton 64 MDCT w/ CARE Dose 4D	534	33	65	29.4

*3,000 uSv, NCRP Report No. 145, 2003 †Average of 5 units ‡dose in uSv x 5.5×10^{-2}

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12X

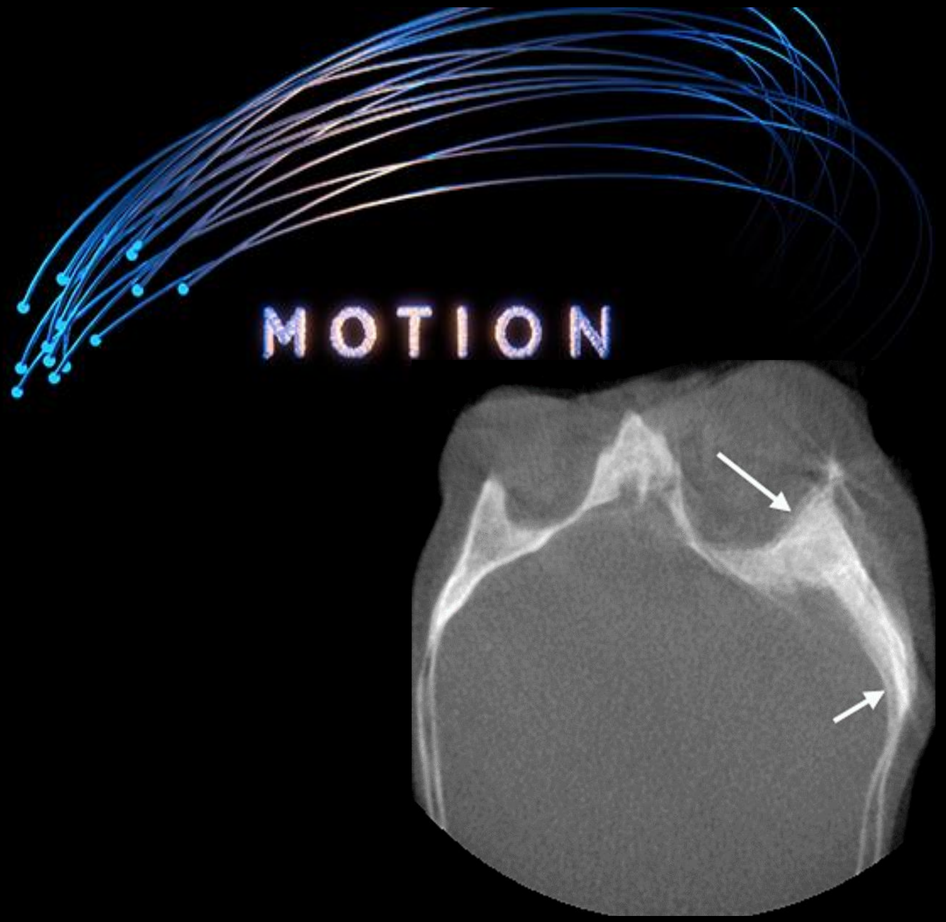
Compliments Dr. John Ludlow

Poor Image Quality

Scan time and Patient Motion

Proper patient stabilization

Involuntary motion

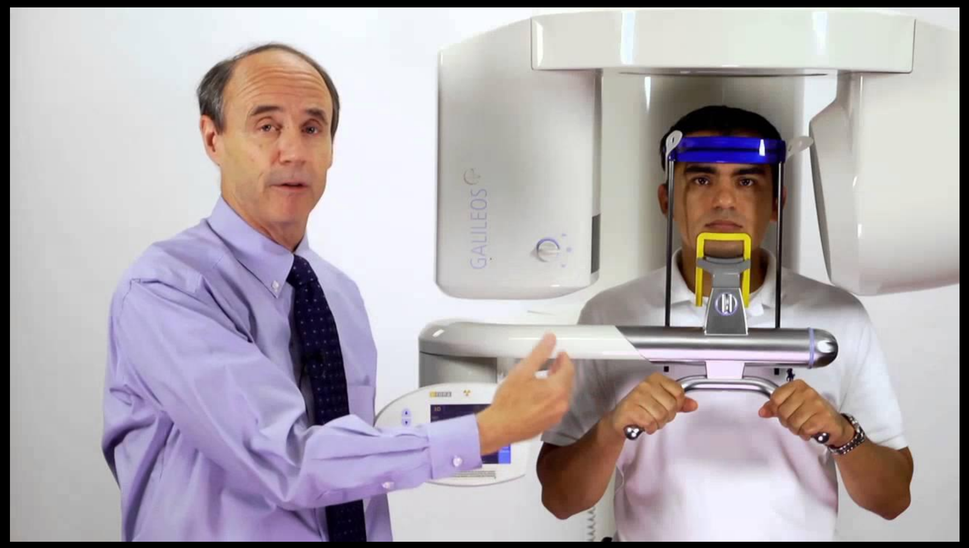


CBCT

Management Plan

Training

- Acquisition
- Interpretation



Training

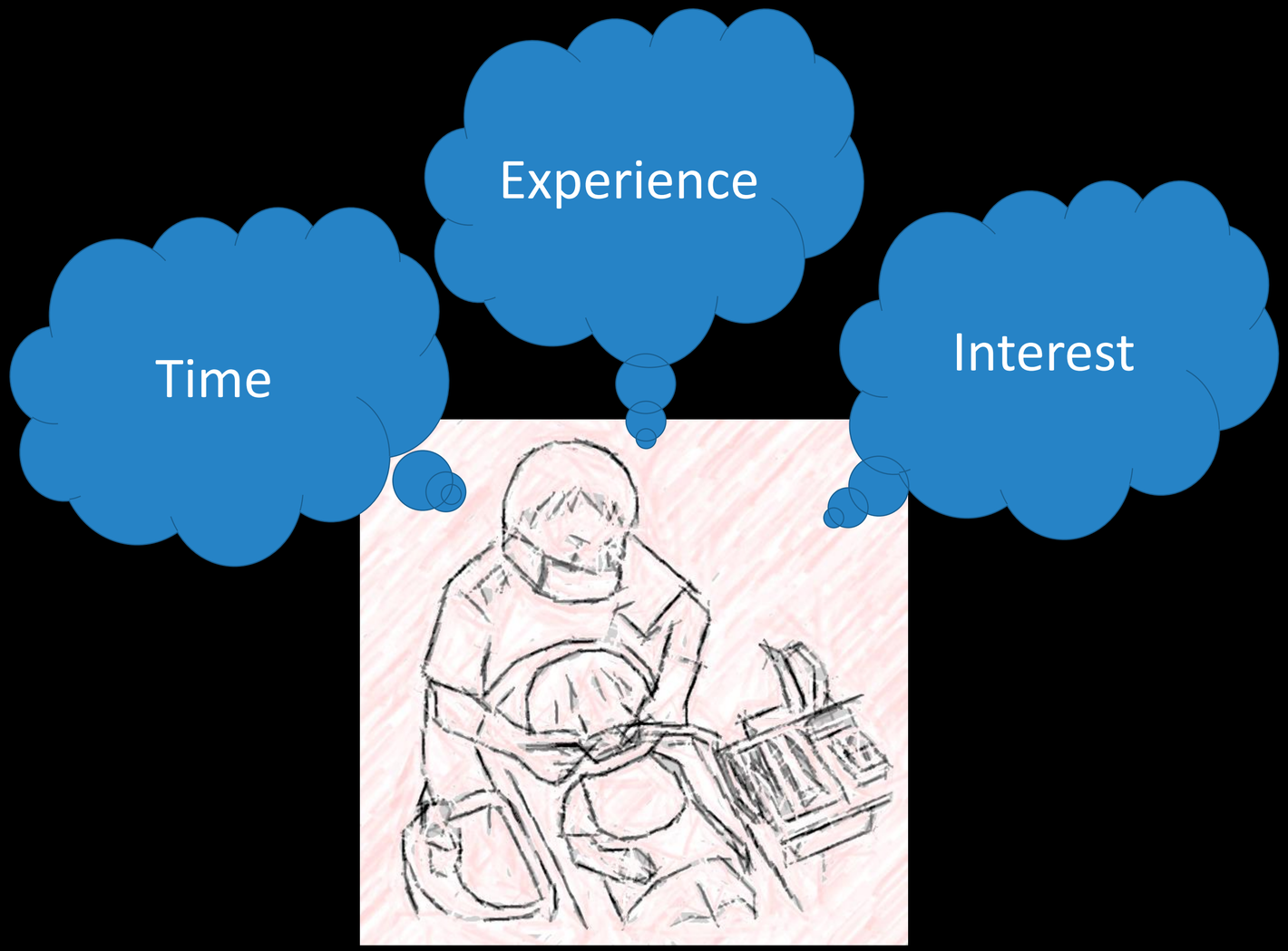
- Acquisition
- Interpretation

✓ Detailed review of the area of interest.

✓ Review of the remainder of the structures captured.

Training

- Acquisition
- Interpretation



Training

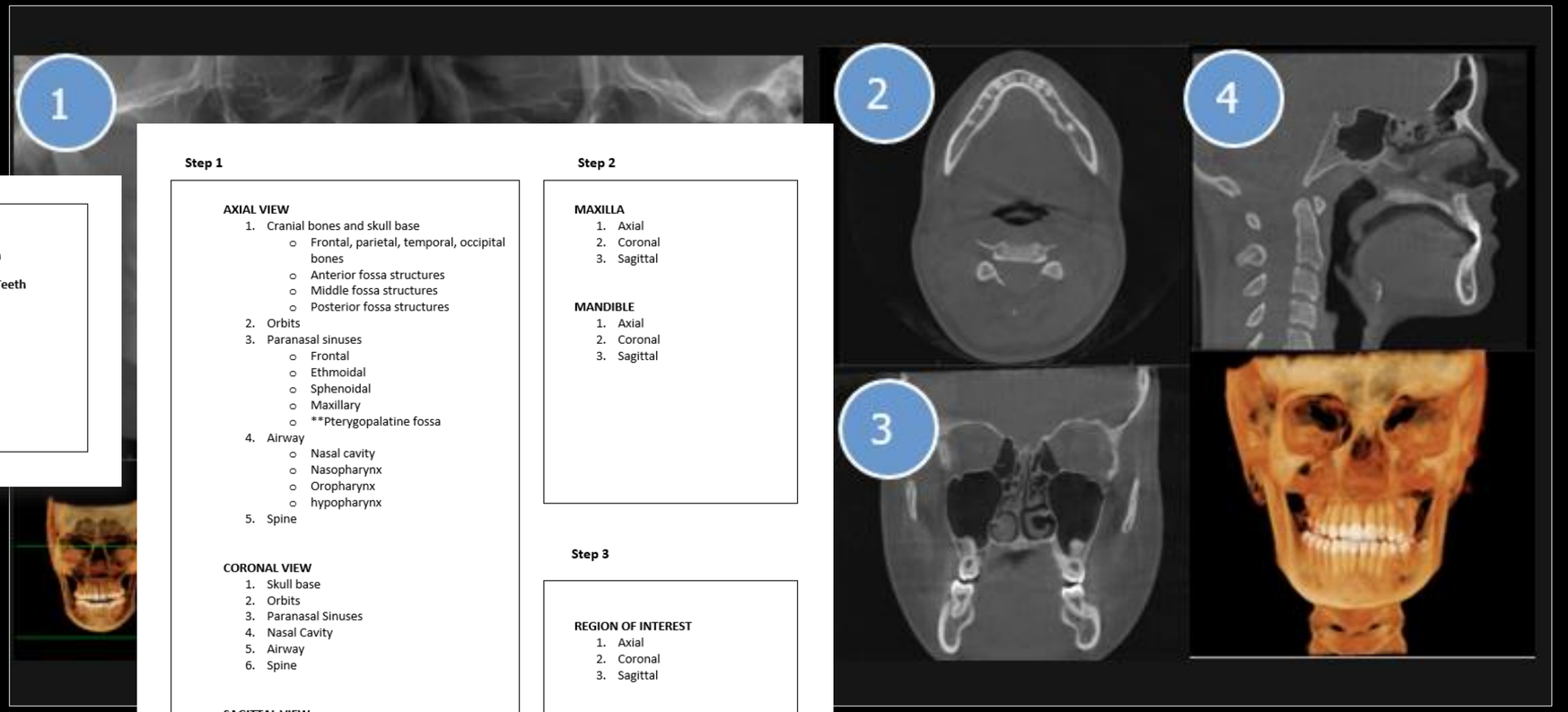
- Acquisition
- Interpretation

1. Develop a Systematic Review Process
2. Recognize Normal Anatomy
3. Use Symmetry
4. Recognize Radiographic Signs
5. Categorize disease and/or abnormalities

Training

- Acquisition
- Interpretation

Systematic Review



TEMPLATE

- ☐ Maxilla and Maxillary Teeth
- ☐ Mandible and Mandibular Teeth
- ☐ Nose and Paranasal Sinuses
- ☐ TMJs
- ☐ Neck and Cervical Spine
- ☐ Skull Base

Step 1

AXIAL VIEW

1. Cranial bones and skull base
   - Frontal, parietal, temporal, occipital bones
   - Anterior fossa structures
   - Middle fossa structures
   - Posterior fossa structures
2. Orbits
3. Paranasal sinuses
   - Frontal
   - Ethmoidal
   - Sphenoidal
   - Maxillary
   - **Pterygopalatine fossa
4. Airway
   - Nasal cavity
   - Nasopharynx
   - Oropharynx
   - hypopharynx
5. Spine

CORONAL VIEW

1. Skull base
2. Orbits
3. Paranasal Sinuses
4. Nasal Cavity
5. Airway
6. Spine

SAGITTAL VIEW

1. Skull base
2. Orbits
3. Paranasal Sinuses
4. Nasal Cavity
5. Airway
6. Spine

Step 2

MAXILLA

1. Axial
2. Coronal
3. Sagittal

MANDIBLE

1. Axial
2. Coronal
3. Sagittal

Step 3

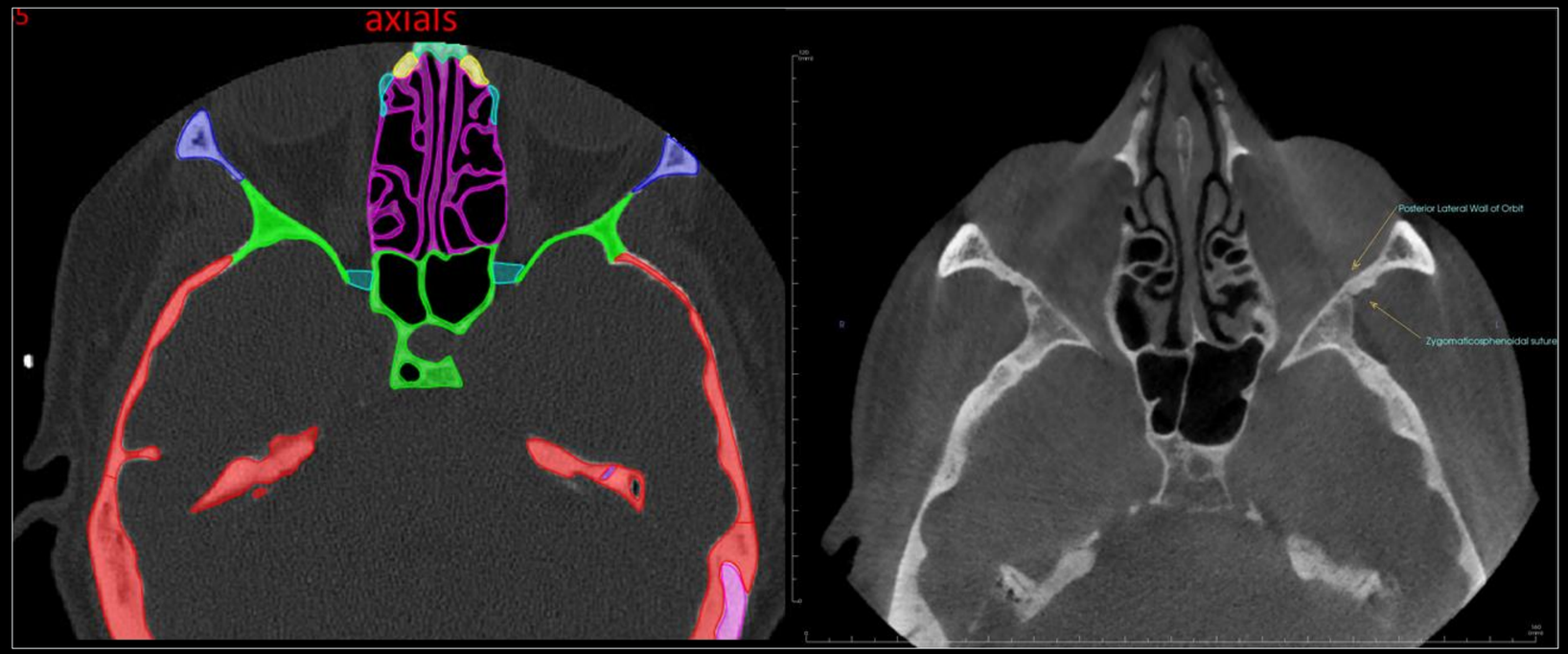
REGION OF INTEREST

1. Axial
2. Coronal
3. Sagittal

Management Plan

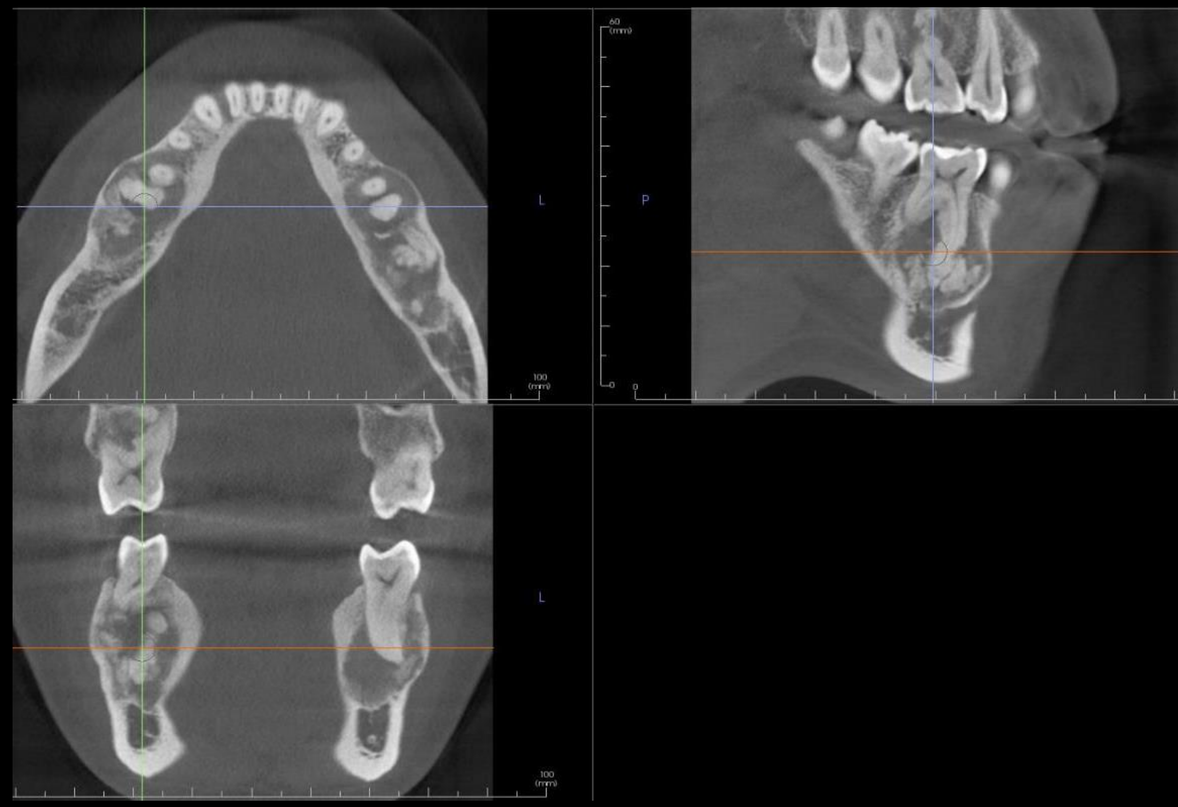
Training

- Acquisition
- Interpretation
  - ✓ Identification
  - ✓ Asymmetry



Training

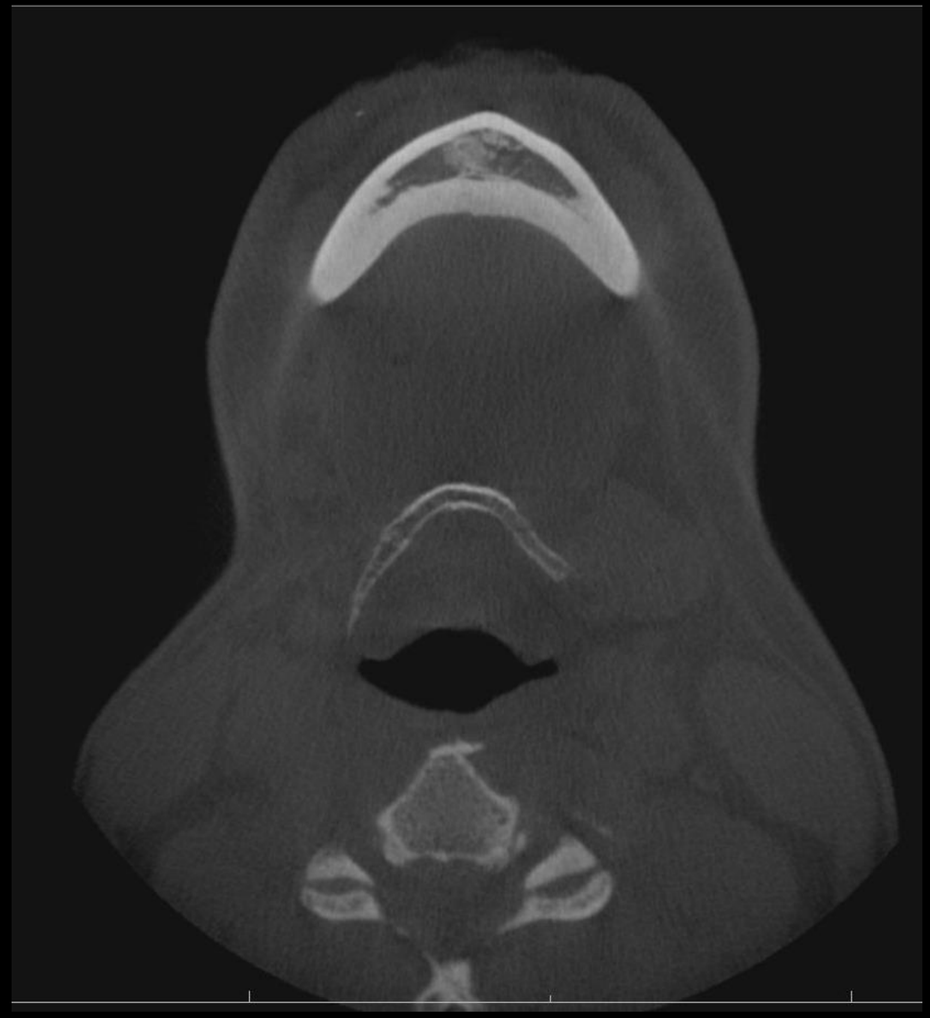
- Acquisition
- Interpretation
  - ✓ Identification
  - ✓ Asymmetry
  - ✓ Change is size, shape, density
  - ✓ Alteration in cortical or cancellous bone



Training

- Acquisition
- Interpretation

  - ✓ Soft tissues
    - ✓ Extensive destruction

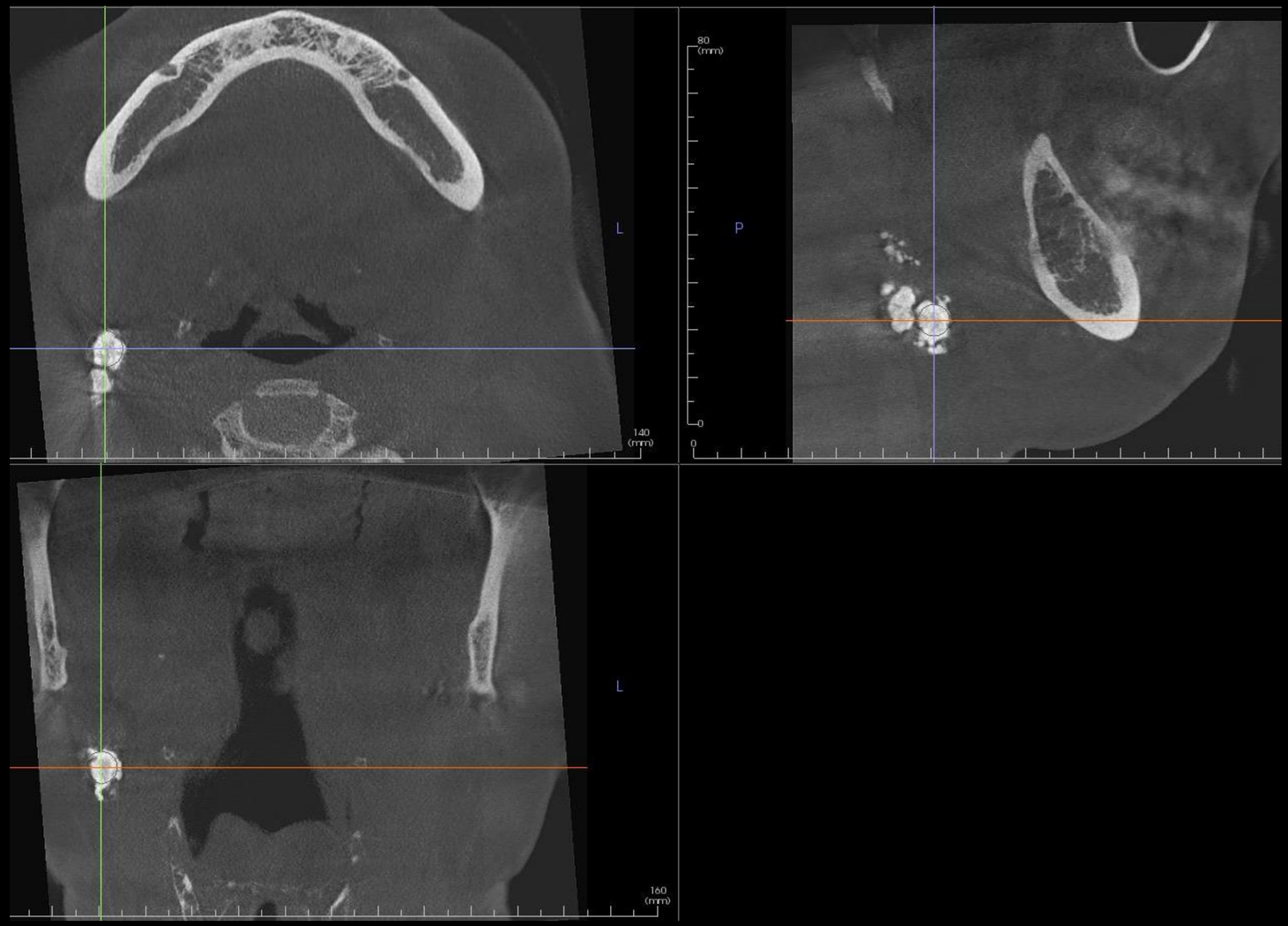


CBCT limitation: showing small differences in density

Training

- Acquisition
- Interpretation

  - ✓ Soft tissues
    - ✓ Extensive destruction
    - ✓ Calcifications

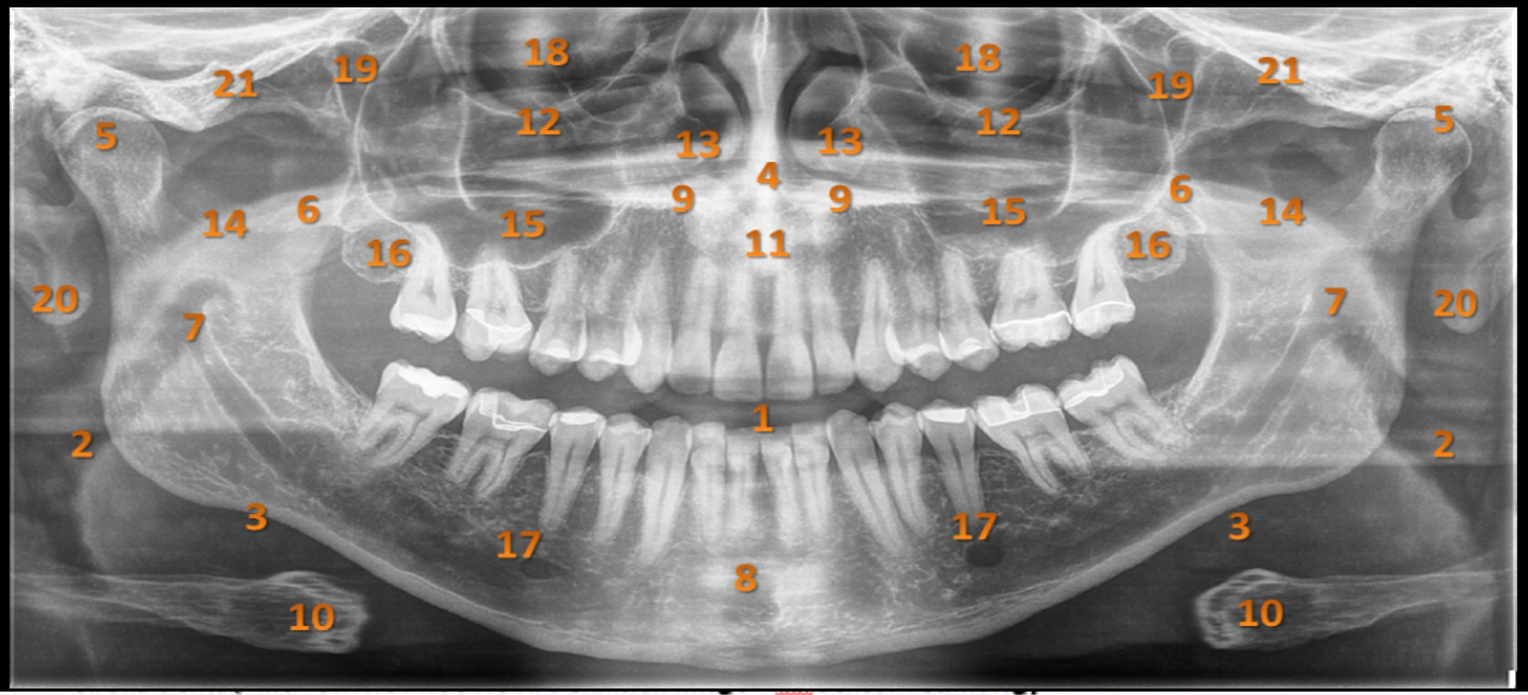


CBCT limitation: showing small differences in density

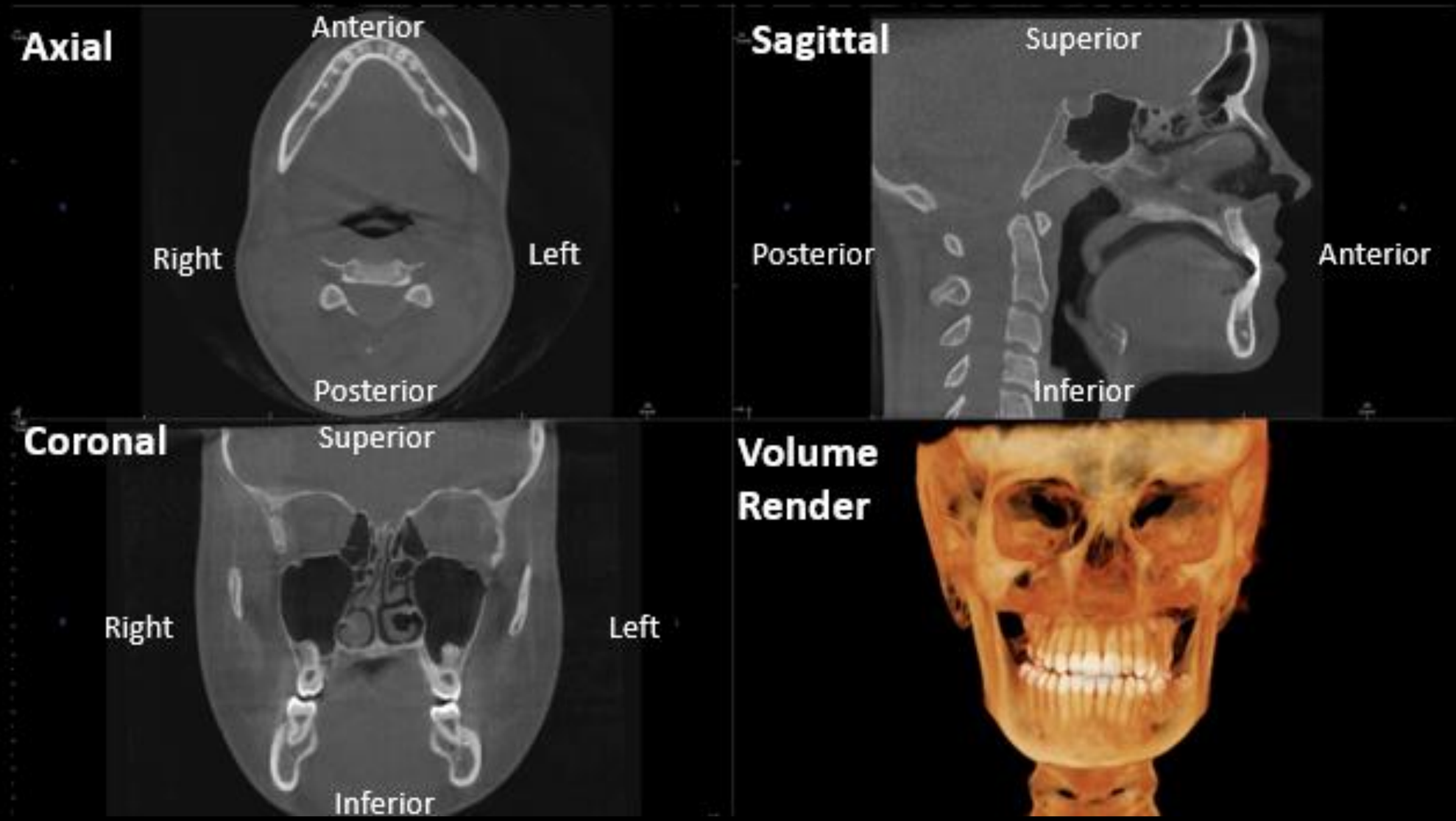
CBCT

Anatomy

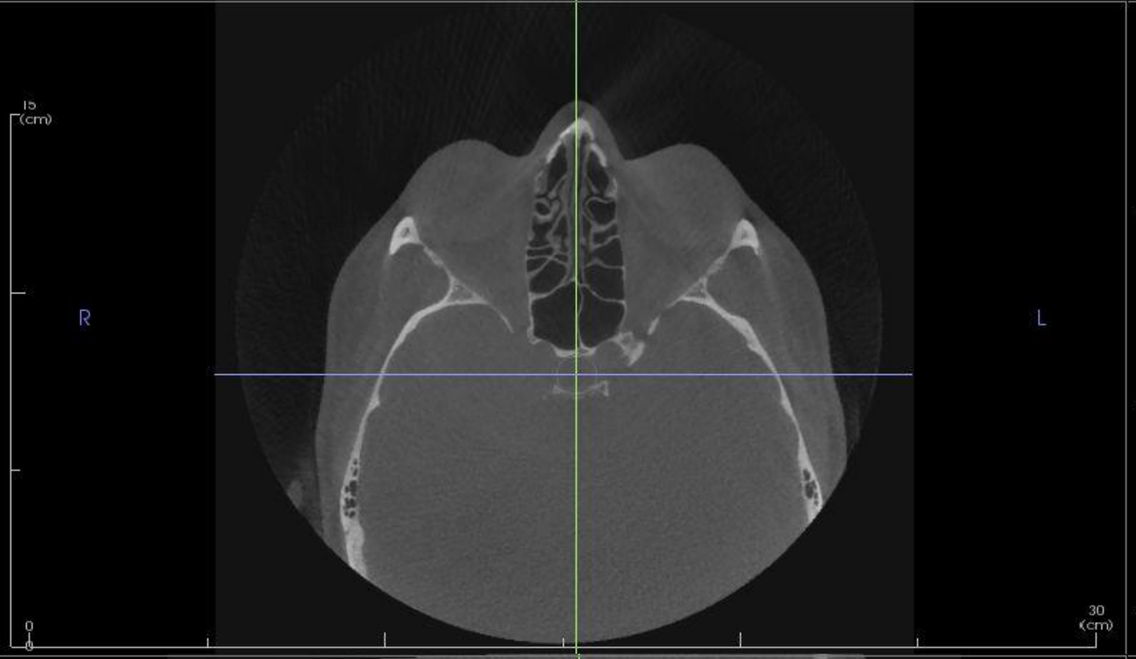
Panoramic Landmarks

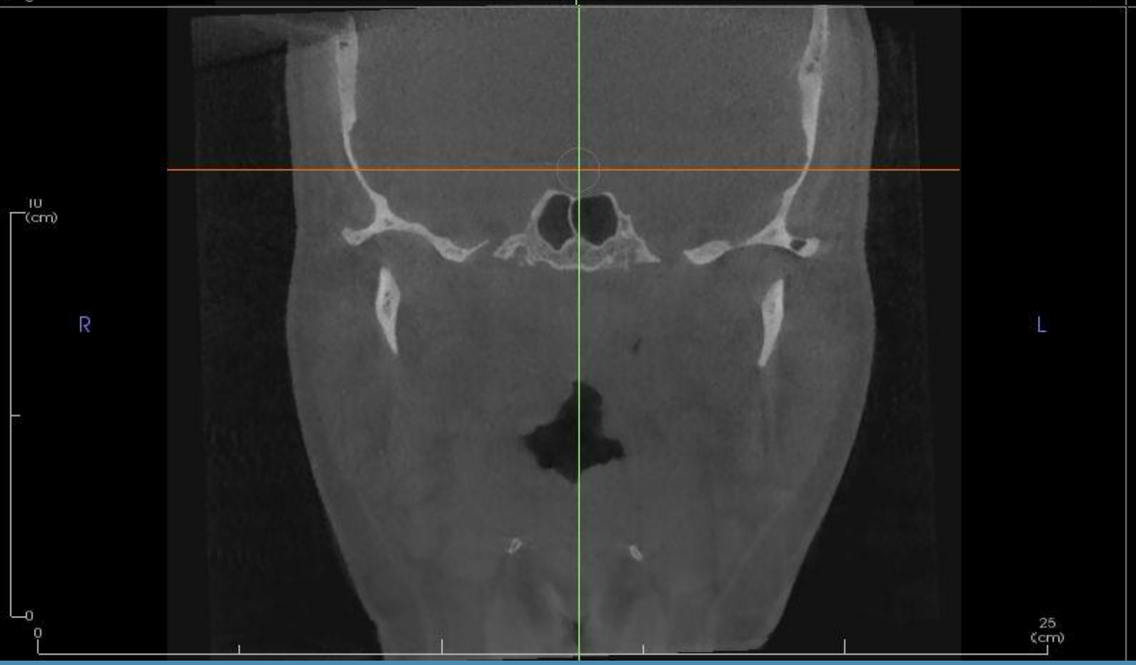


1 Air space/lips open	8 Genial tubercles	15 Maxillary sinus
2 Air space/swallow	9 Hard palate	16 Maxillary tuberosity
3 Angle of mandible	10 Hyoid	17Mental foramen
4 Anterior nasal spine	11 Incisive canal	18 Orbit
5 Condylar head (with TMJ expanded)	12 Infraorbital margin	19 Pterygomaxillary fissure
6 Coronoid process	13 Lower turbinate	20 Shadow of outer ear
7 Entrance of mandibular canal	14 Mandibular notch	21 Zygomatic arch


Axial
Anterior
Right
Left
Posterior
Sagittal
Superior
Posterior
Anterior
Inferior
Coronal
Superior
Right
Left
Inferior
Volume
Render

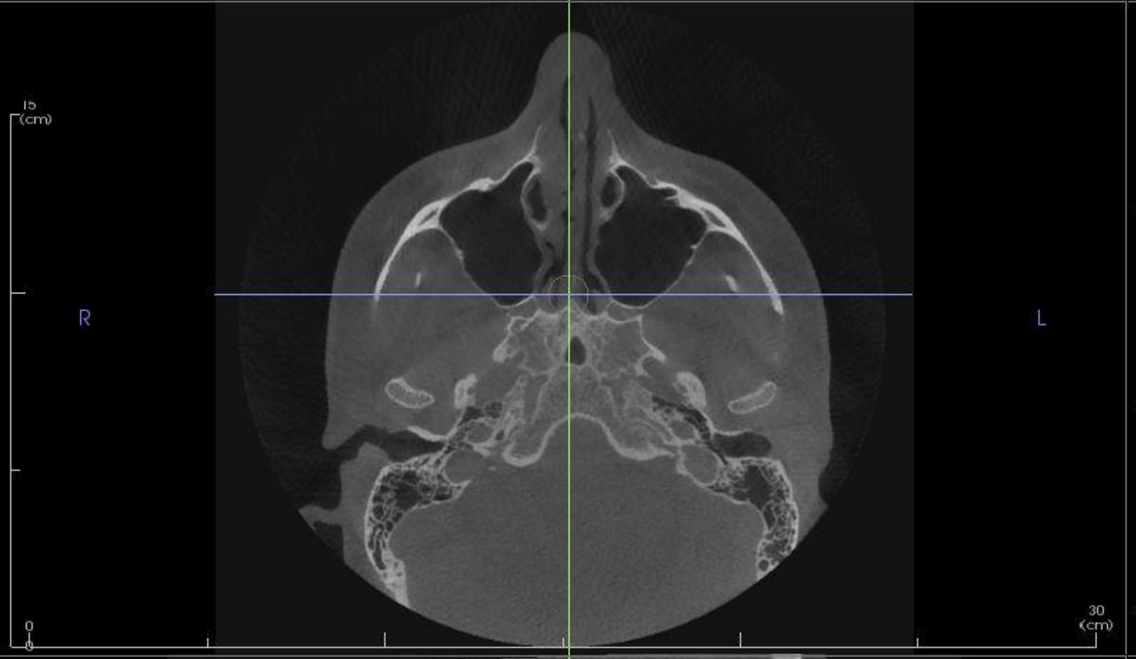
Anatomy

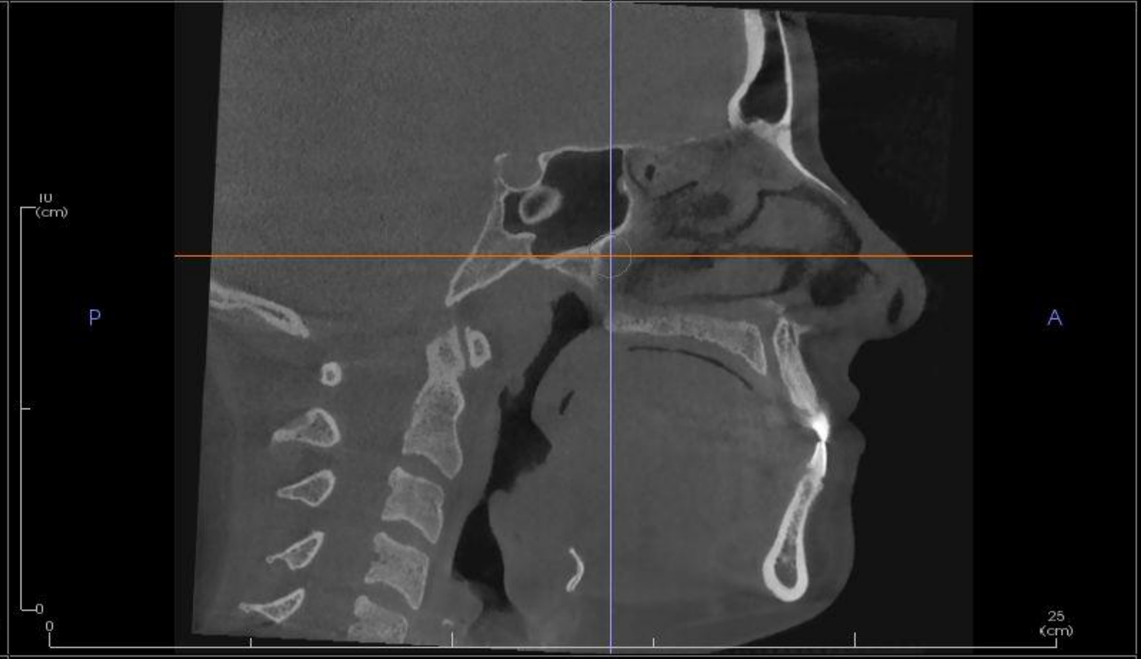




Level Sella Turcica

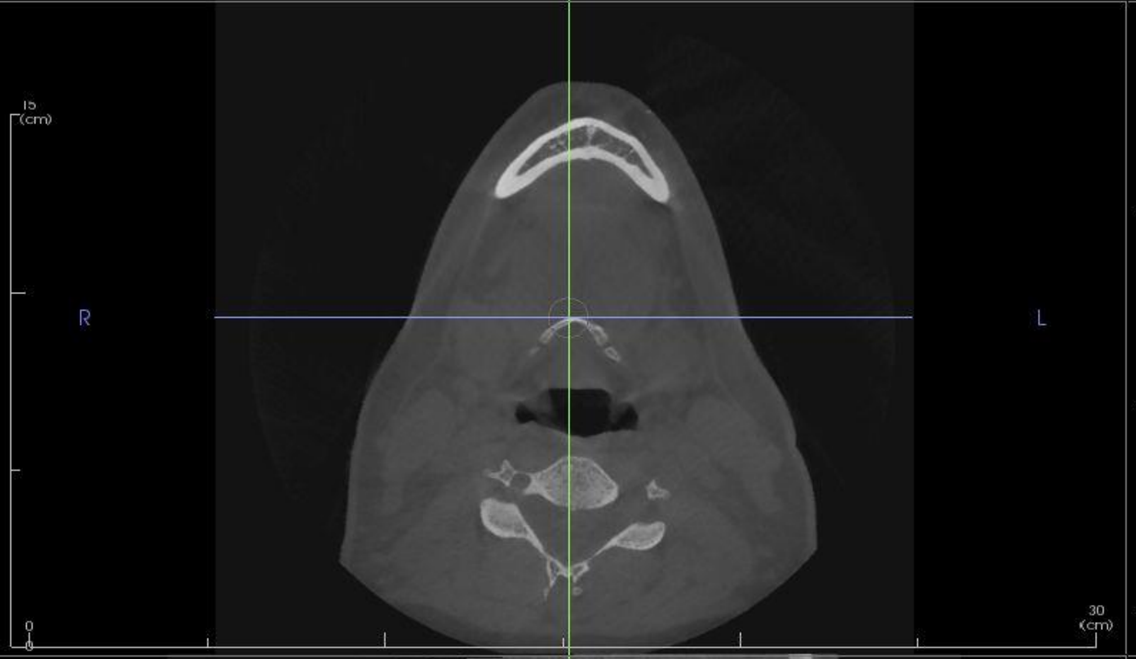
orbits
zygomatic bone
ethmoid sinuses
middle cranial fossa





Level Nasal Fossa

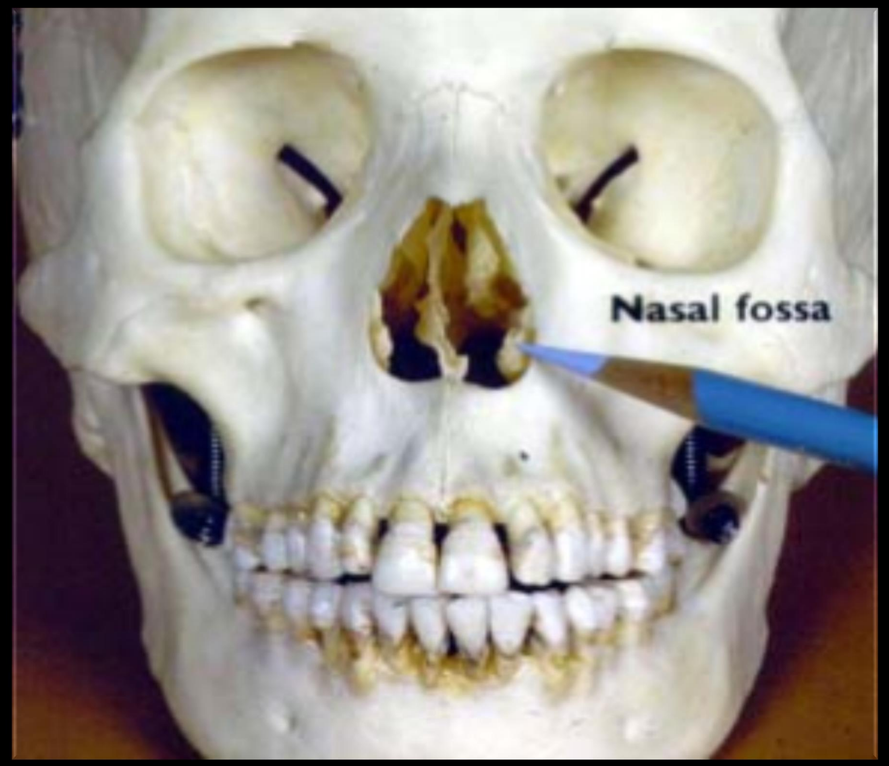
maxillary sinuses
nasolacrimal ducts
pterygopalatine fossa/pterygomaxillary fissure
mandibular condyles
clivus
posterior cranial fossa

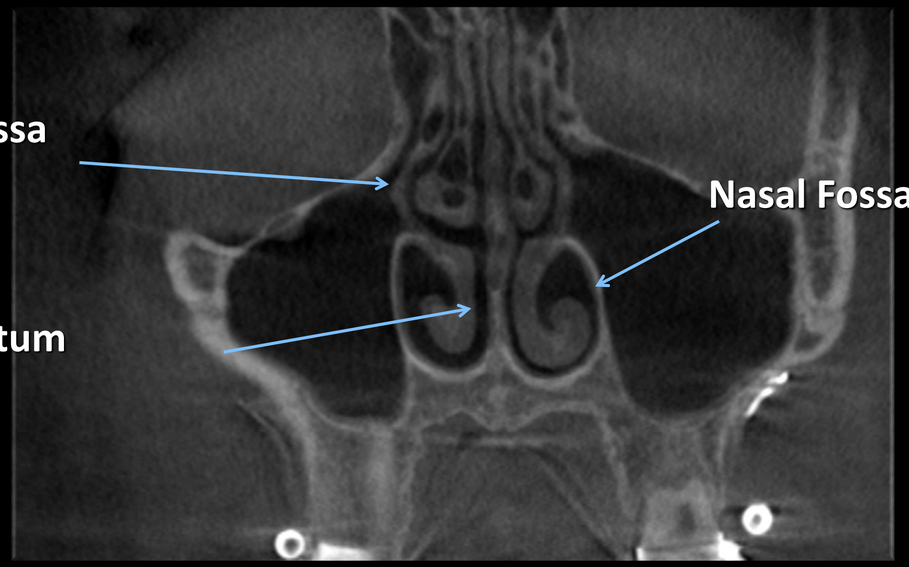


Level hyoid bone

cervical vertebrae C3 and C4
submandibular glands
hypopharynx

Nasal Fossa and Septum

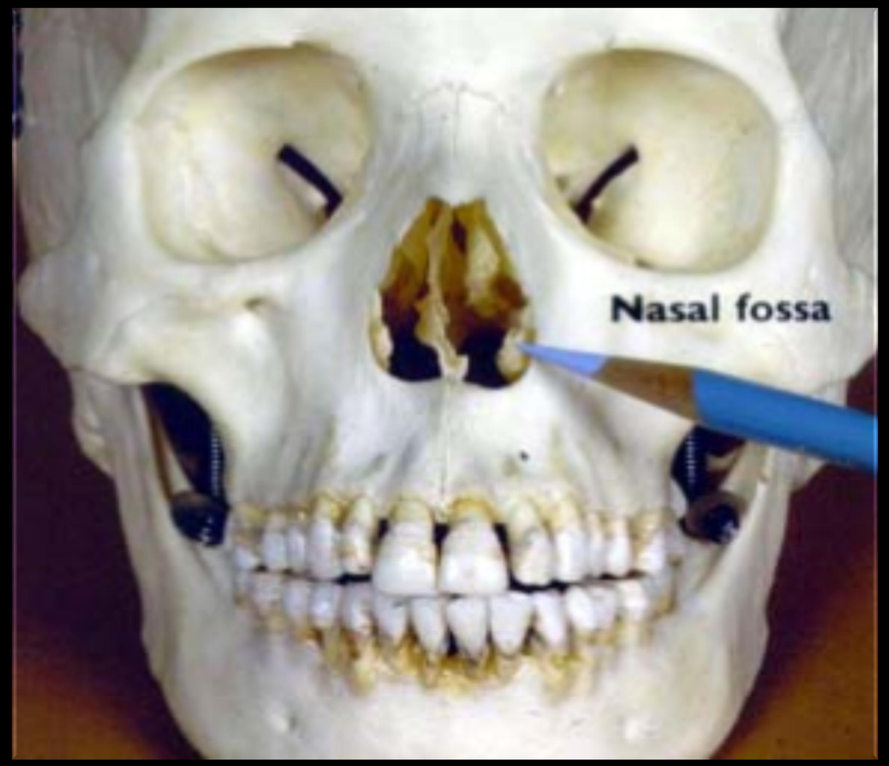




4 Functions

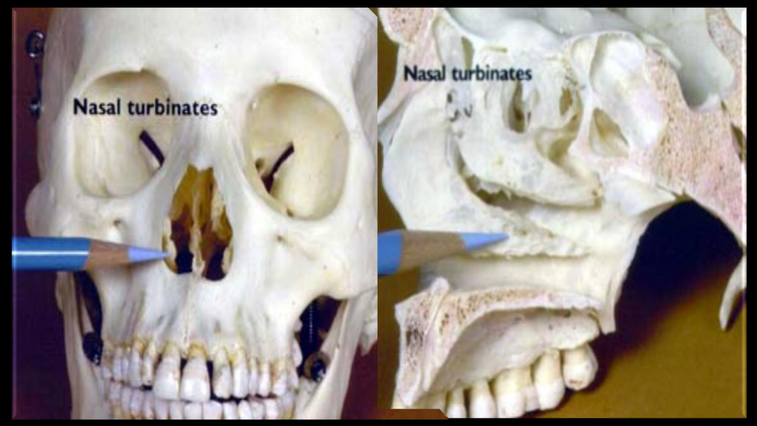
- Warms and humidifies air
- Removes and traps pathogens
- Responsible for sense of smell
- Drains and clears the paranasal sinuses

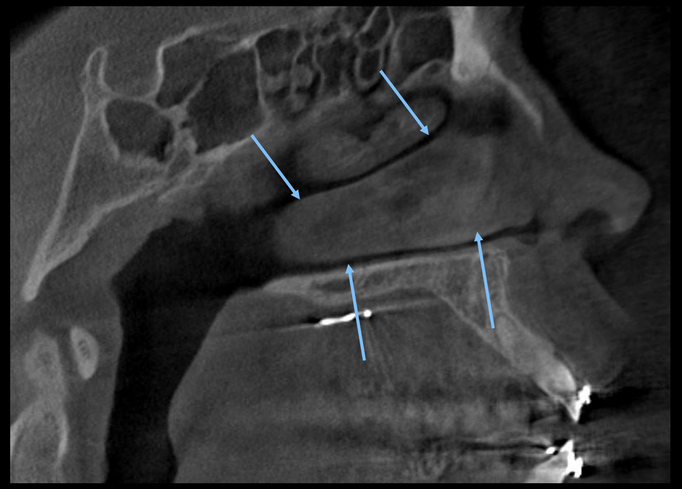
Nasal Fossa and Septum

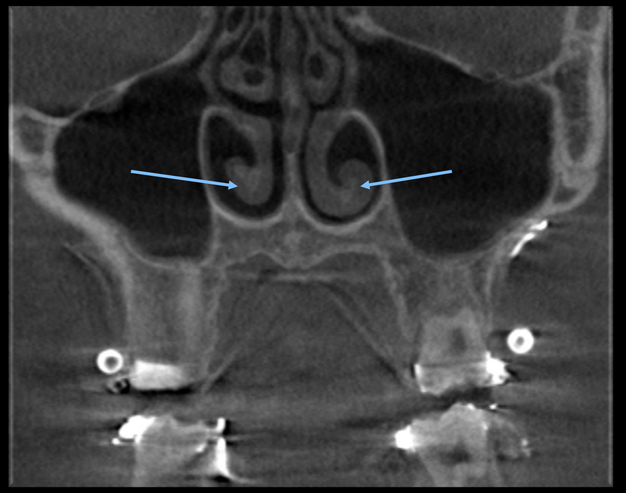


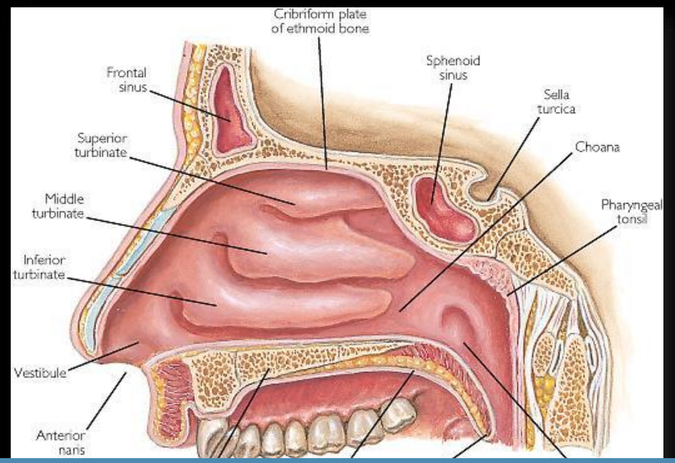
Nasal Septum

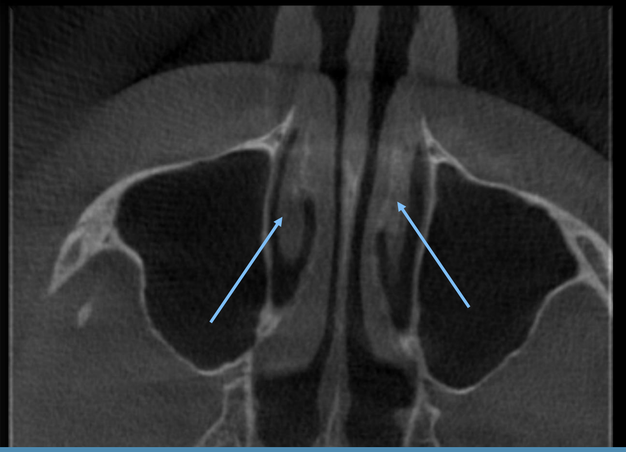
Nasal Turbinates



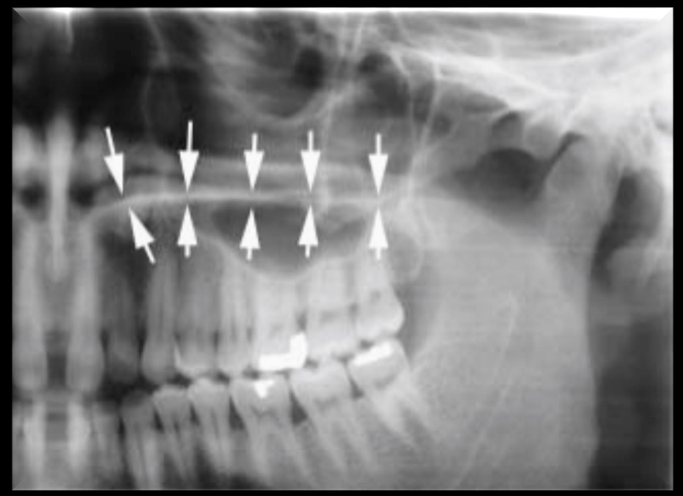


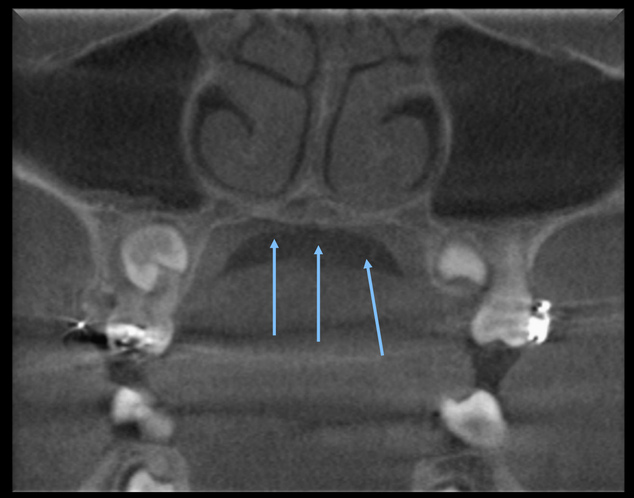


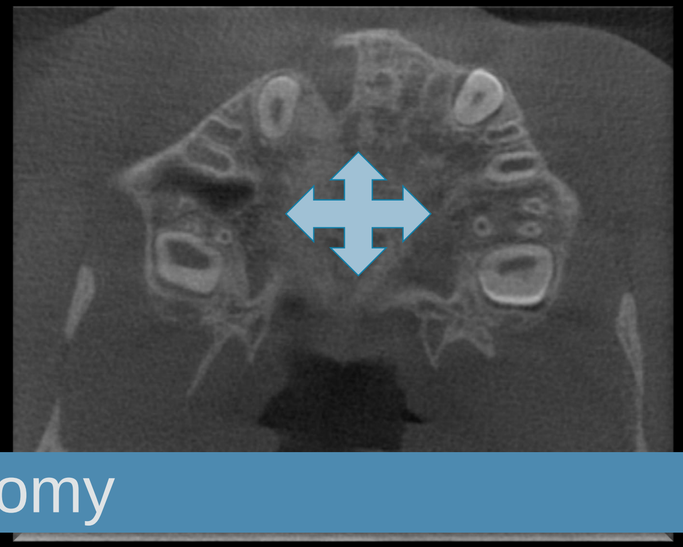


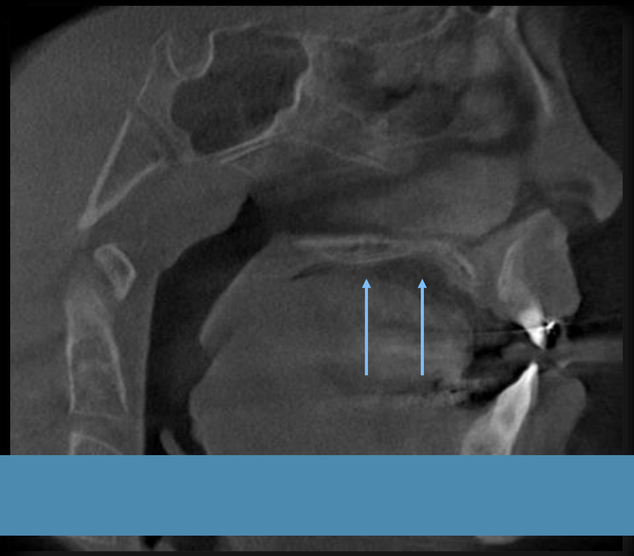


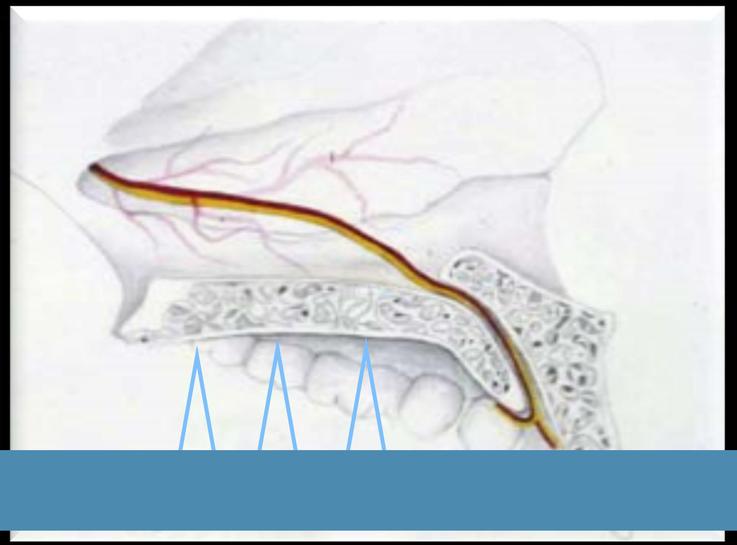
Hard Palate/Floor of Nasal Fossa



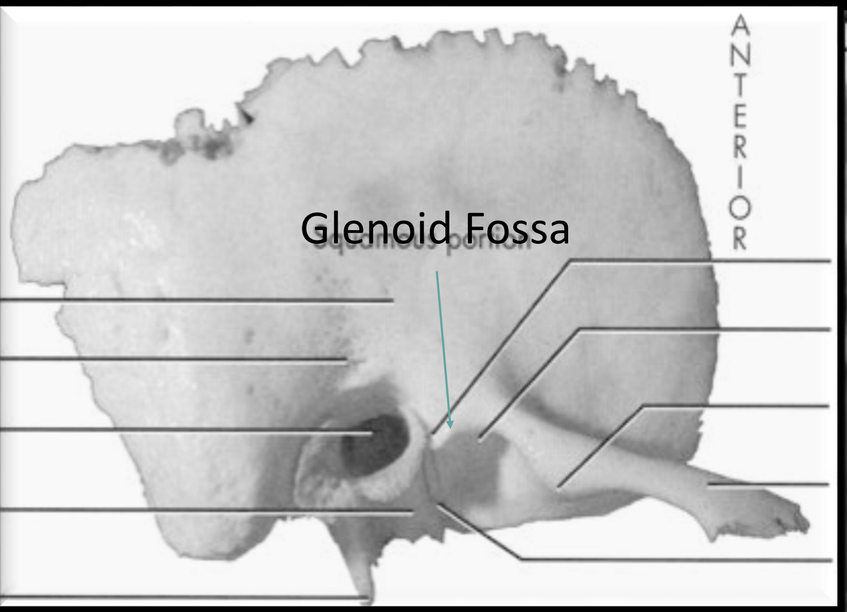


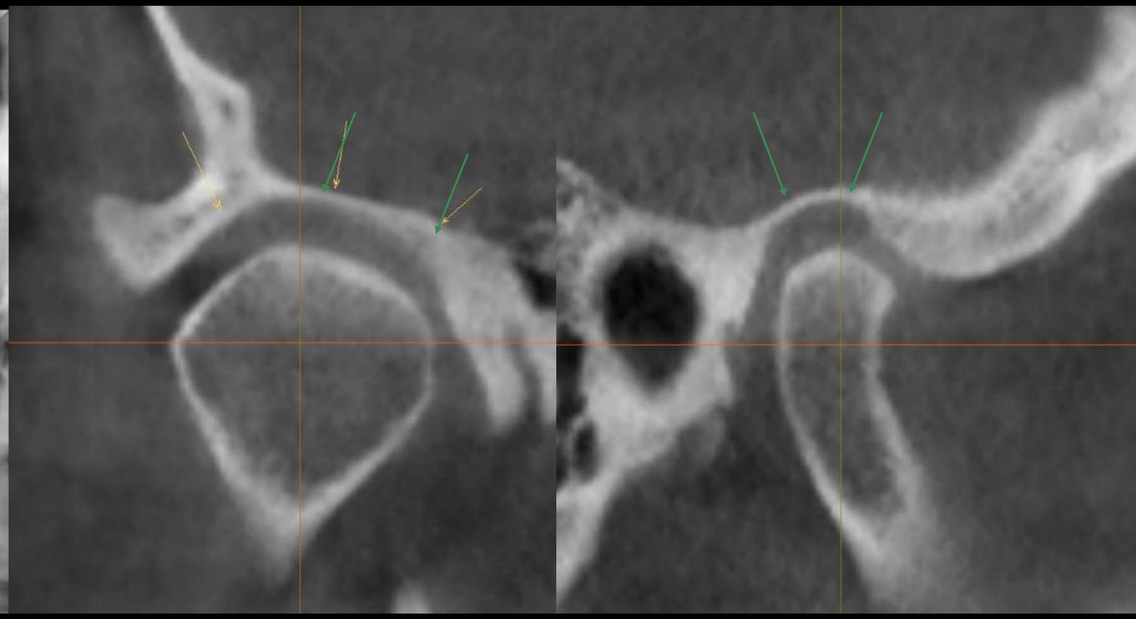






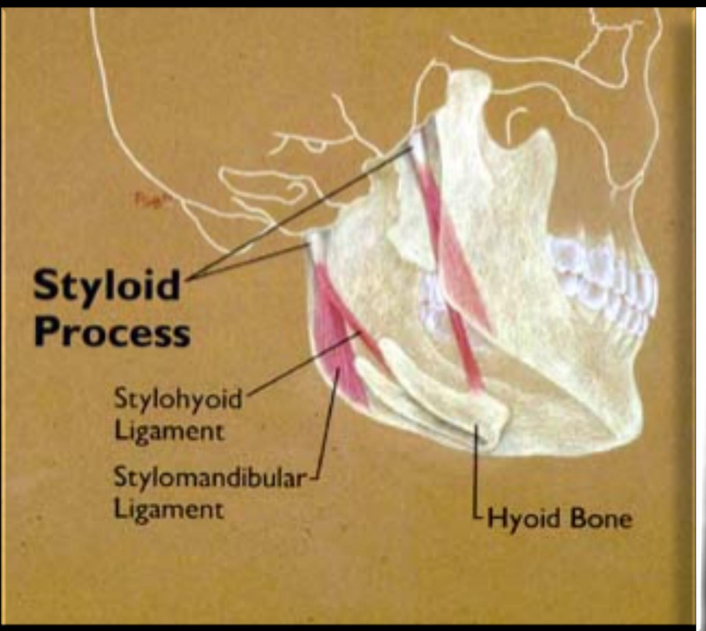
Glenoid Fossa

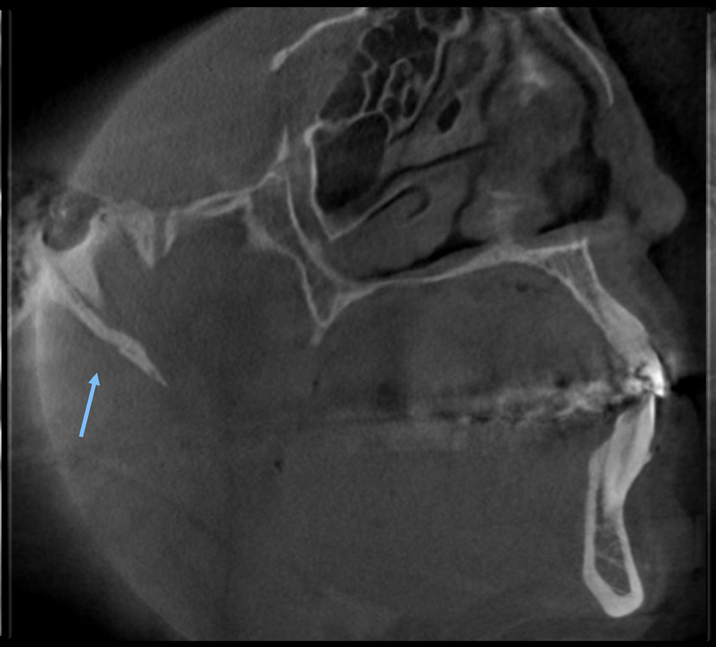


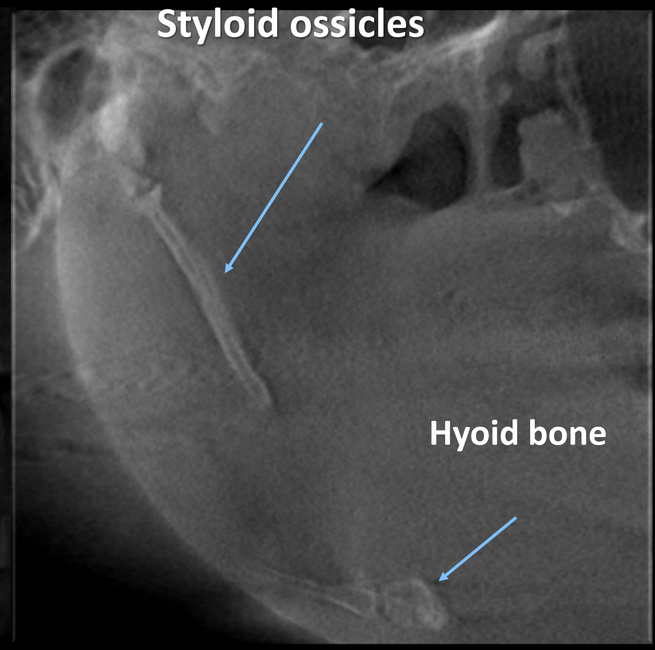


Styloid Process

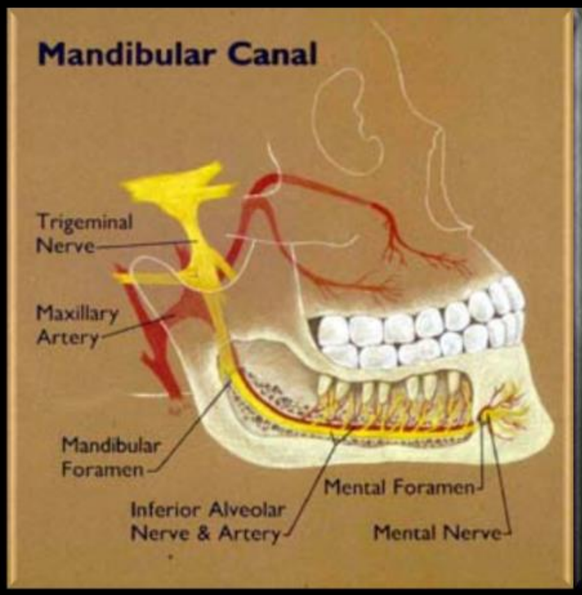
Styloid ossicles

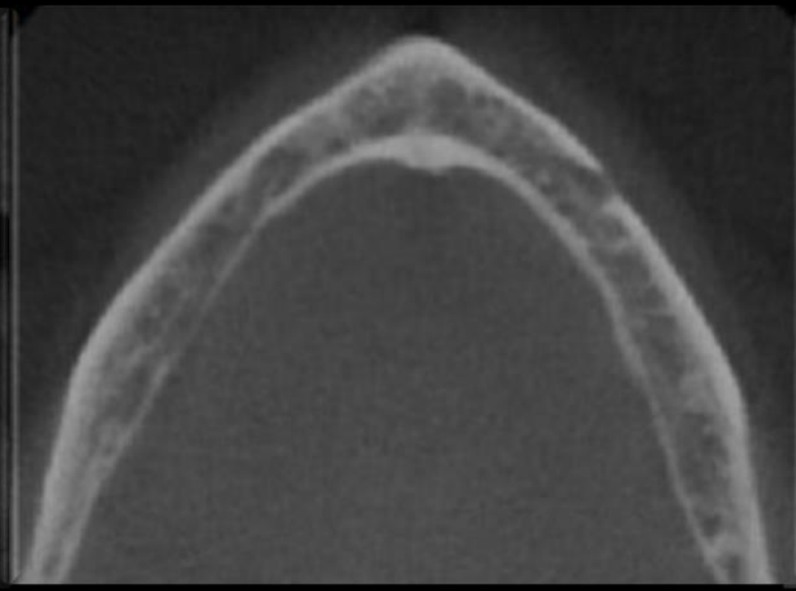




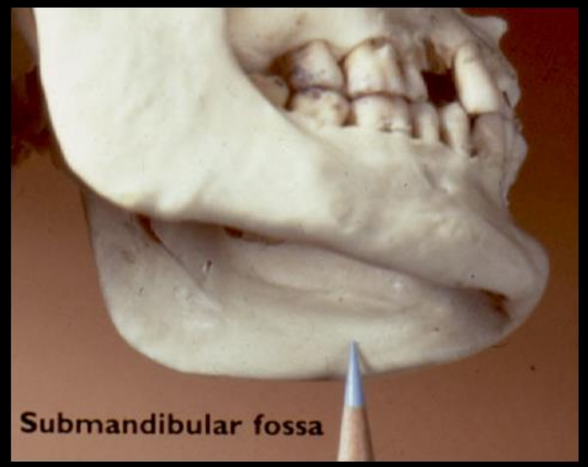


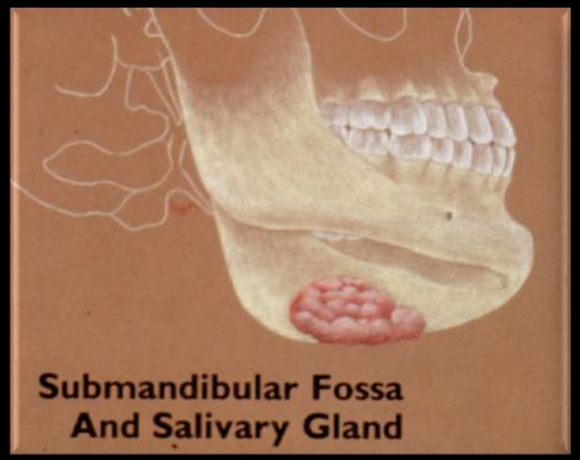
Mandibular Canal

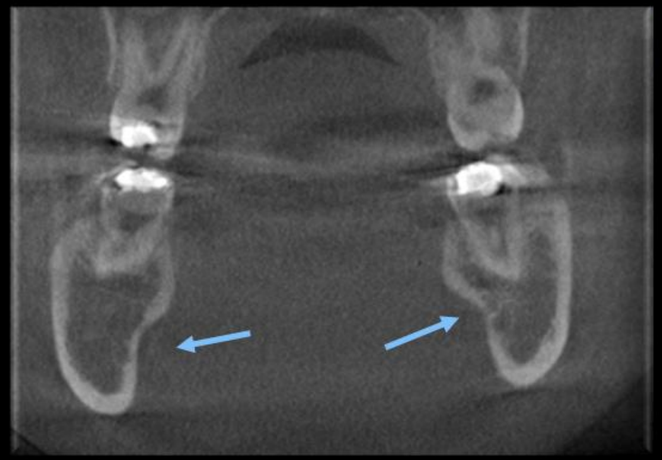




Submandibular Fossa







CBCT

Incidental Findings

Incidental findings

Findings not associated with the purpose of the exam

Edwards et al. J Am Dent Assoc 2013; 144(3): 161-170. systematic review

- ✓ Frequency per scan 1 - 3
- ✓ Number of scans with incidental findings 25 – 93%

Price et al. Clin Oral Implants Res 2012; 23(11):1261-1268.

- ✓ Frequency per scan 3
- ✓ 272 scans with 881 incidental findings
  - ✓ Airway and paranasal sinuses 35%
  - ✓ Soft tissue calcifications 20%
  - ✓ Bone pathology 17.5%
  - ✓ TMJ 15.4%
  - ✓ Endodontic 11.3%

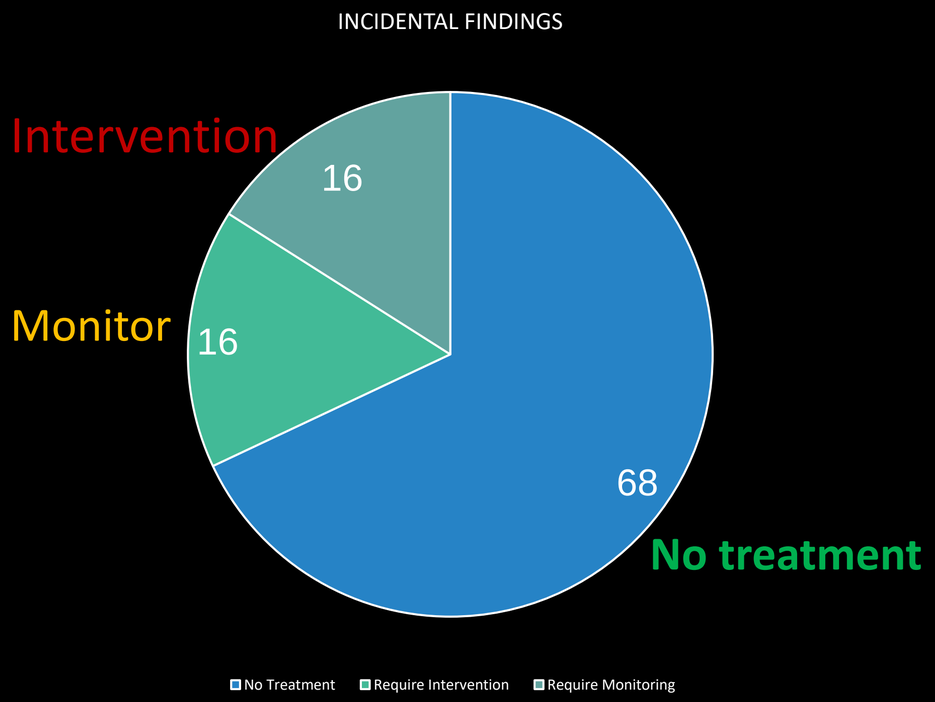
Incidental findings

Findings not associated with the purpose of the exam

Most incidental findings require no treatment or follow up.

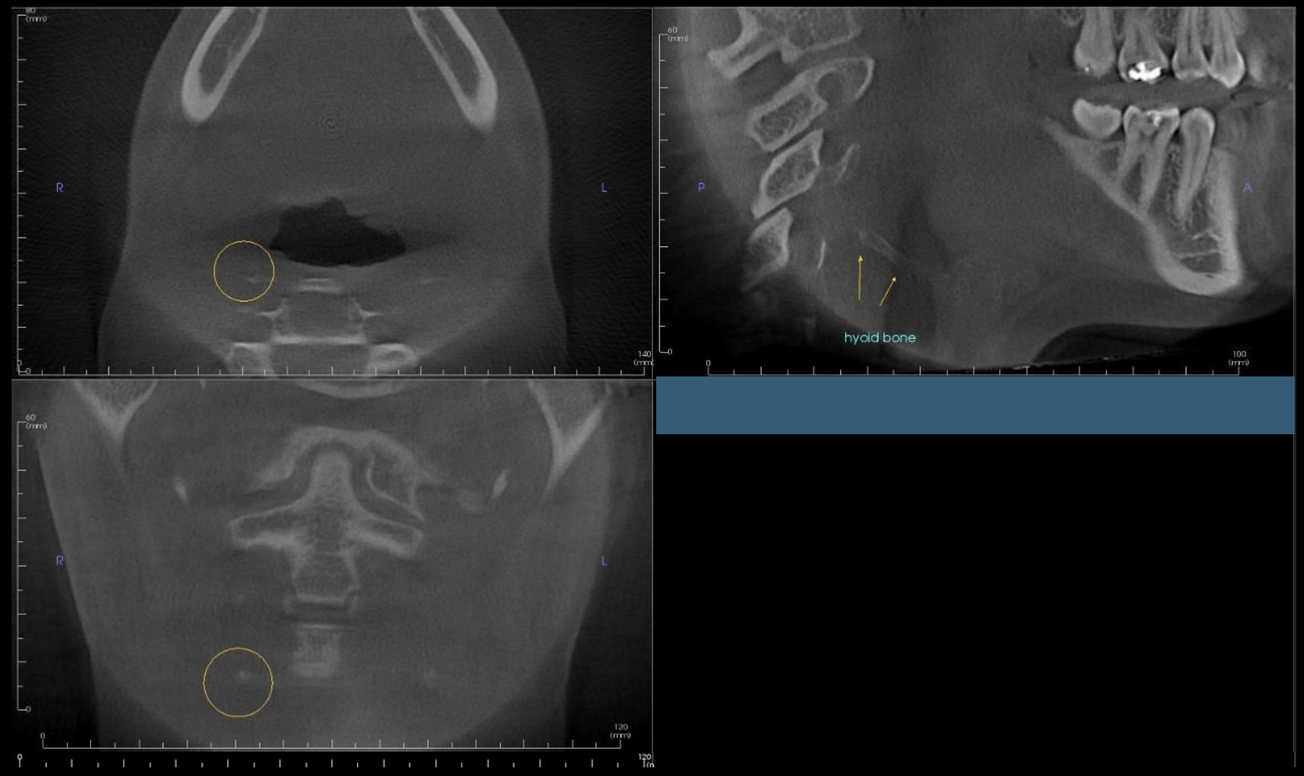
Lack of recognition may have severe consequences.

Lack of training may lead to higher false-positives.



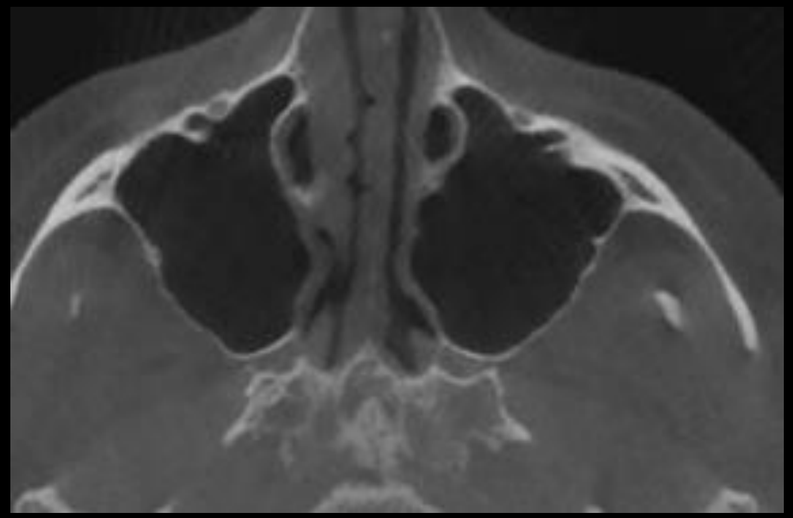
Carotid Space Calcifications

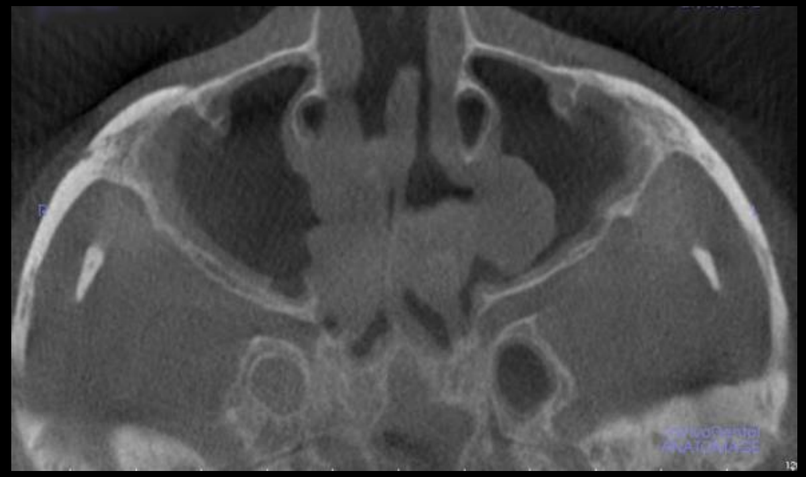
- Deposits of fat, cholesterol, inflammatory cells within artery
- Progressive narrowing reduces blood flow
- Well-defined, high density, ring-like opacities



Paranasal Sinuses

- Mucosal thickening
- Thickened borders





Paranasal Sinuses

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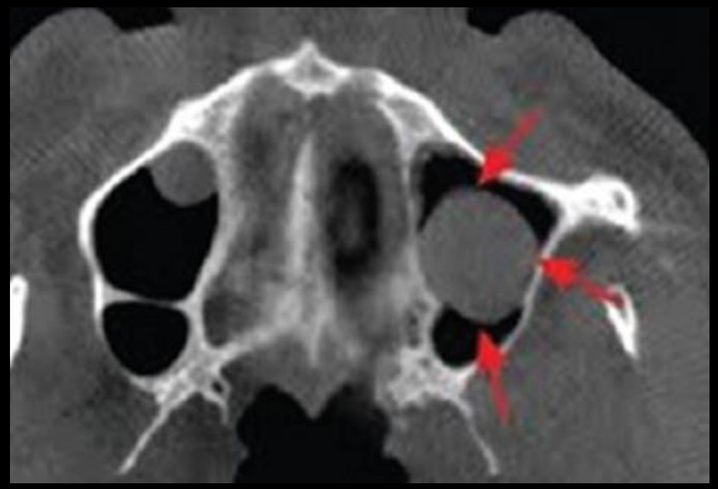

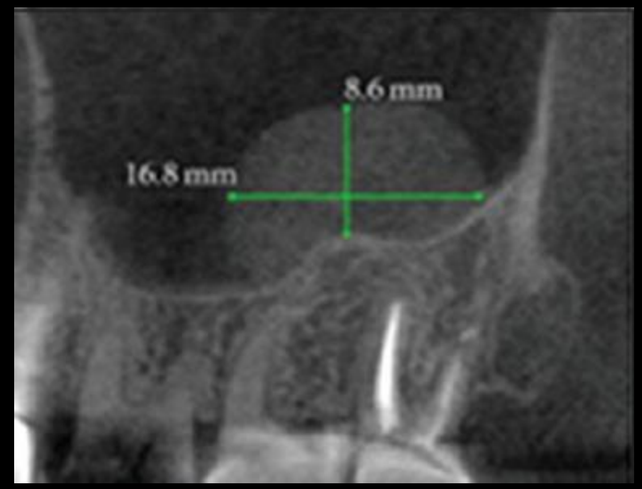

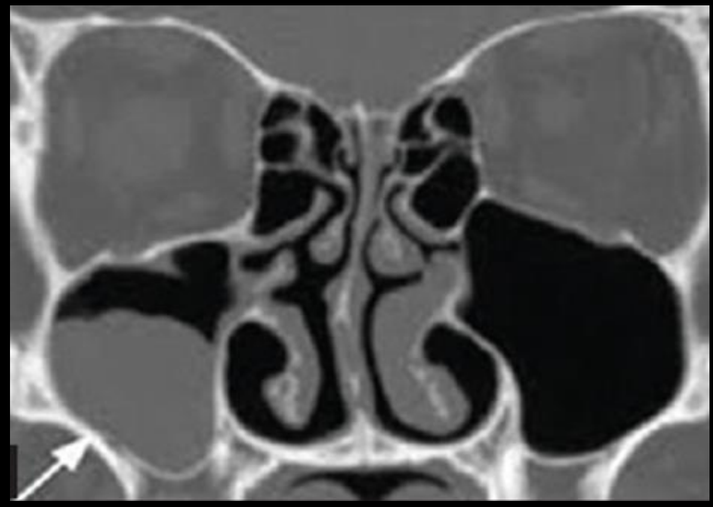

Jafari-Pozve, N. et al Indian Journal of Dental Research; 2018 (29): 4; 410-413

Paranasal Sinuses

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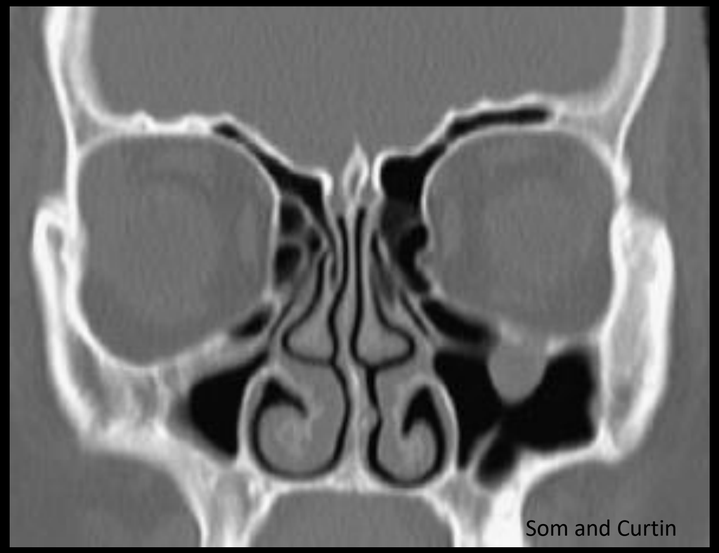
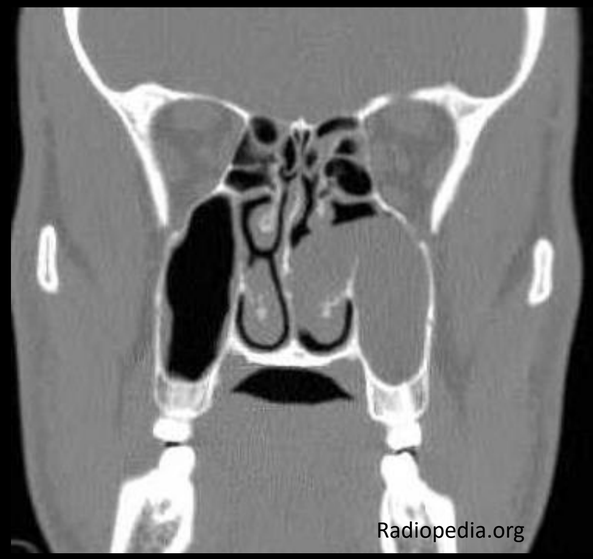


Intrasinus polyp

- Defined, soft tissue density
- Patent ostium
- No bone destruction



Antrochoanal polyp

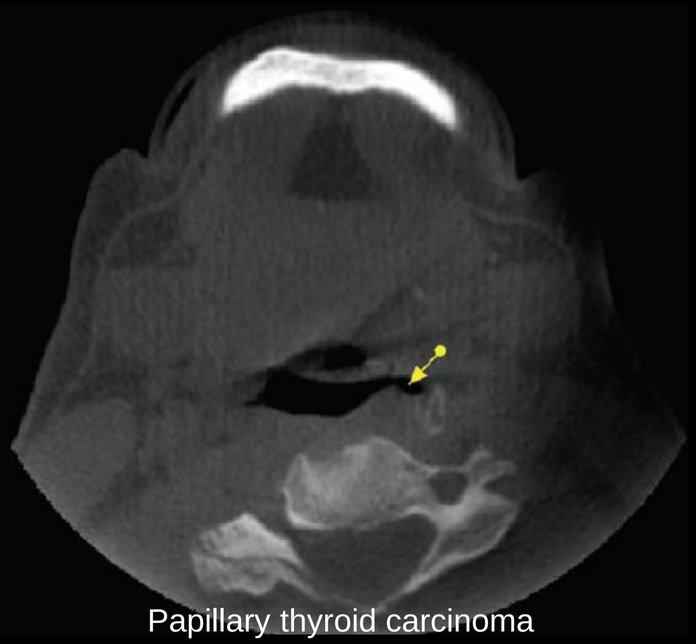
- Defined, soft tissue density
- Widened ostium
- Extends posteriorly to nasopharynx
- No bone destruction

Airway Asymmetry

- May result from artifacts (breathing/swallowing during scan)
- May result from hypertrophic tonsils
- May result from benign or malignant tumors from adjacent spaces

Artifact

Hypertrophic tonsils



Papillary thyroid carcinoma

Endodontics

- Resorption

Endodontics

- Resorption

CBCT Examples…

Summary

CBCT

Reviewed features for selecting a unit

Discussed a plan for managing images

Identified basic anatomy

Demonstrated common incidental findings

Implant Treatment

- Pre-treatment site planning
- Surgical Guides
- Postoperative evaluation*

Vol. 113 No. 6 June 2012

Position statement of the American Academy of Oral and Maxillofacial Radiology on selection criteria for the use of radiology in dental implantology with emphasis on cone beam computed tomography

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A Position Paper Subcommittee of the American Academy of Oral and Maxillofacial Radiology (AAOMR) reviewed the literature since the original position statement on selection criteria for radiology in dental implantology, published in 2000. All current planar modalities, including intraoral, panoramic, and cephalometric, as well as cone beam computed tomography (CBCT) are discussed, along with radiation dosimetry and anatomy considerations. We provide research-based, consensus-derived clinical guidance for practitioners on the appropriate use of specific imaging modalities in dental implant treatment planning. Specifically, the AAOMR recommends that cross-sectional imaging be used for the assessment of all dental implant sites and that CBCT is the imaging method of choice for gaining this information. This document will be periodically revised to reflect new evidence. (Oral Surg Oral Med Oral Pathol Oral Radiol 2012;113: 817-826)

In 2000, the American Academy of Oral and Maxillofacial Radiology (AAOMR) published a position paper on the role of imaging in dental-implant treatment planning.[1] They state, "After reviewing the current literature, the AAOMR recommends that some form of cross-sectional imaging be used for implant cases and that conventional cross-sectional tomography be the method of choice for gaining this information for most patients receiving implants." Since then, the introduction and increased use of maxillofacial cone beam computed tomography (CBCT) has had an impact on the availability of digital, cross-sectional imaging and expanded imaging clinical applications for dental-implant imaging.[2-18]

In 2008, the Executive Council (EC) of the AAOMR published an executive opinion statement on the performance and interpretation of CBCT in dentistry.[19] The EC proposed guidelines and principles for CBCT use in contemporary dental practice; these included practitioner responsibilities, the requirement for documentation, and the need for radiation-dose and quality-assurance optimization. If CBCT is used (as with any radiographic imaging technology), the benefits to the patient must outweigh the risks associated with exposure to ionizing radiation.

The purpose of developing imaging selection criteria for implant therapy is to identify the most appropriate imaging technology for each stage of patient care.[1] The development of selection criteria is based on review of treatment-decision and outcome-assessment studies. Although more than 10 years have passed since publication of the AAOMR position paper on dental implants,[1] studies of the clinical efficacy of cross-sectional imaging for implant planning decisions have been equivocal.[20-25]

The purpose of this document is to summarize current knowledge about maxillofacial imaging (with emphasis on CBCT) for dental, endosseous-implant therapy and to provide up-to-date radiographic selection criteria for dental implantology. The recommendations presented are not prescriptive but rather advisory and are intended to provide the dental profession with current considered opinions on the appropriate imaging for implant dentistry. The underlining goal is to maximize diagnostic efficiency while minimizing patient radiation risk.

CLINICAL CONSIDERATIONS IN SELECTION CRITERIA FOR DENTAL IMPLANTOLOGY

The diagnostic phase of dental-implant therapy and, in particular, the appropriate choice of radiographic ex-

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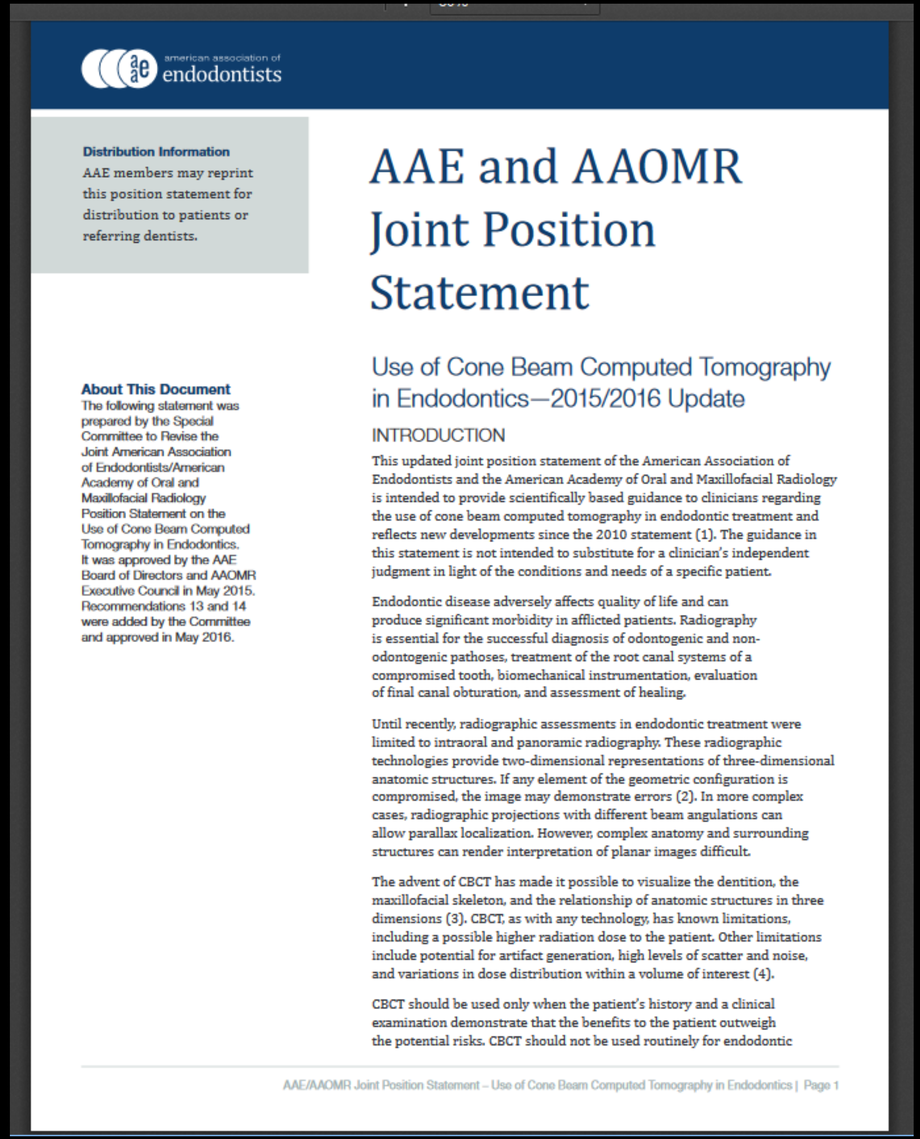
2212-4403/$ - see front matter
http://dx.doi.org/10.1016/j.oooo.2012.03.005

Literature

Endodontics

- Nonspecific signs and symptoms
- Possible complex morphology
- Detection of root fracture
- Dentoalveolar trauma
- Resorptive defects
- Outcome assessment*



american association of endodontists

Distribution Information
AAE members may reprint this position statement for distribution to patients or referring dentists.

About This Document
The following statement was prepared by the Special Committee to Revise the Joint American Association of Endodontists/American Academy of Oral and Maxillofacial Radiology Position Statement on the Use of Cone Beam Computed Tomography in Endodontics. It was approved by the AAE Board of Directors and AAOMR Executive Council in May 2015. Recommendations 13 and 14 were added by the Committee and approved in May 2016.

AAE and AAOMR Joint Position Statement

Use of Cone Beam Computed Tomography in Endodontics—2015/2016 Update

INTRODUCTION

This updated joint position statement of the American Association of Endodontists and the American Academy of Oral and Maxillofacial Radiology is intended to provide scientifically based guidance to clinicians regarding the use of cone beam computed tomography in endodontic treatment and reflects new developments since the 2010 statement (1). The guidance in this statement is not intended to substitute for a clinician's independent judgment in light of the conditions and needs of a specific patient.

Endodontic disease adversely affects quality of life and can produce significant morbidity in afflicted patients. Radiography is essential for the successful diagnosis of odontogenic and non-odontogenic pathoses, treatment of the root canal systems of a compromised tooth, biomechanical instrumentation, evaluation of final canal obturation, and assessment of healing.

Until recently, radiographic assessments in endodontic treatment were limited to intraoral and panoramic radiography. These radiographic technologies provide two-dimensional representations of three-dimensional anatomic structures. If any element of the geometric configuration is compromised, the image may demonstrate errors (2). In more complex cases, radiographic projections with different beam angulations can allow parallax localization. However, complex anatomy and surrounding structures can render interpretation of planar images difficult.

The advent of CBCT has made it possible to visualize the dentition, the maxillofacial skeleton, and the relationship of anatomic structures in three dimensions (3). CBCT, as with any technology, has known limitations, including a possible higher radiation dose to the patient. Other limitations include potential for artifact generation, high levels of scatter and noise, and variations in dose distribution within a volume of interest (4).

CBCT should be used only when the patient's history and a clinical examination demonstrate that the benefits to the patient outweigh the potential risks. CBCT should not be used routinely for endodontic

Literature

Thank you