CBCT interpretation for dental implant treatment planning

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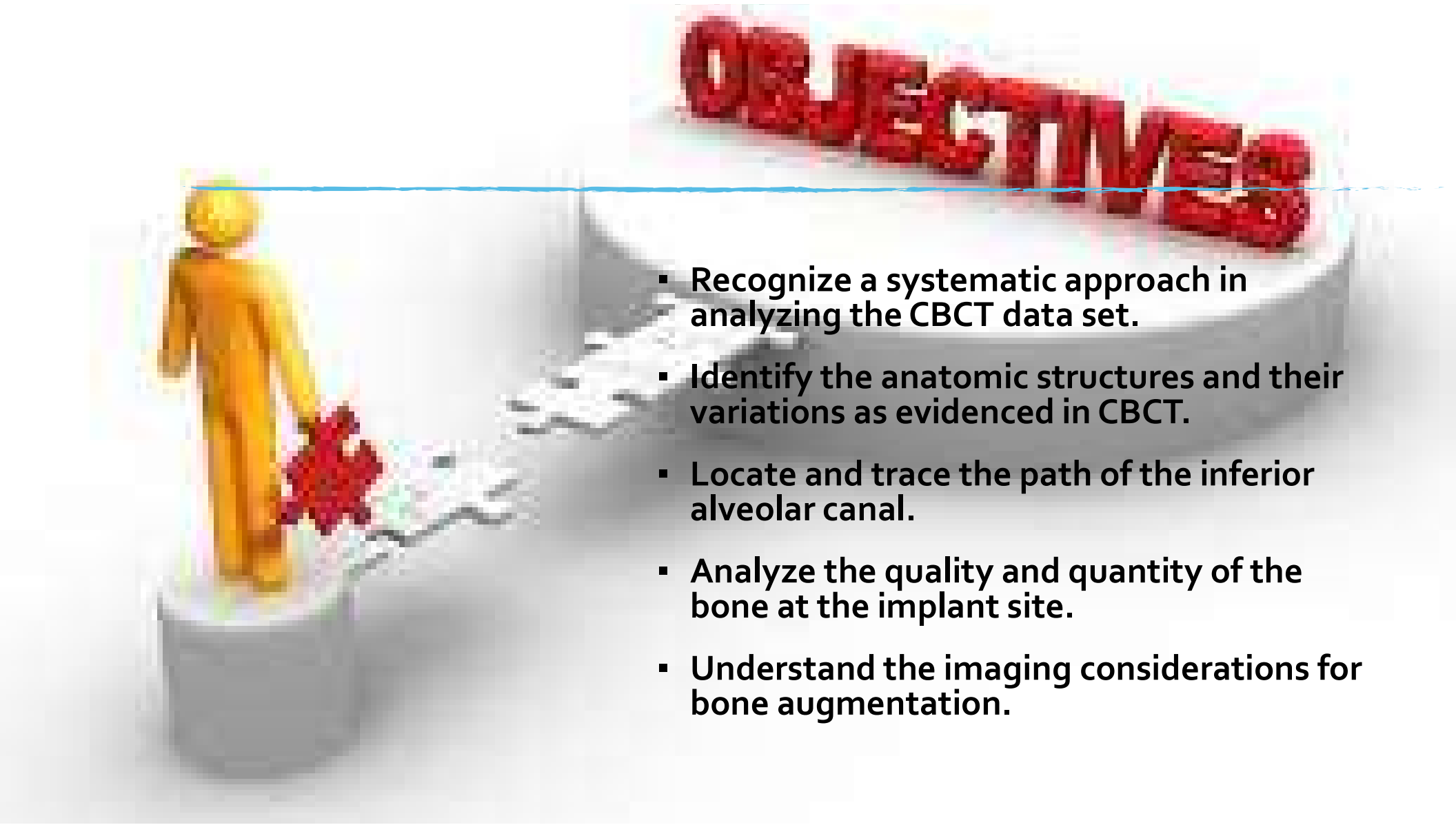


- Recognize a systematic approach in analyzing the CBCT data set.
- Identify the anatomic structures and their variations as evidenced in CBCT.
- Locate and trace the path of the inferior alveolar canal.
- Analyze the quality and quantity of the bone at the implant site.
- Understand the imaging considerations for bone augmentation.

When CBCT?

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

Donald A. Tyndall, DDS, MSPH, PhD,[a] Jeffery B. Price, DDS, MS,[b] Sotirios Tetradis, DDS, PhD,[c] Scott D. Ganz, DMD,[d] Charles Hildebolt, DDS, PhD,[e] and William C. Scarfe, BDS, MS[f]

Initial examination	Preop site specific imaging	Post op imaging
Panoramic radiography supplemented with intraoral periapical radiography	Cross sectional imaging orthogonal to the site, preferably CBCT	Intraoral periapical radiography/ panoramic radiography for asymptomatic pt
NO CBCT	CBCT, if planning for bone augmentation/sinus lift/ site development	CBCT (limited FoV) – Implant mobility, altered sensation, implant retrieval

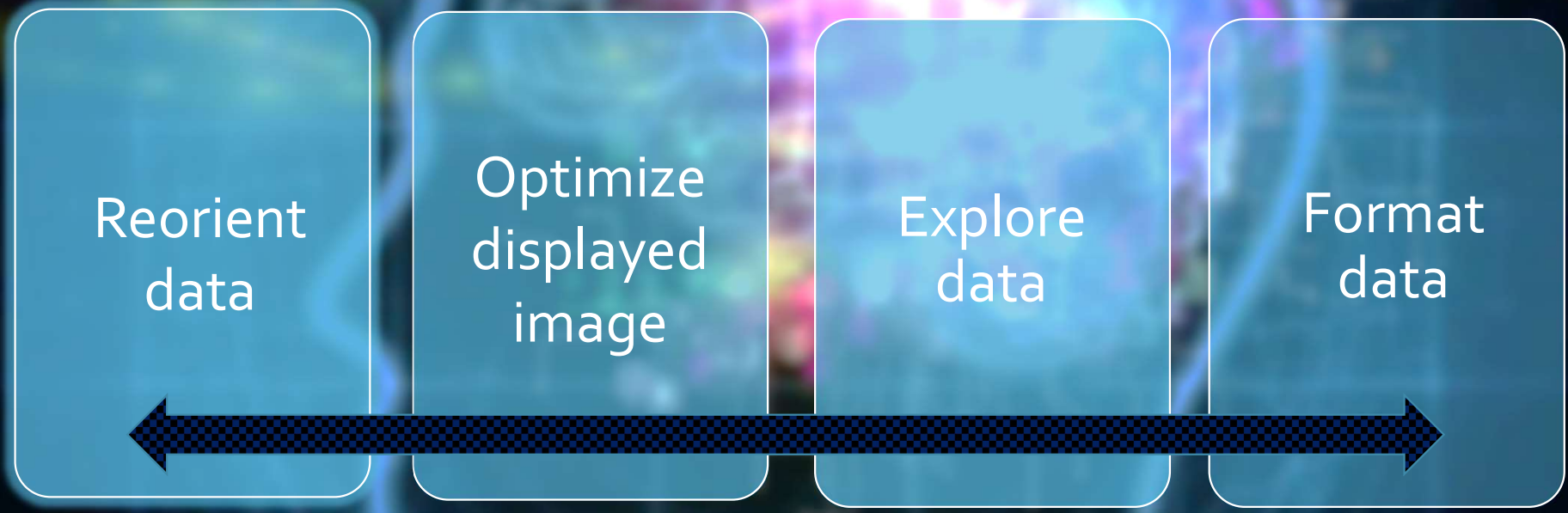
Radiation exposure concerns

Typical Effective Dose From Radiographic Examinations

Examination	Median effective dose	Equivalent background exposure
FMX	100 µSv	12 days
Panoramic	20 µSv	2.5 days
CBCT (small Fov)	50 µSv	6 days
CBCT (medium Fov)	100 µSv	12 days

American College of Radiology, https://www.acr.org/~/media/ACR/Images/Quality-Safety/eNews/2015-September/Dose_chart.png?la=en

Systematic approach for CBCT interpretation



Reorient data

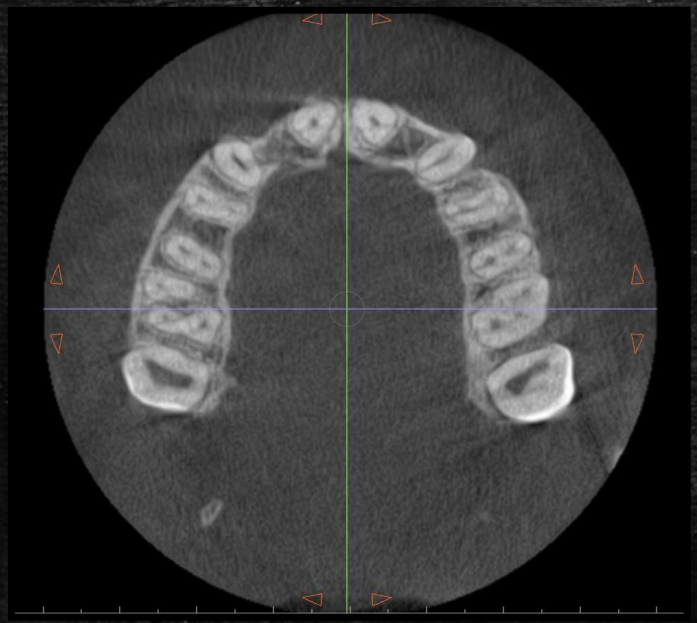
Axial section

Coronal section

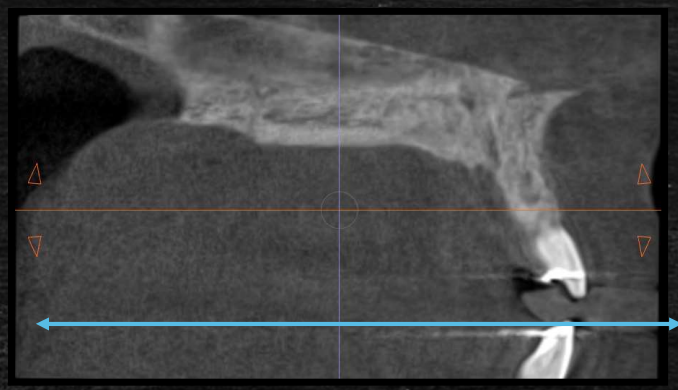
Sagittal section

How to reorient the data?

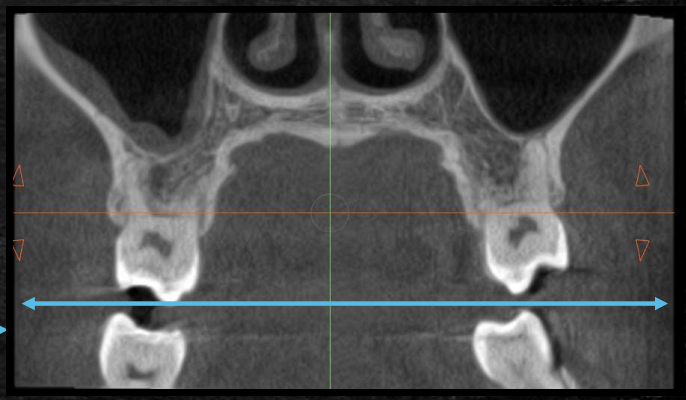
- Axial – Maintain maxillary/mandibular jaw symmetry



- Sagittal – Occlusal plane parallel to the floor



- Coronal – Occlusal plane parallel to the floor

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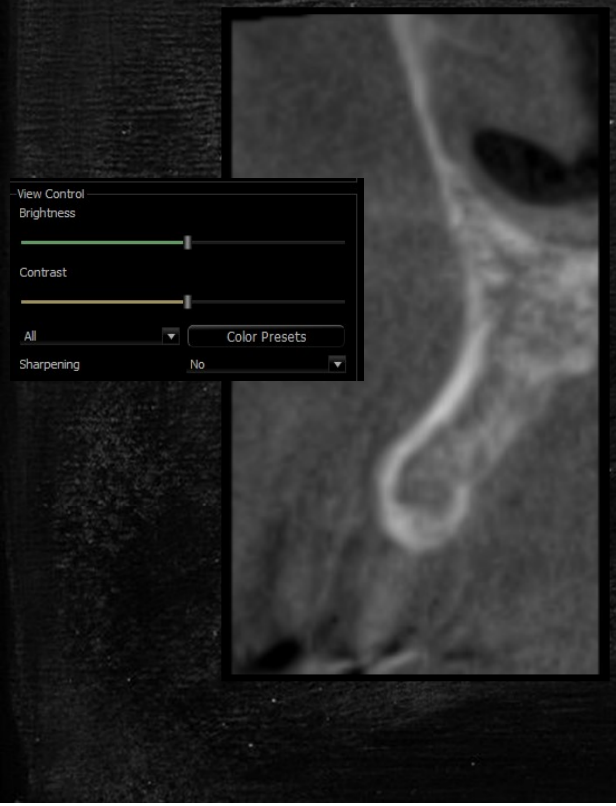
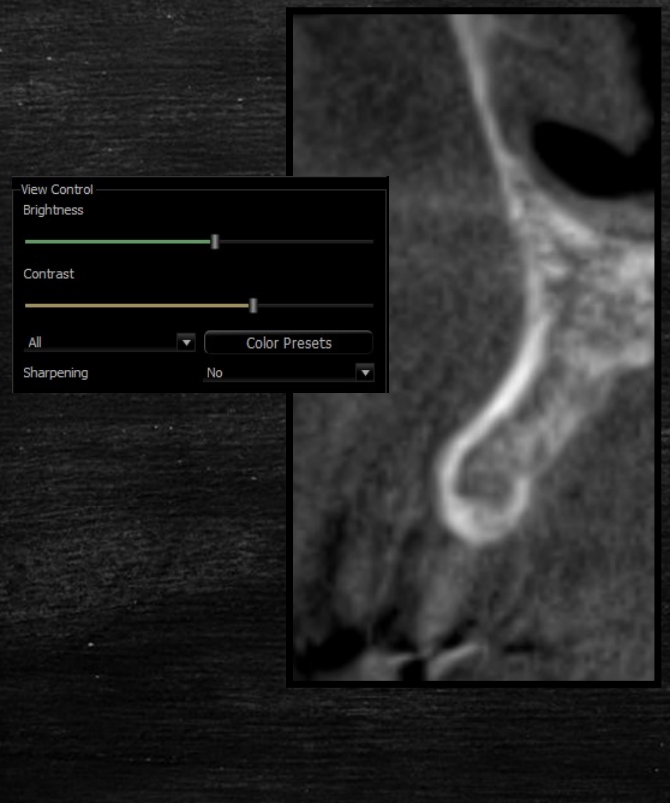
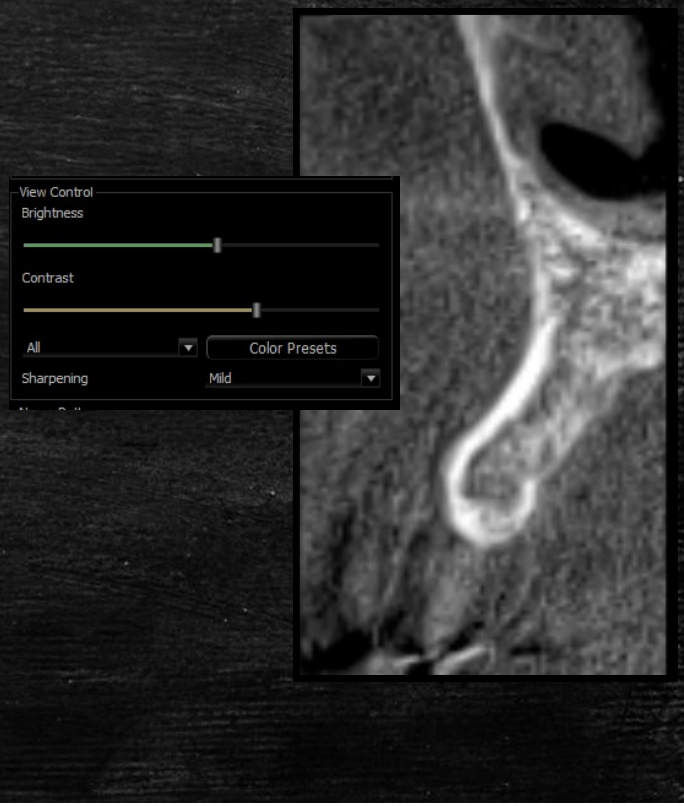


After brightness & contrast adjustment

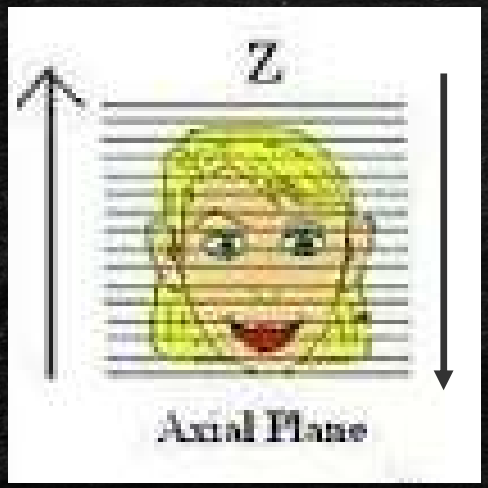


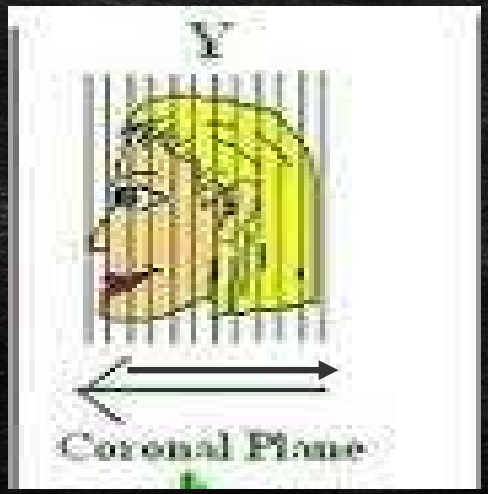
After sharpening



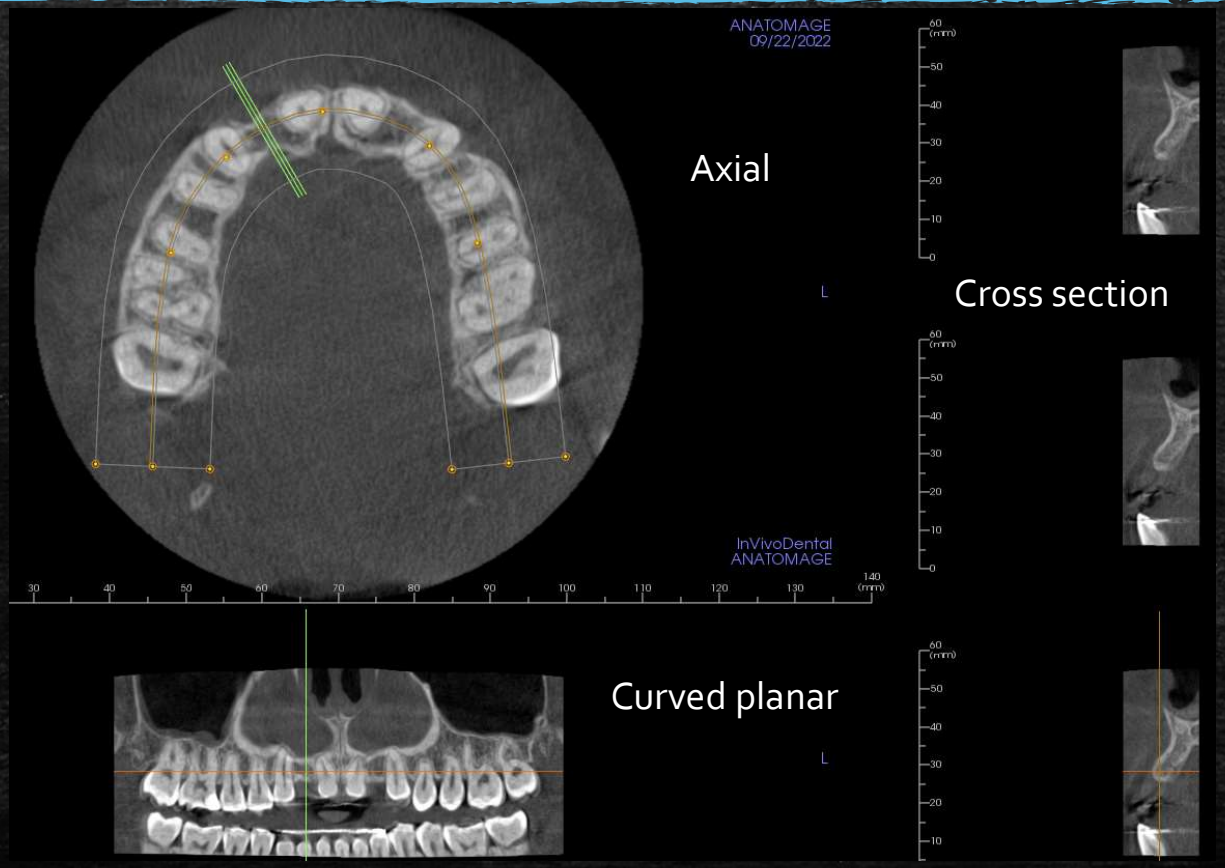
Explore the data

- Scrolling be performed craniocaudally (i.e., from head to toe) and then in reverse
- Should be performed at least in two planes (e.g. coronal and axial).





Format data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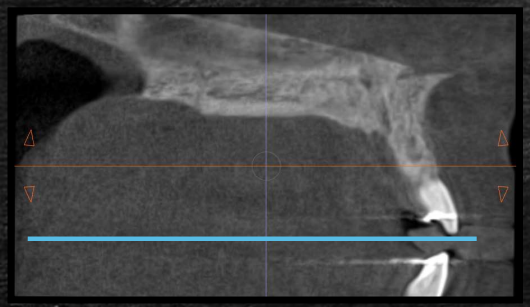
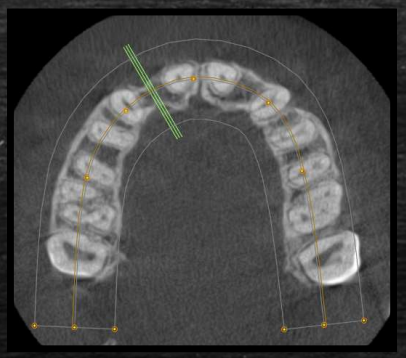
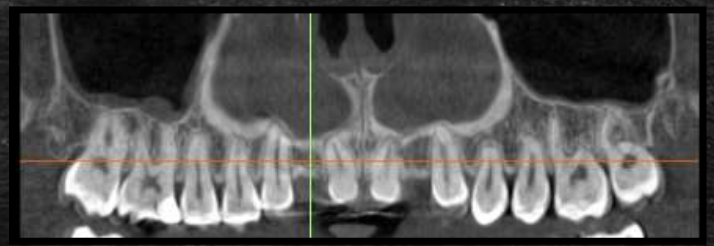
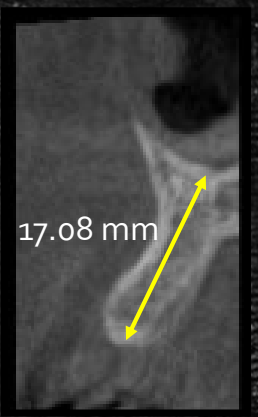
Why reorienting is important for cross sections?







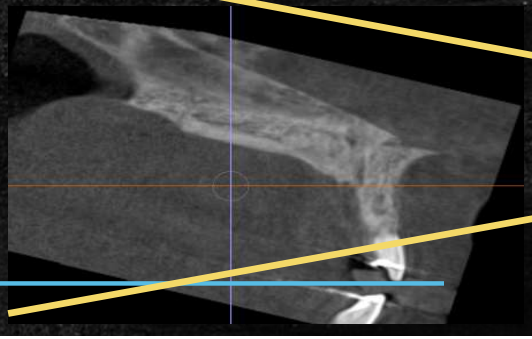


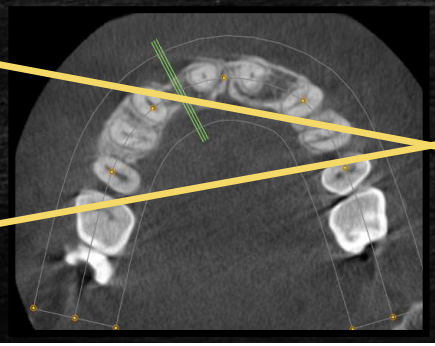
Sagittal section

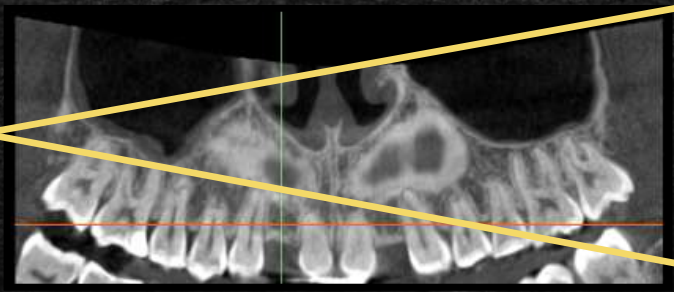
Axial section

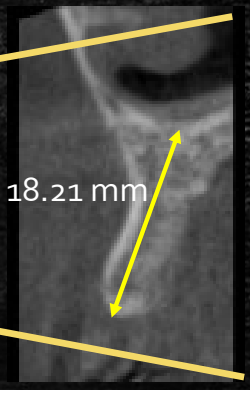
Arch section

Cross section

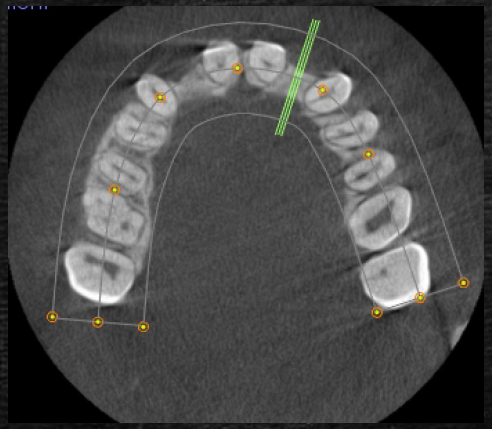




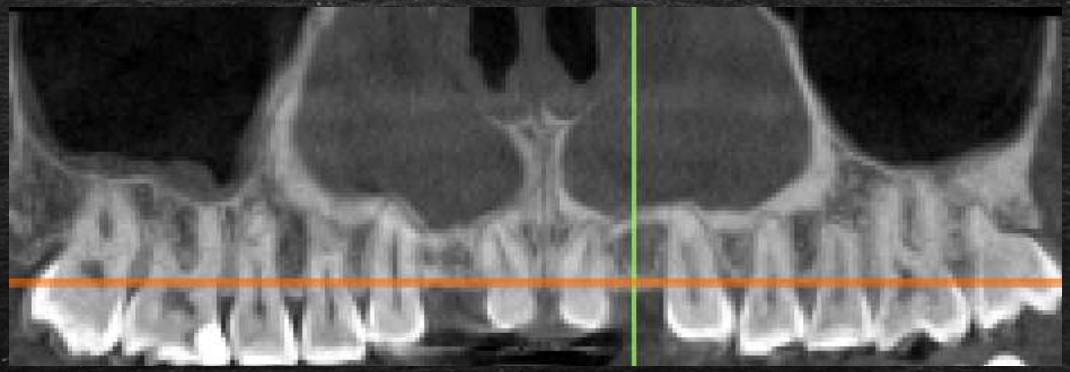




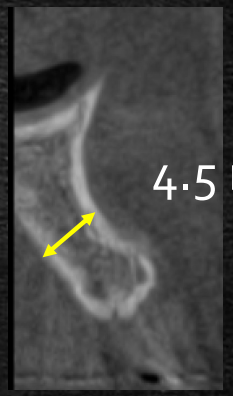
Forming accurate arch spline is important in constructing cross sections



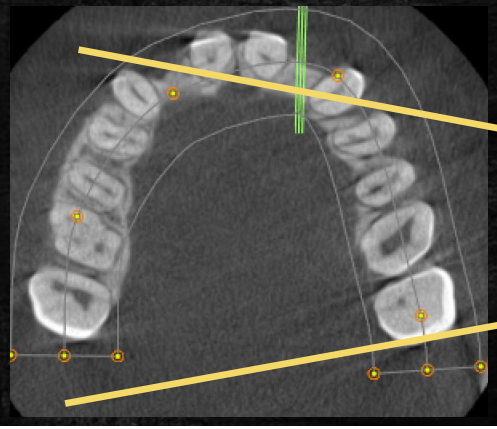
Axial section



Arch section



Cross section



Bone quality assessment

Lekholm and Zarb in 1985:

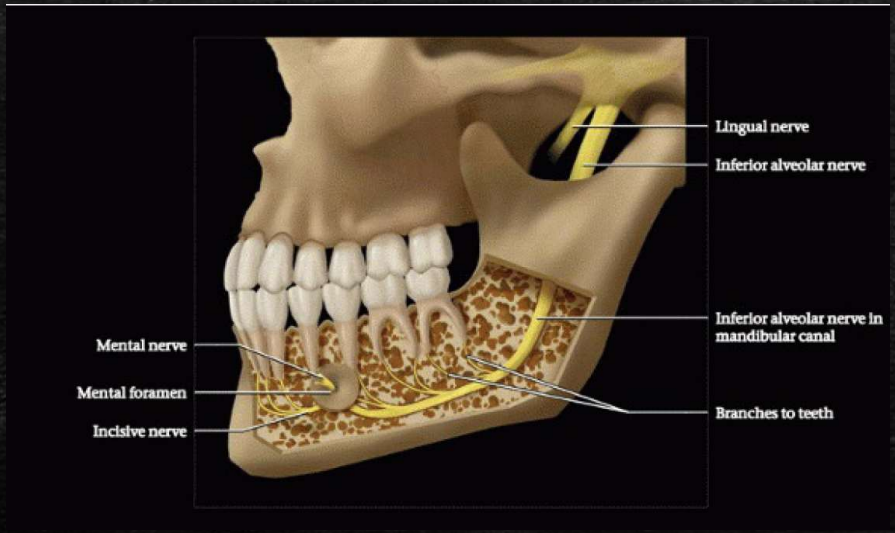
Quality 1	Quality 2	Quality 3	Quality 4
• Homogenous compact bone	• Thick layer of compact bone around a core of dense trabecular bone	• Thin layer of cortical bone around dense trabecular bone • Favorable strength	• Thin layer of cortical bone around a coreof low density trabecular bone

Best → Poor

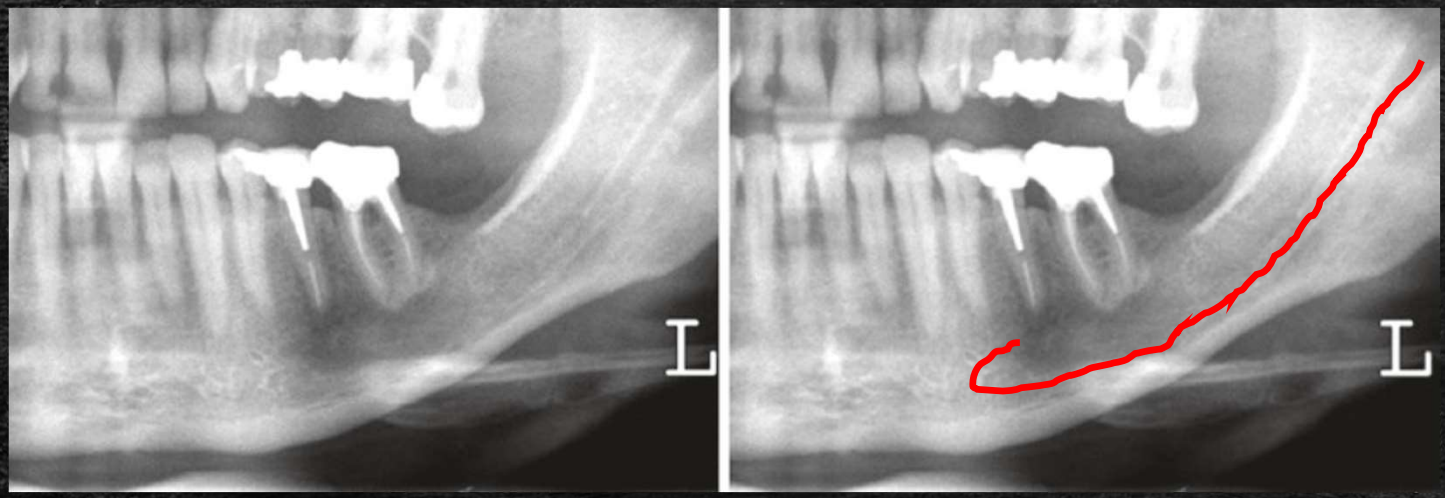
Anatomic considerations & Variations - Mandible

Inferior alveolar canal

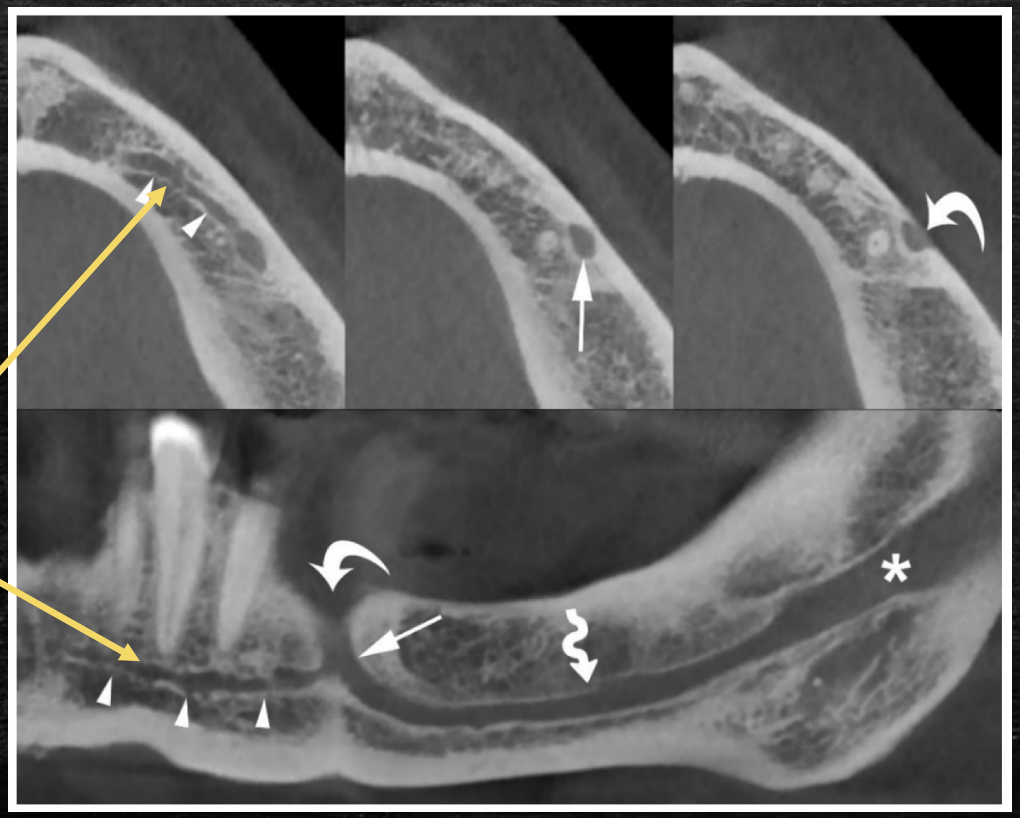
- Starts posteriorly at the mandibular foramen on the lingual plate, runs anteriorly, forms a small loop before exiting at the mental foramen apical to 2nd premolar or between the bicuspids.



Inferior alveolar canal



Anterior loop (incisive canal) of inferior alveolar canal

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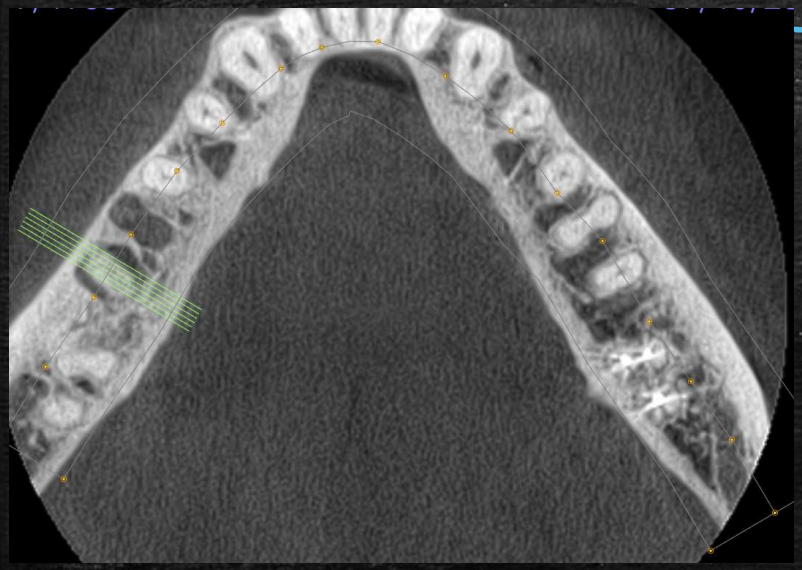
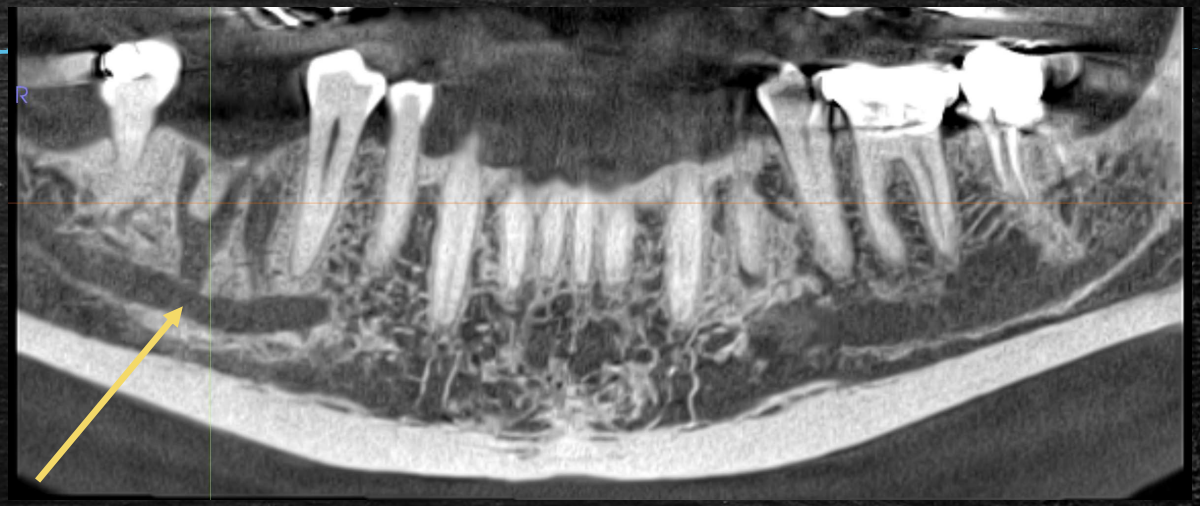
When IAN is not traced…



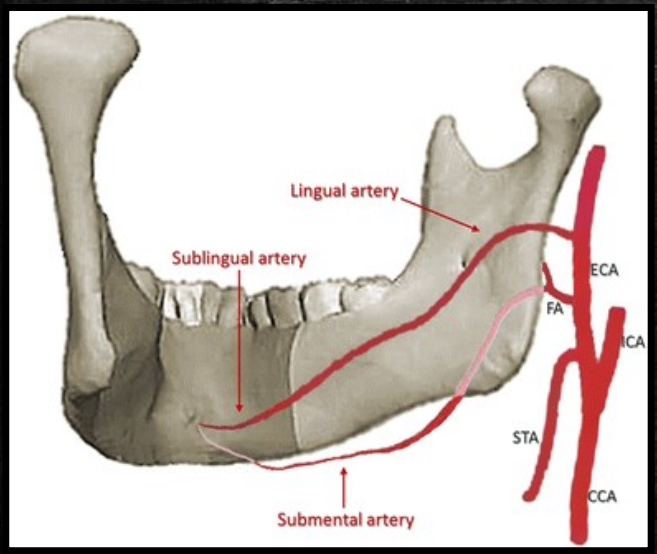
Axial

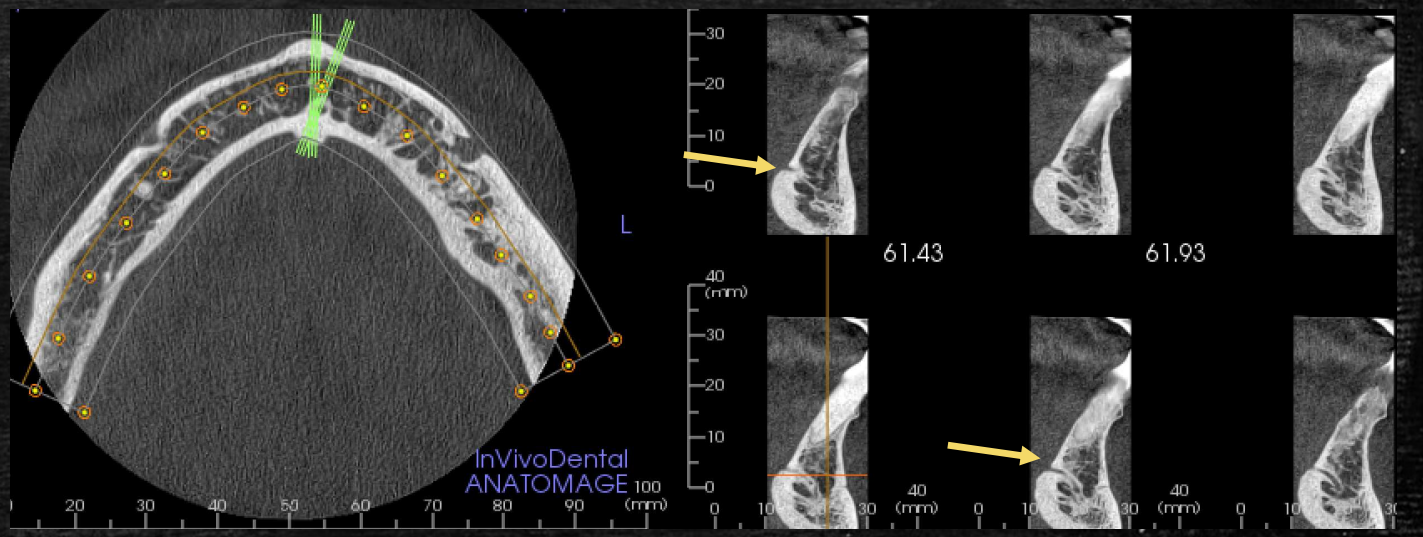


Arch section

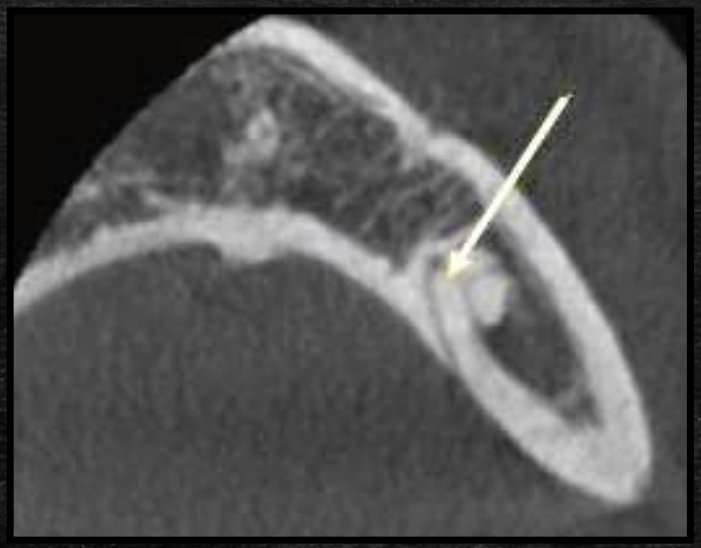
Cross section

Lingual canal & foramen

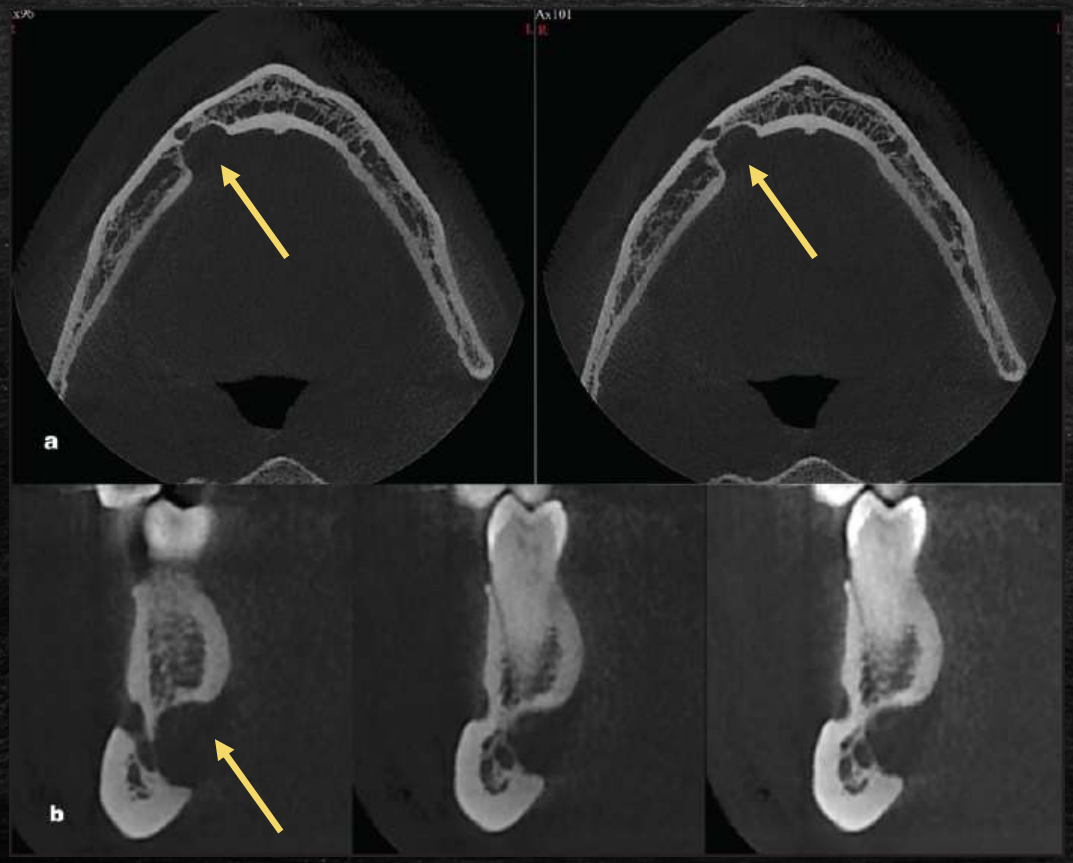




Accessory neurovascular canals (Lateral lingual canal)



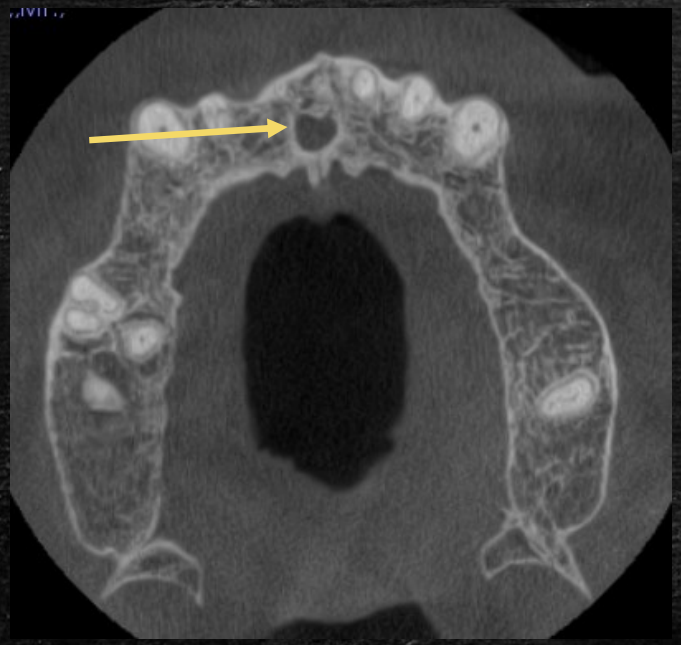
Submandibular salivary gland depression



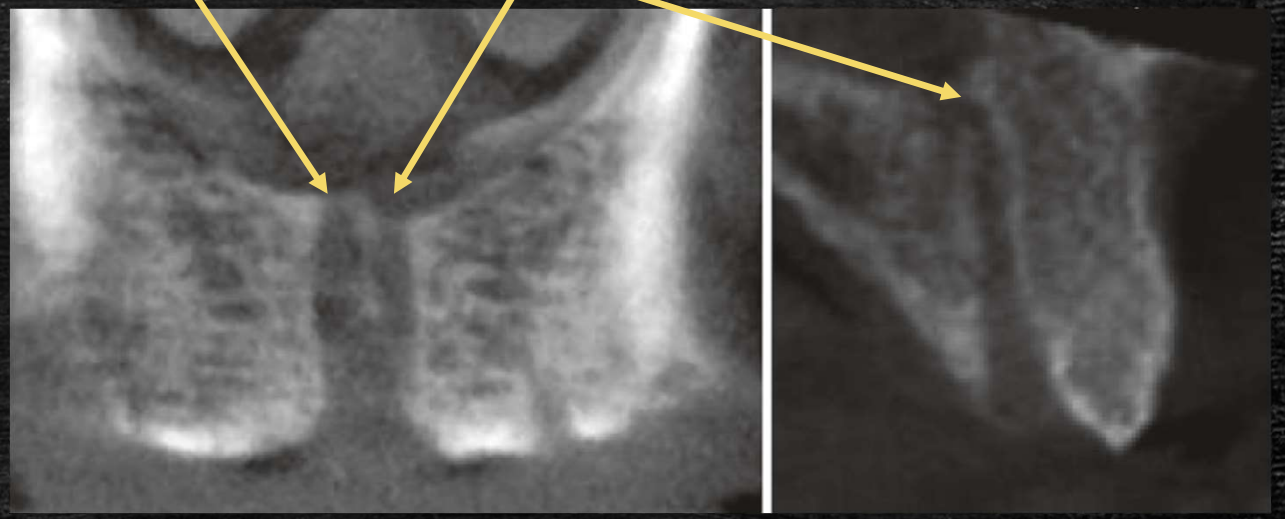
Retromolar canal

Anatomic considerations & Variations - Maxilla

Nasopalatine canal & incisive foramen

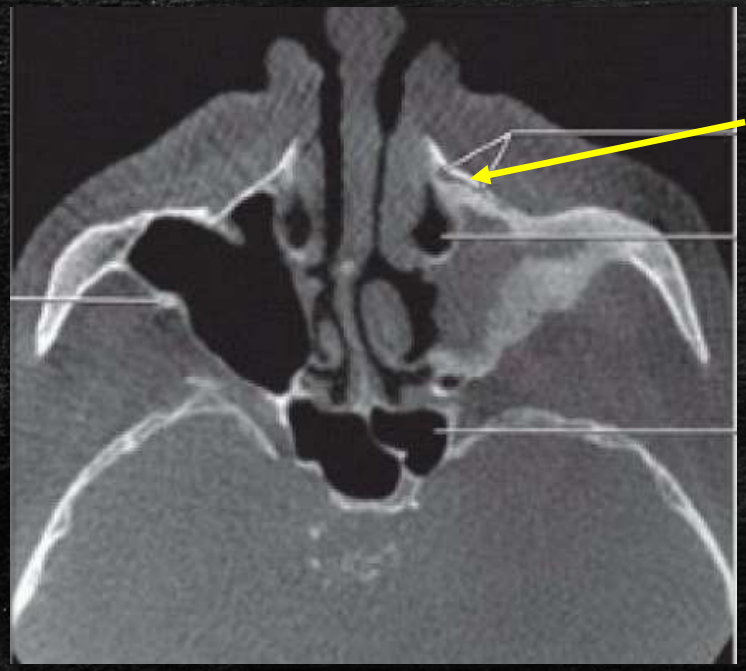


Foramina of Stenson



Canalis sinuosus

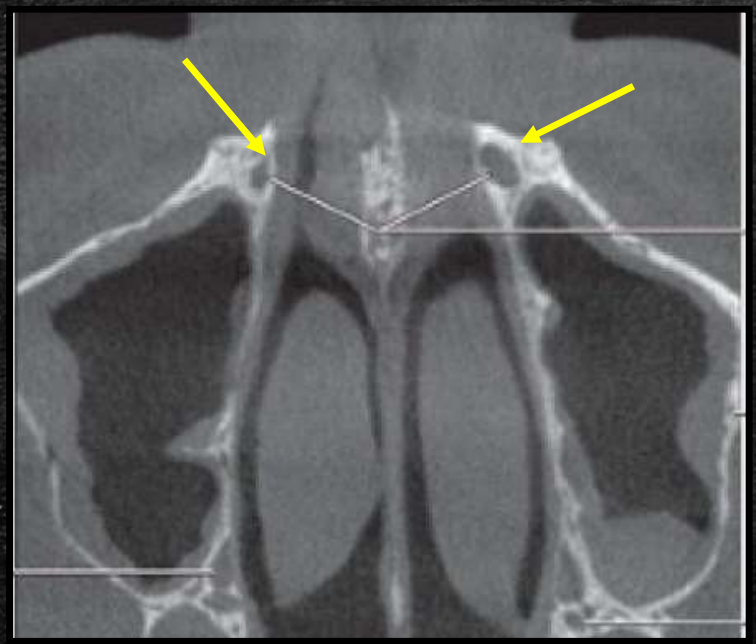
- Palatal extension of anterior superior alveolar canal

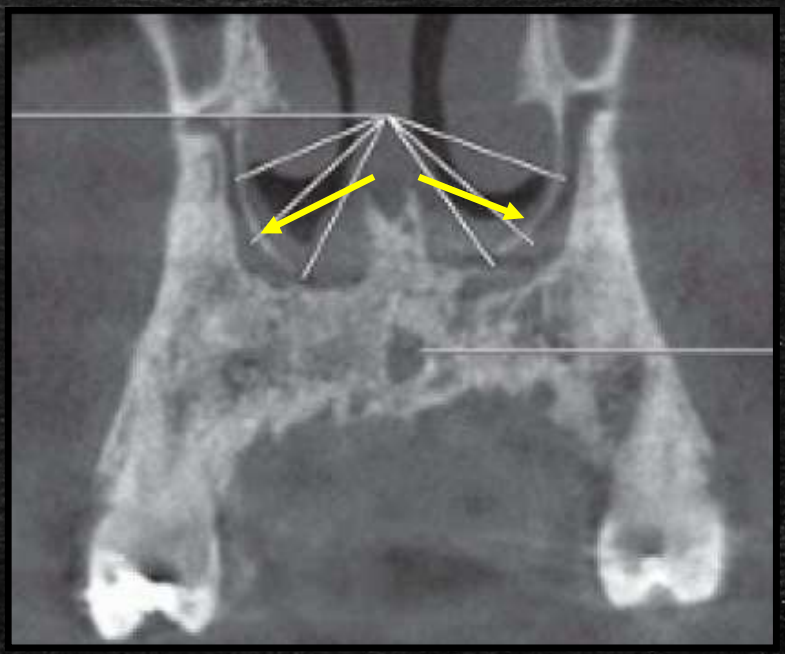


Anterior superior alveolar canal

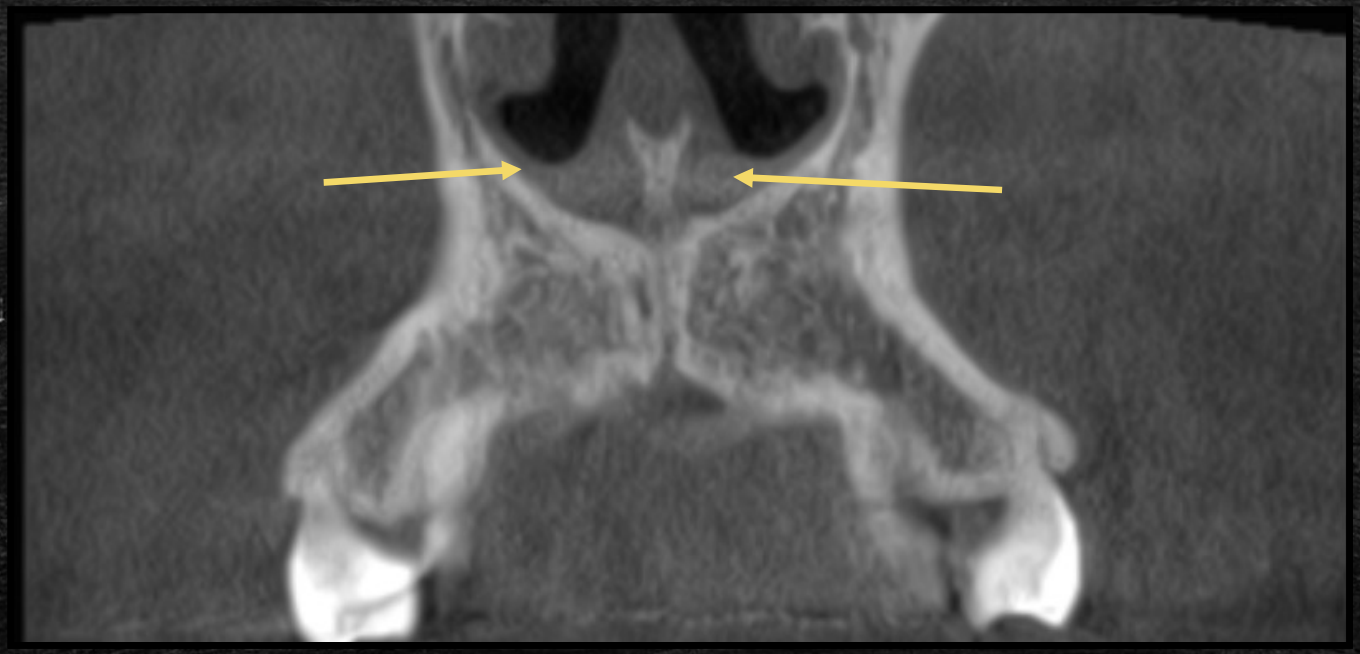
Canalis sinuosus

Prominent anterior superior alveolar canal

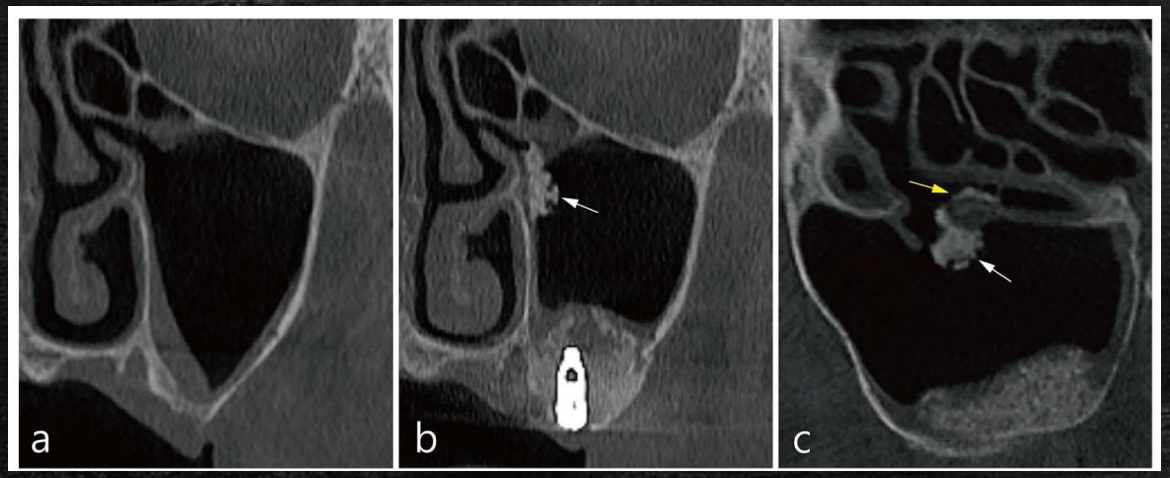


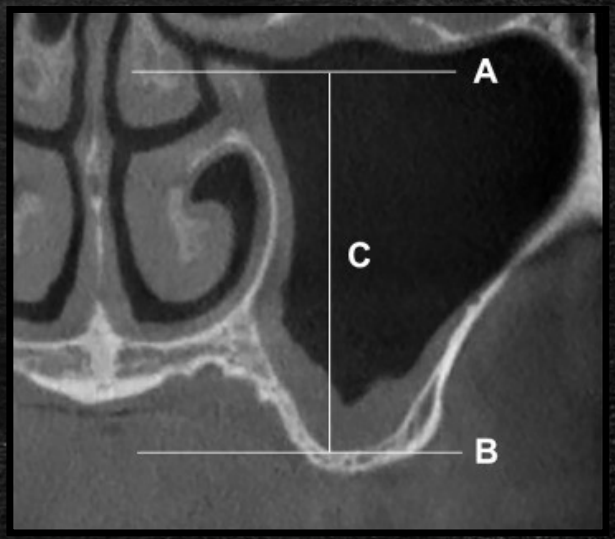


Nasal fossa

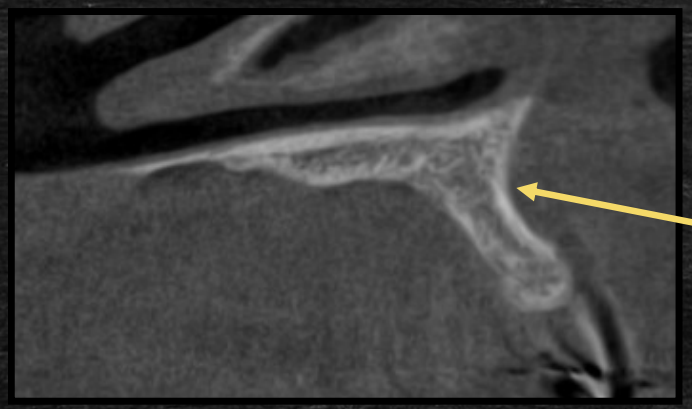


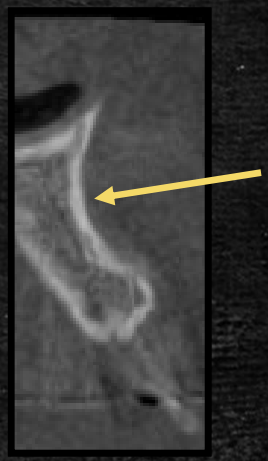
Pneumatization of the maxillary sinus



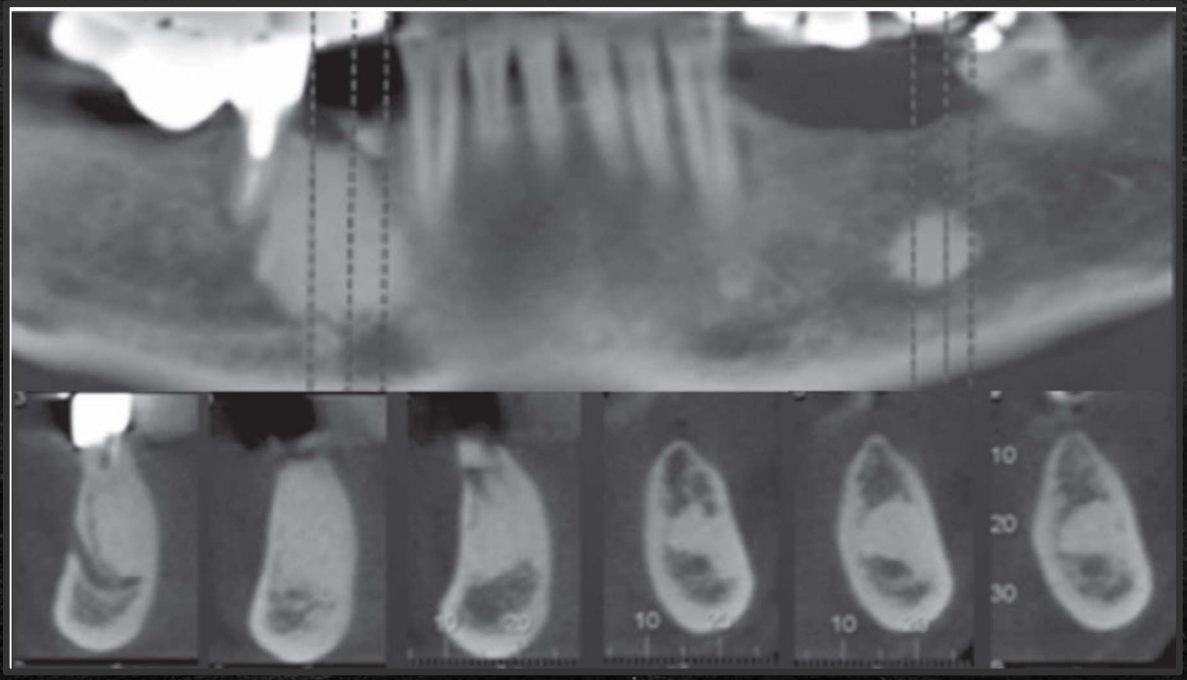


Buccal/labial concavity





Dense bone island



Might compromise healing due to decreased vascularity

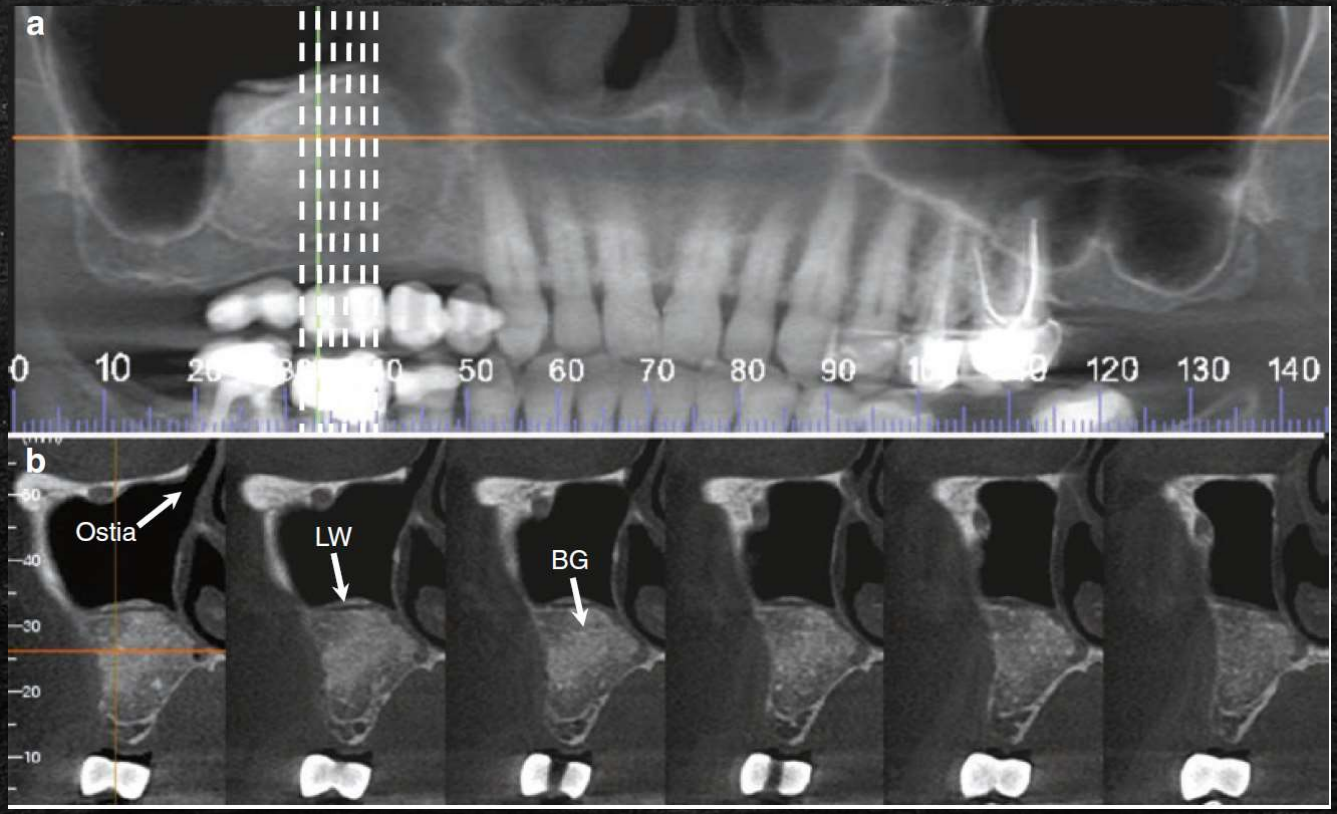
Li ZJ, Lai RF, Feng ZQ. Case History Report: Cone Beam Computed Tomography for Implant Insertion Guidance in the Presence of a Dense Bone Island. Int J Prosthodont. 2016 Mar-Apr;29(2):186-7. doi: 10.11607/ijp.4160. PMID: 26929962.

Anatomic considerations for bone augmentation

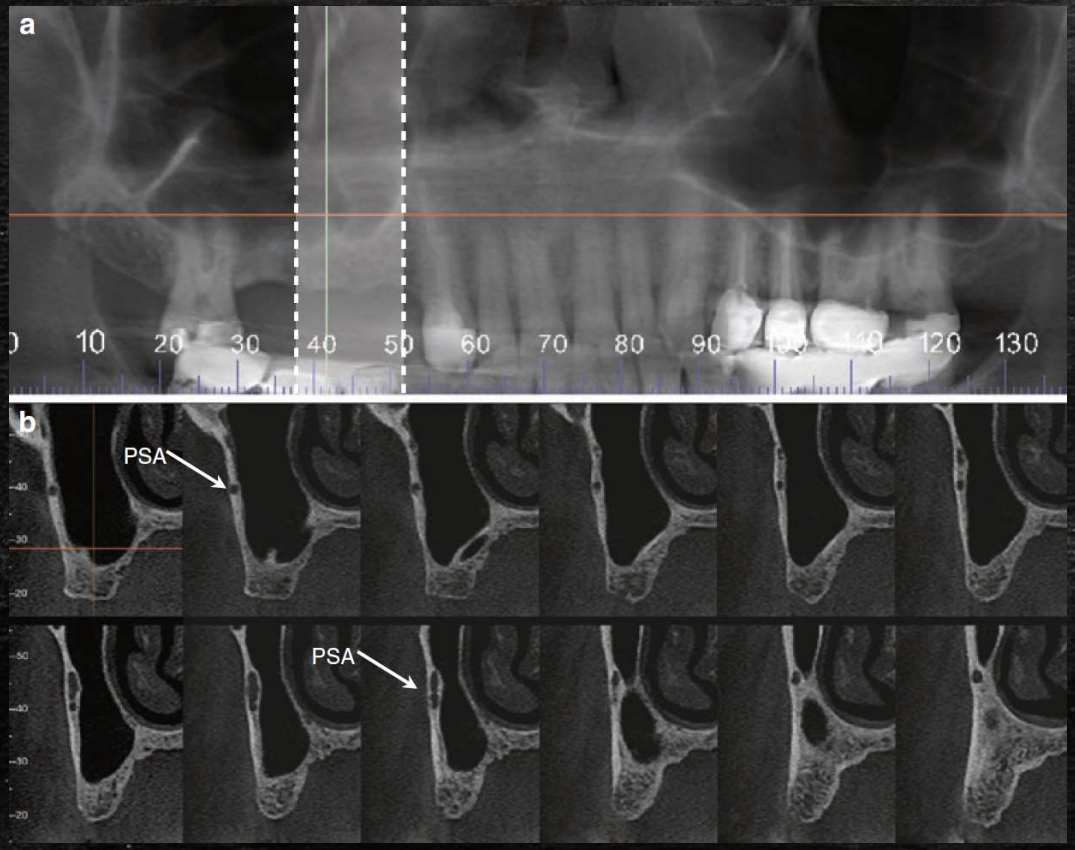
Considerations for maxillary sinus augmentation

- Cross sectional CBCT – location specific measurements to optimize access (3–4 mm above the apical base of the maxillary sinus through the buccal plate)
- Sinus disease free or have minimal mucosal thickening (<3 mm)
- Ostia patent
- Posterior superior alveolar artery in the lateral antral wall should be identified and avoided during surgery.
- Any condition leading to obstruction of ostium and drainage of the maxillary sinus such as localized mucosal thickening of the ostium and concha bullosa (pneumatized inferior turbinate) should be identified.

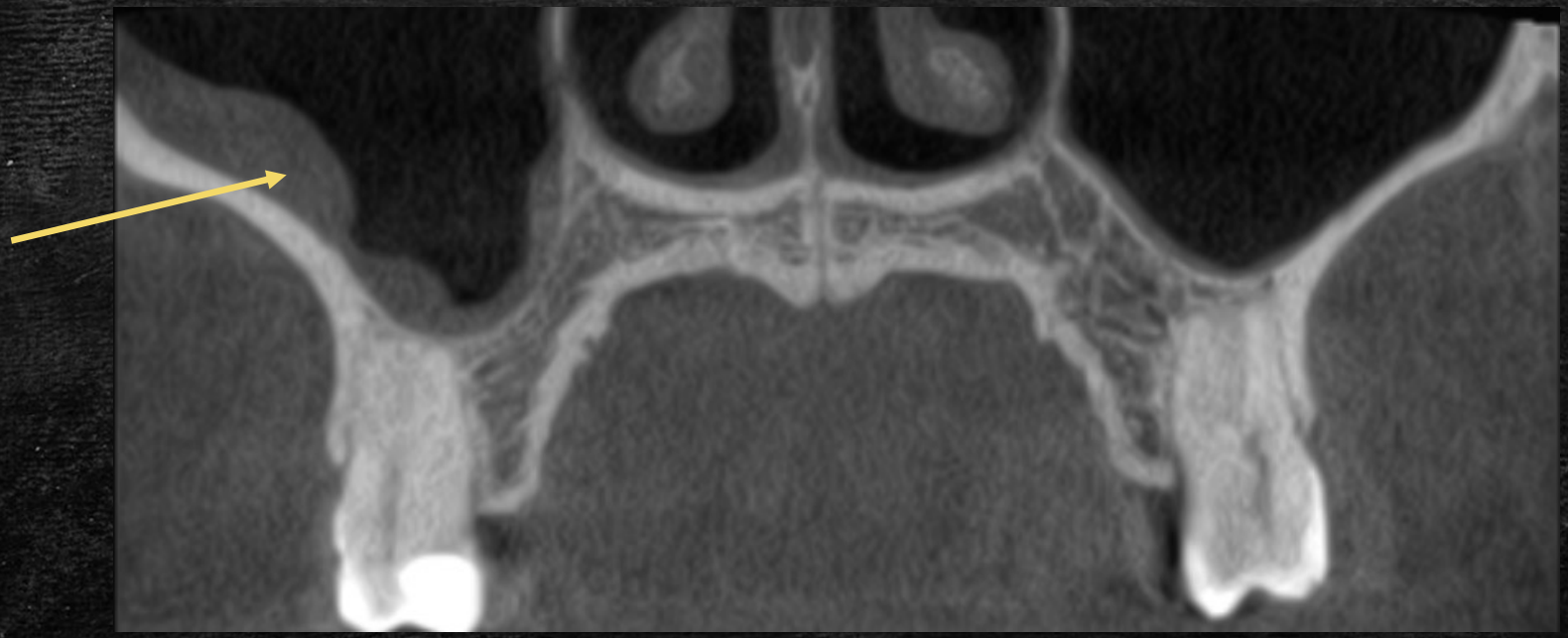
Patent ostium



Posterior superior alveolar canal

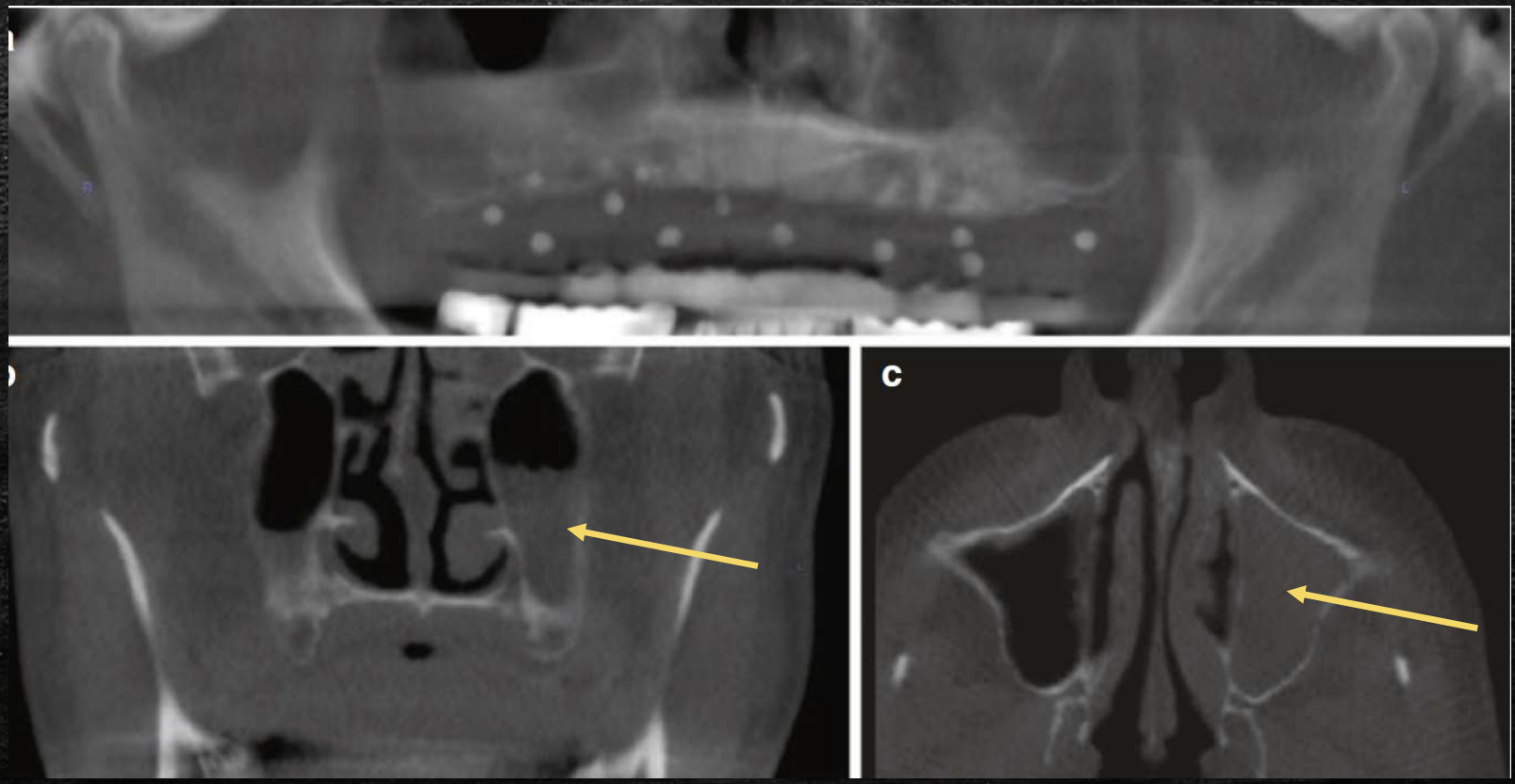


Presence of maxillary sinus mucositis

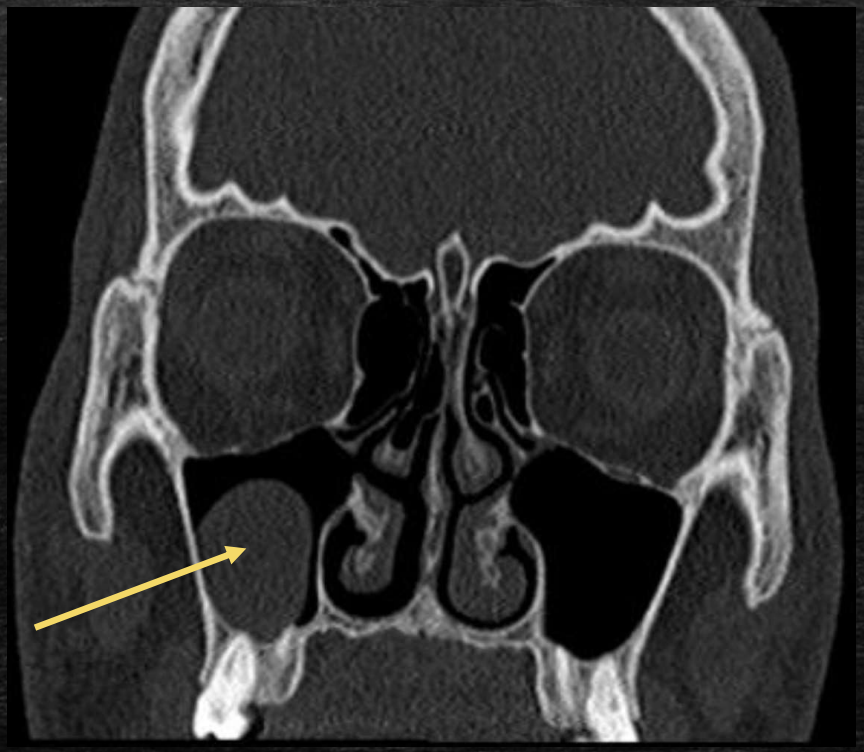


Should be no more than 3 mm

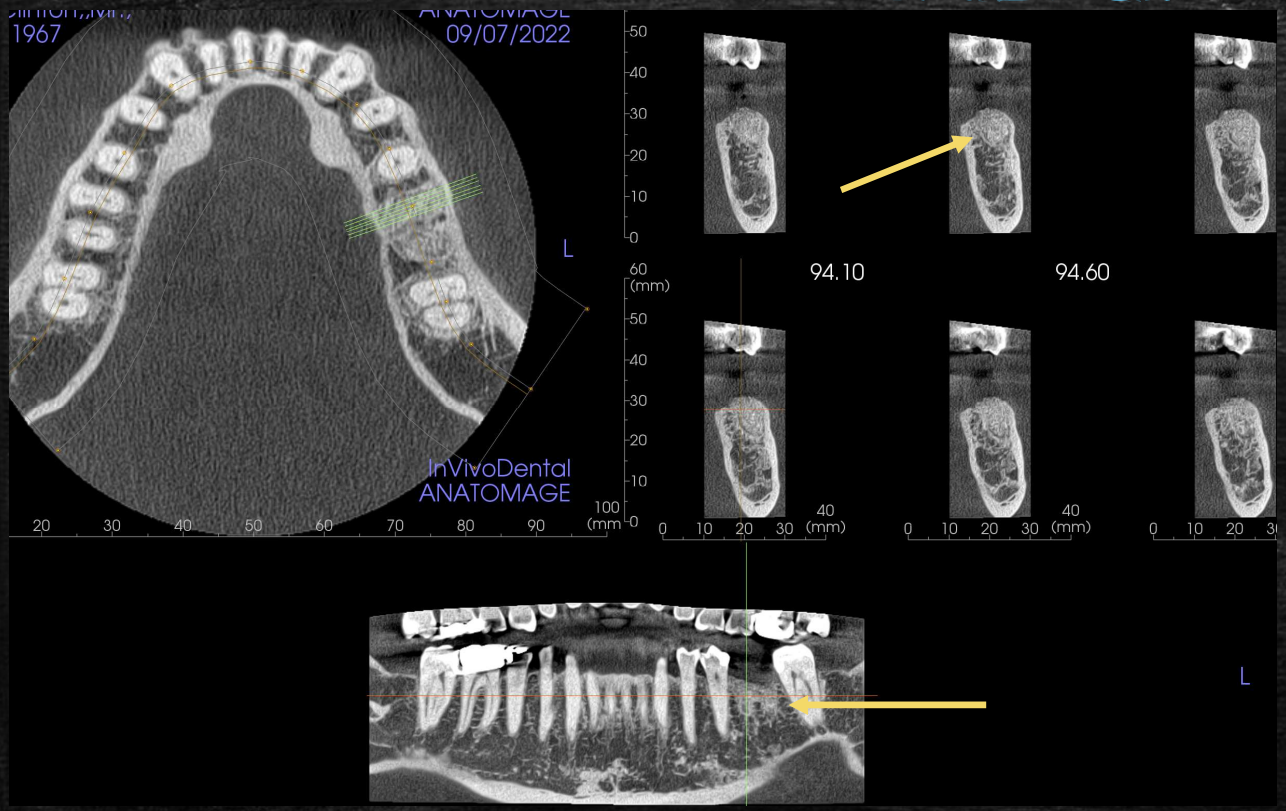
Chronic sinusitis



Mucous retention pseudocyst



Socket preservation/bone graft



Graft integration

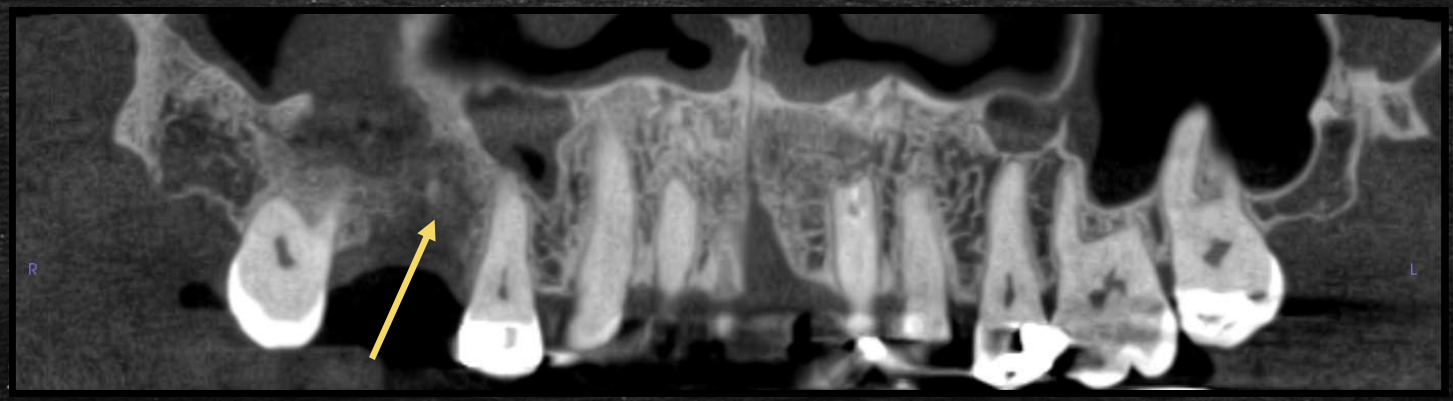
- Well integrated
- Moderately integrated
- Poorly integrated

Consolidation

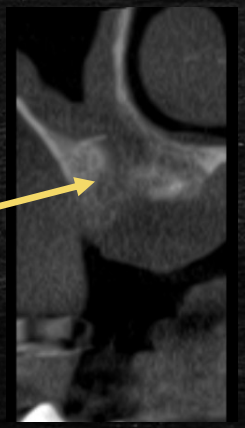
- Well consolidated
- Moderately consolidated
- Poorly consolidated

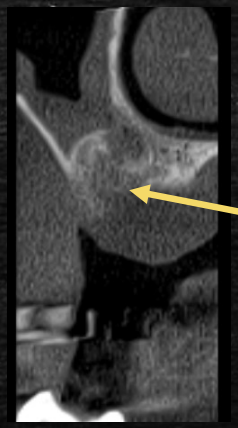
Well-integrated, well consolidated bone graft

Poorly integrated bone graft



Poorly integrated bone graft with oroantral communication





Conclusion…

- Follow a systematic approach in interpreting CBCT
- Trace IAN canal; identify & locate adjacent anatomic structures
- Assess the bone quality and quantity
- Determine the necessity for bone augmentation

References:

- Scarfe WC, Angelopoulos C. Maxillofacial cone beam computed tomography – Principles, techniques and clinical applications. Cham (Switzerland): Springer; 2018
- Mallya SM, Lam EWN. White and Pharoah's Oral Radiology: Principles and interpretation. Elsevier; 8th Ed.
- Tyndall DA, Price JB, Tetradis S, Ganz SD, Hildebolt C, Scarfe WC; American Academy of Oral and Maxillofacial Radiology. 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. Oral Surg Oral Med Oral Pathol Oral Radiol. 2012 Jun;113(6):817-26. doi: 10.1016/j.0000.2012.03.005. PMID: 22668710.
- American College of Radiology, https://www.acr.org/~/media/ACR/Images/Quality-Safety/eNews/2015-September/Dose_chart.png?la=en
- Lekholm U, Zarb GA. In: Patient selection and preparation. Tissue integrated prostheses: osseointegration in clinical dentistry. Branemark PI, Zarb GA, Albrektsson T, editor. Chicago: Quintessence Publishing Company; 1985. p. 199–209.
- Li ZJ, Lai RF, Feng ZQ. Case History Report: Cone Beam Computed Tomography for Implant Insertion Guidance in the Presence of a Dense Bone Island. Int J Prosthodont. 2016 Mar-Apr;29(2):186-7. doi: 10.11607/ijp.4160. PMID: 26929962.

Thank you!