

Cone Beam CT:

Principles, Applications, Appropriate Use & Diagnosis

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Objectives:



Understand the fundamental principles of CBCT technology and how it differs from conventional radiographic imaging.



Identify common indications for CBCT in dental practice.

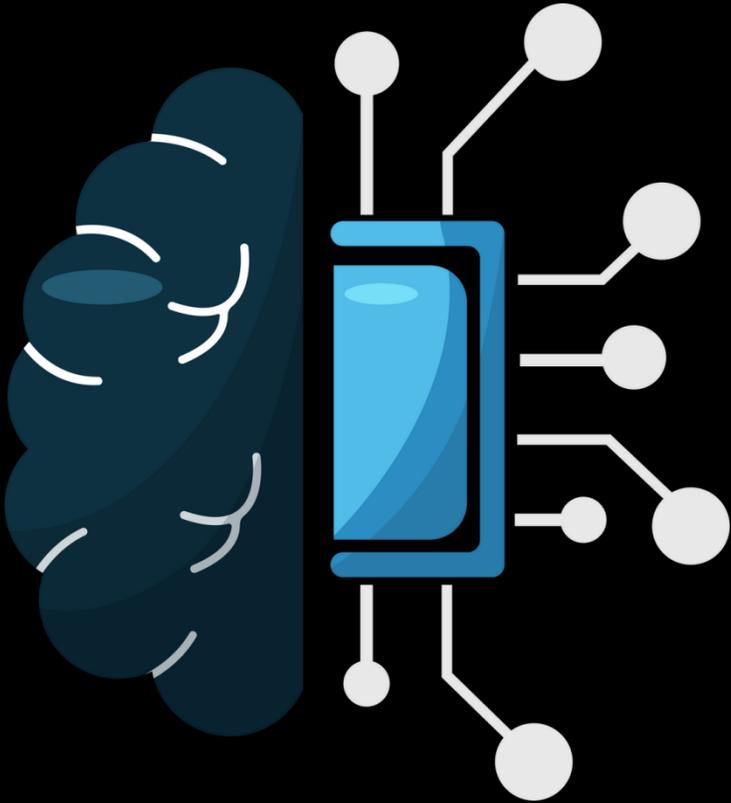


Appreciate radiation dose considerations and justification principles associated with CBCT.



Gain an introduction to interpreting basic CBCT.

What is Cone beam CT?



Low dose 3D imaging modality

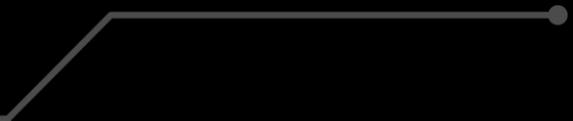
Hard tissues of the dento-facial region

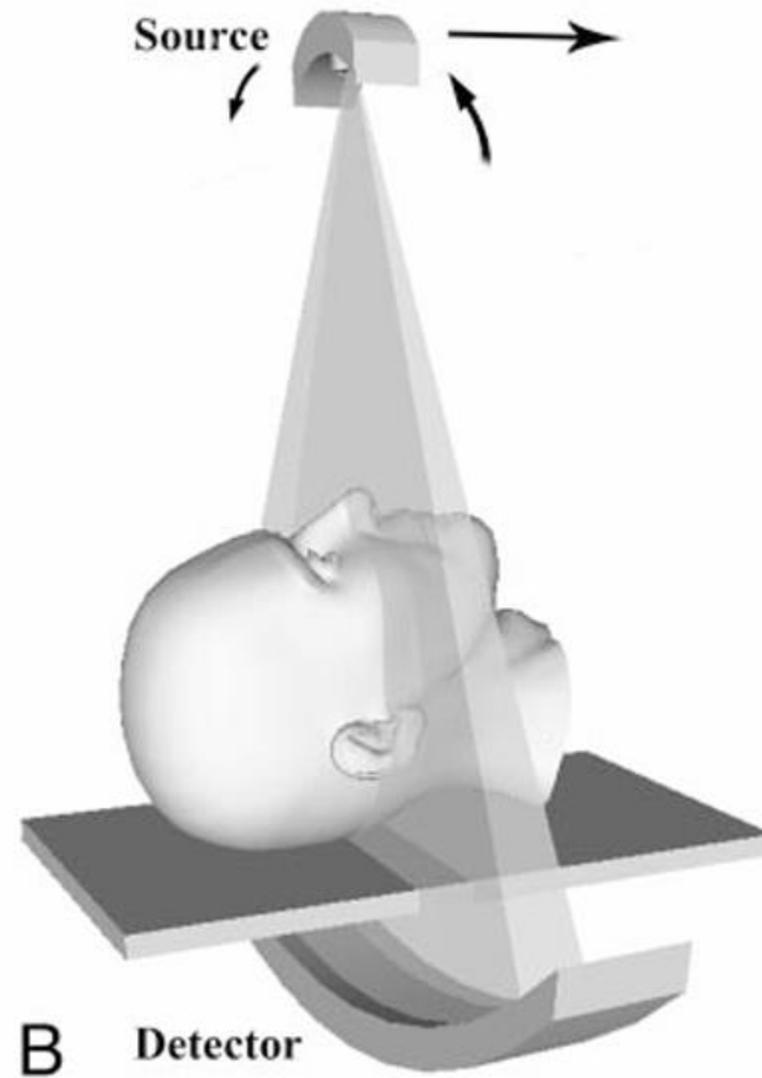
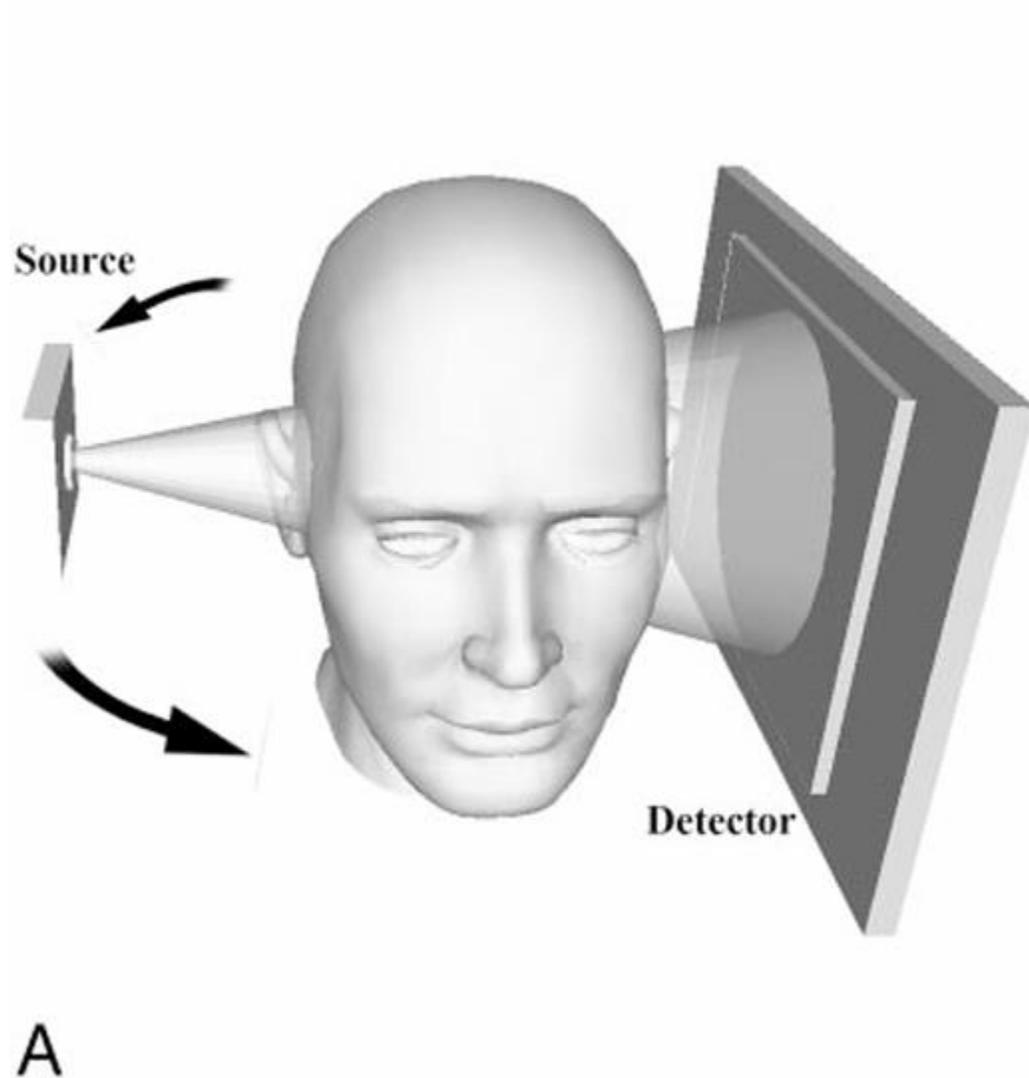
It is not subject to distortion > 3D Recon in any plane

High Resolution Images

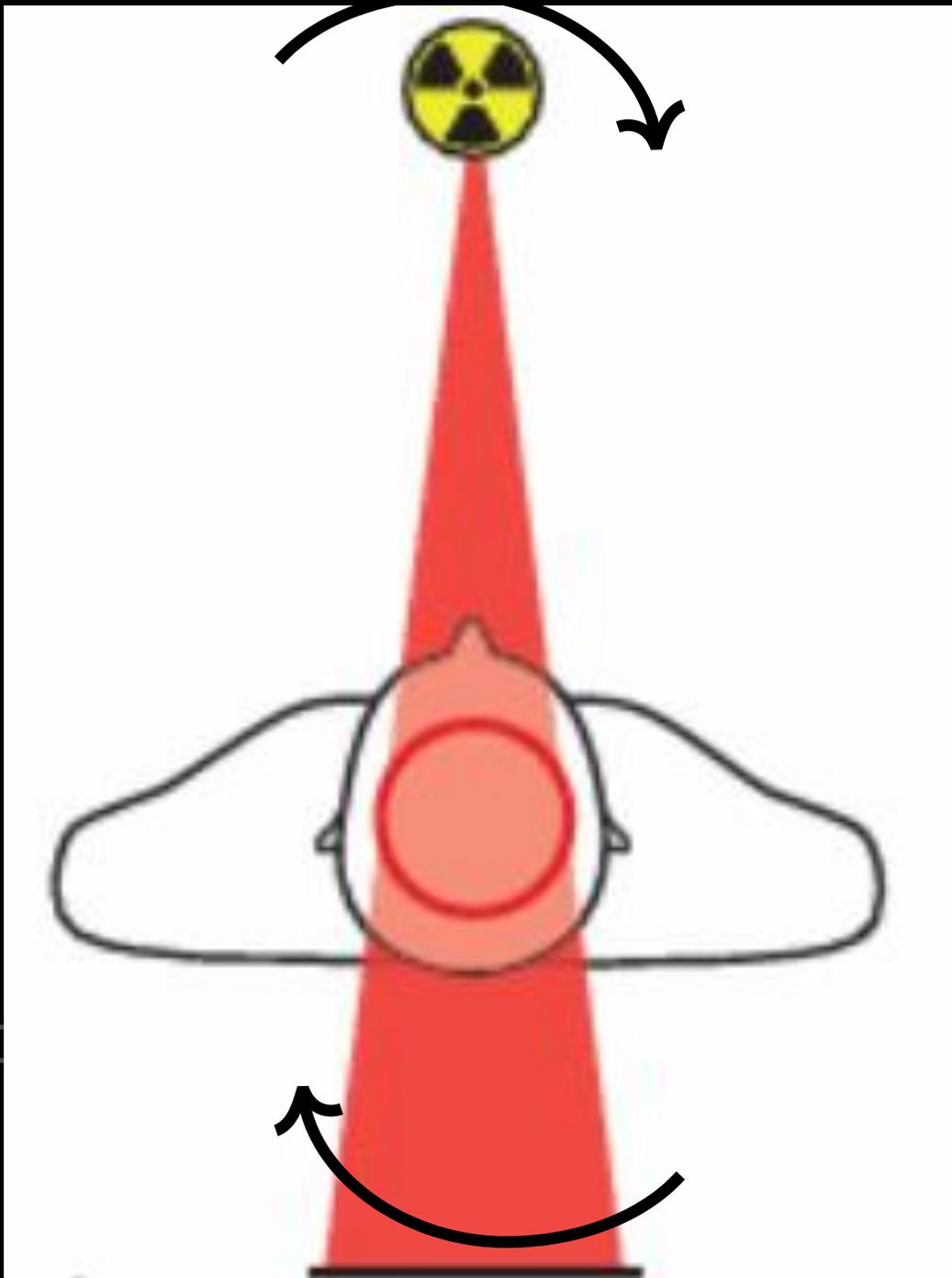
Not technique sensitive

Lower Dose than Conventional Medical CT

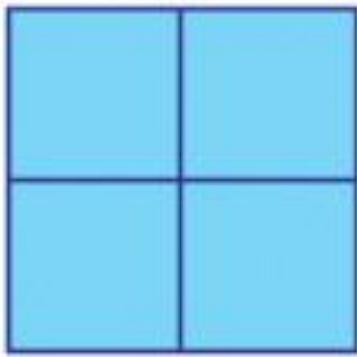




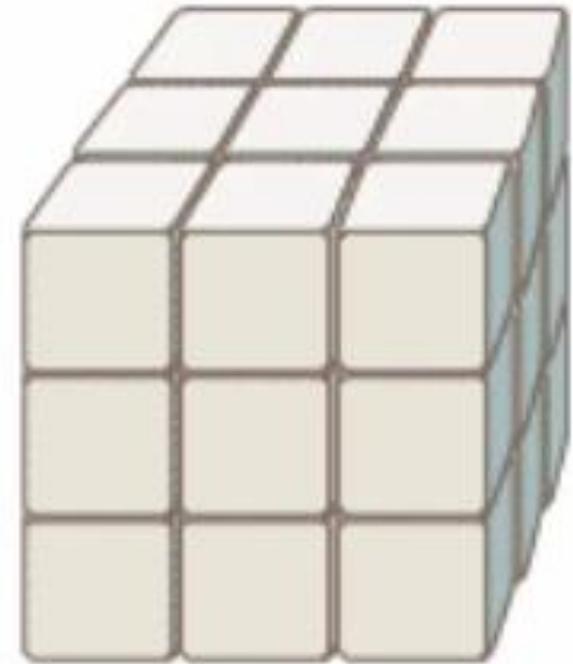
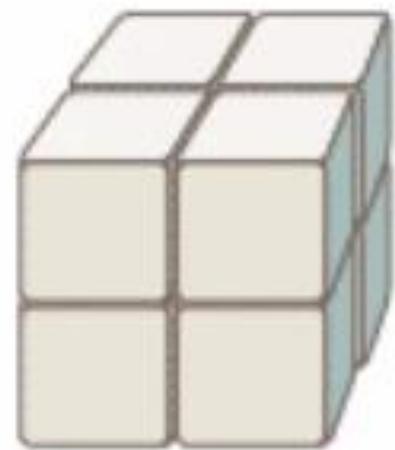
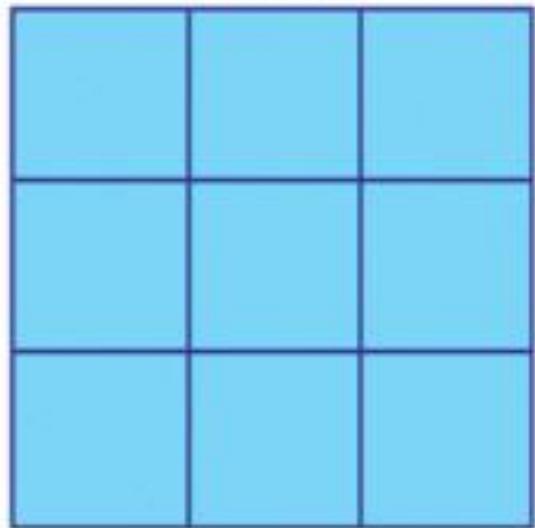
de Graaf J, Maal TJ, Rangel FA, Borstlap WA, Kuijpers-Jagtman AM, Bergé SJ. On the influence of computed tomography exposure parameters on image quality and dose in cephalometric three-dimensional imaging. *AJNR Am J Neuroradiol.* 2009;30(6):1088-1094.

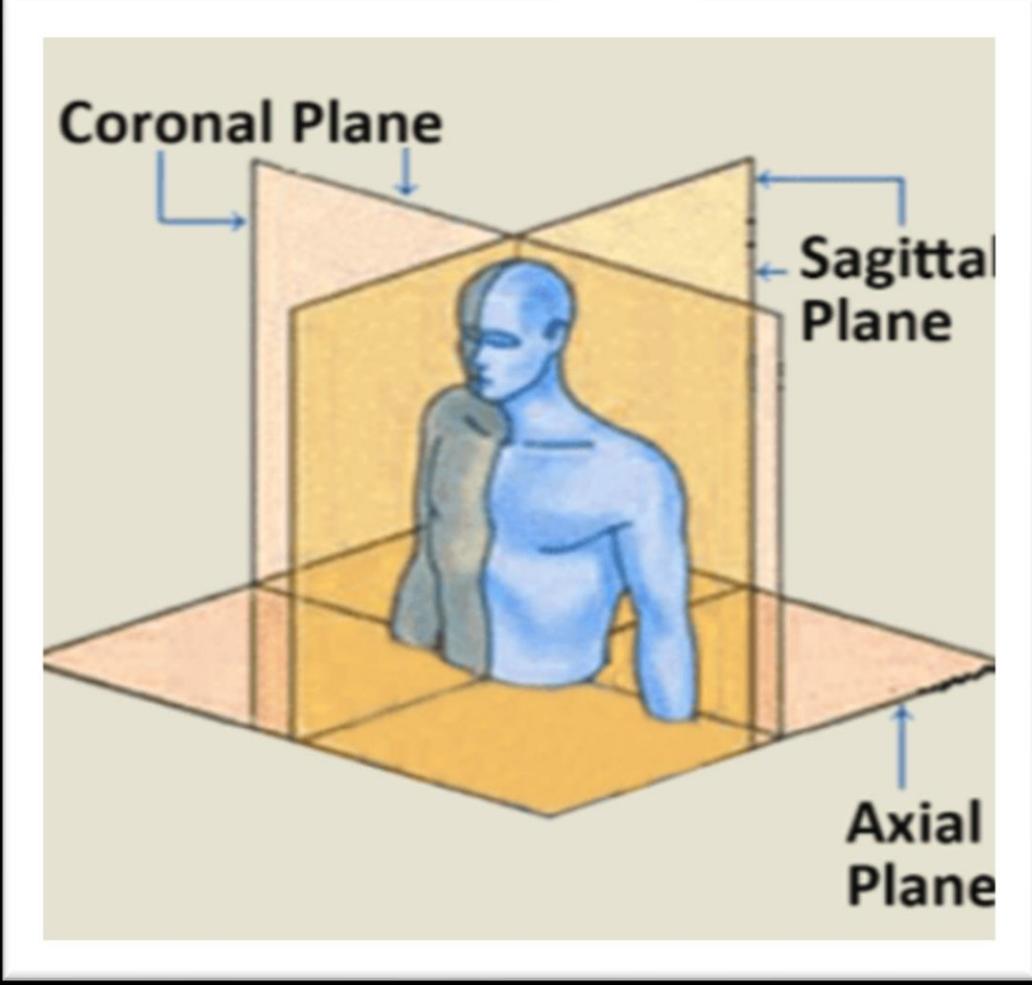
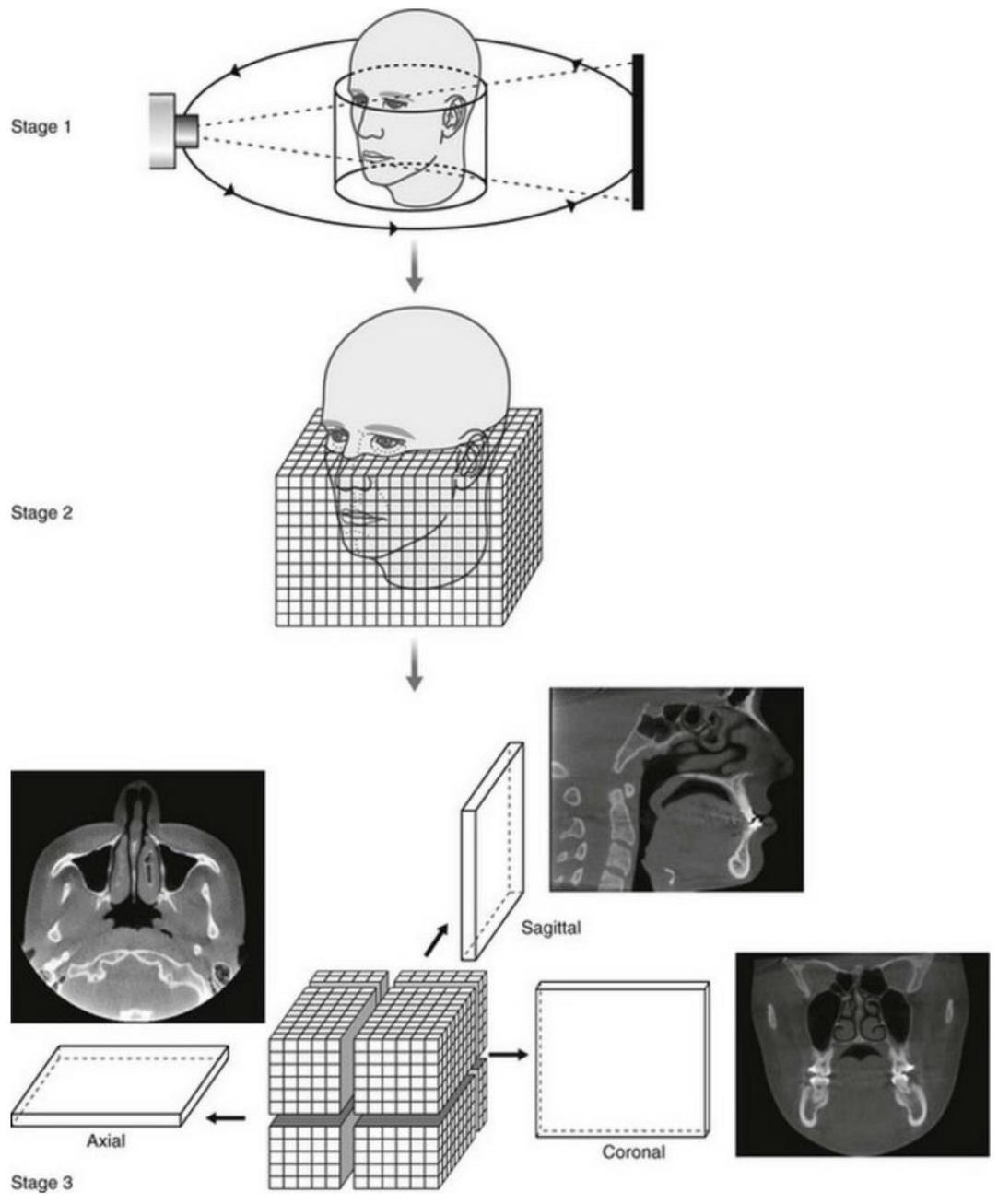


0.2 mm
Med Res



0.3 mm
Low Res







A

B

C

SIZE	HEIGHT	EFF DOSE (msv)
SMALL	<5CM	11-214
MEDIUM	5-10CM	18-674
LARGE	10-15CM	60-511

TABLE 1 Typical patient doses from x-ray examinations of the head

Examination	Effective dose (μSv)¹	Dose as a multiple of the dose from a typical panoramic exam
Panoramic	24	1
Small FOV* CBCT	48 – 652	2 - 27
Large FOV* CBCT	68 – 1073	3 - 45
CT scan (dental programme)	534 – 2100	22 - 88

* FOV = Field of view

FOV

**Voxel
Size**

**Rotation
Arc**

**Exposure
Factors**



Why 3D Imaging in Modern Dentistry?

Can a 2D image answer the clinical question?

2D limitations

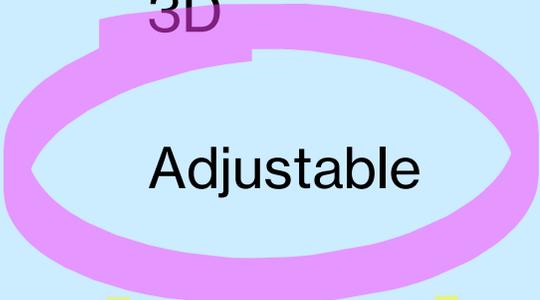
3D accurate diagnosis and treatment planning

Digital Workflow Integration (VSP)

Question	2D	3D
Caries?	Yes	Possibly!
Root #?	Possibly!	Possibly!
Peri-implant bone loss?	Yes	No
Impacted tooth?	Yes	Yes
Resorption?	Possibly!	Yes
Accessory root canal?	No	Yes
Cyst/Tumour/Lesion?	Yes	Yes
Bone #?	Yes	Yes
ID Canal involvement?	Yes	Yes
Relationship to 3 rd Molar?	To an extent...	Yes

2D	3D
Superimposition	No Superimposition
Quick	Shows Exact Position
Easy Comparison	1:1 Scale
High Spatial Resolution	Limitless Manipulation
Can be straightforward to interpret	Difficult to Interpret
Distortion	Multiple Images
Artefacts	Artefacts: Metal, Movement
Low Dose	Higher Dose

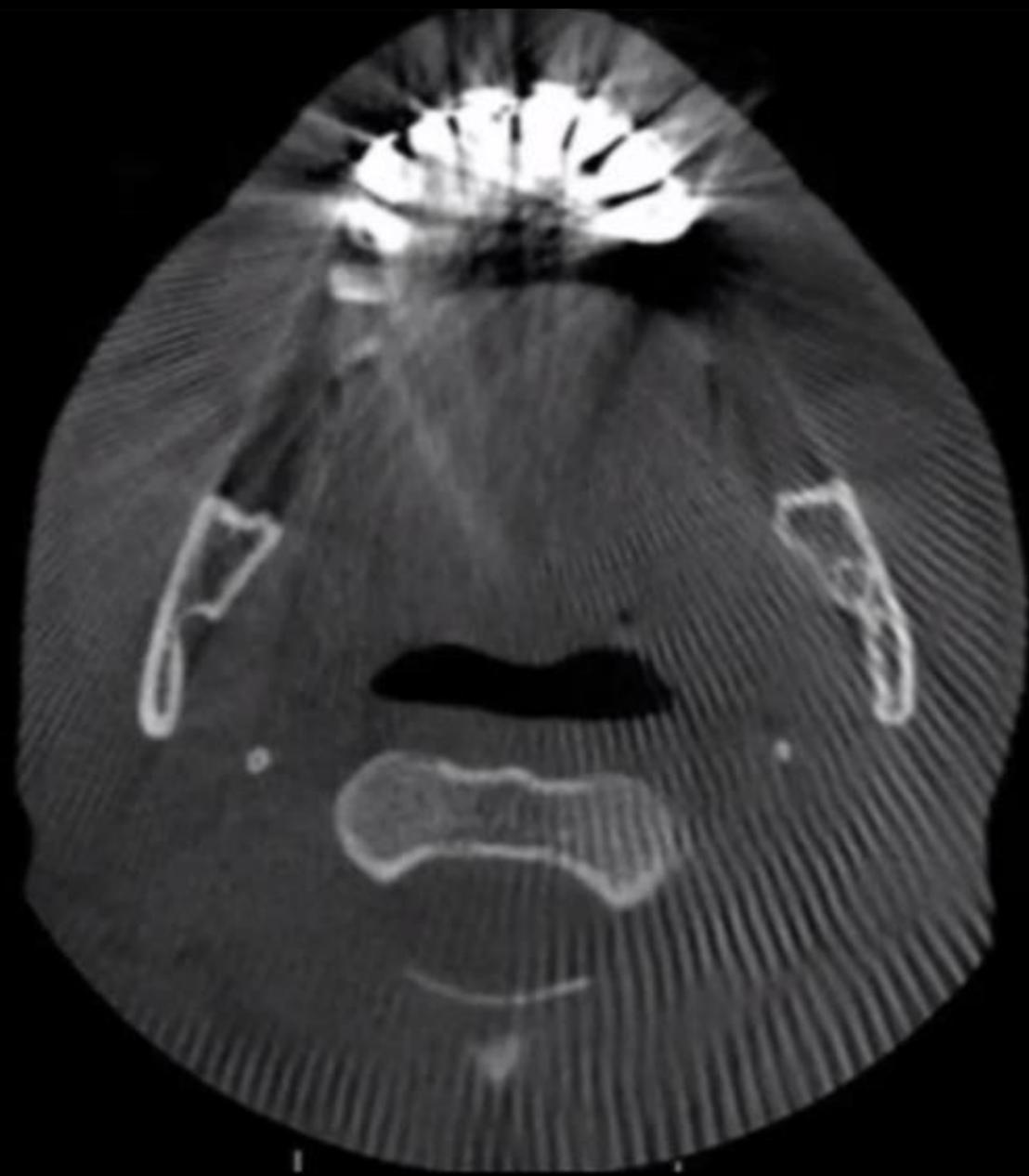
Feature	Intraoral/Panoramic	Medical CT	CBCT
Beam type	Narrow fan	Fan	Cone
Dimension	2D	3D	3D
Field of View	Limited	Large	Adjustable
Radiation dose	Low	High	Moderate
Spatial resolution	High	Moderate	High

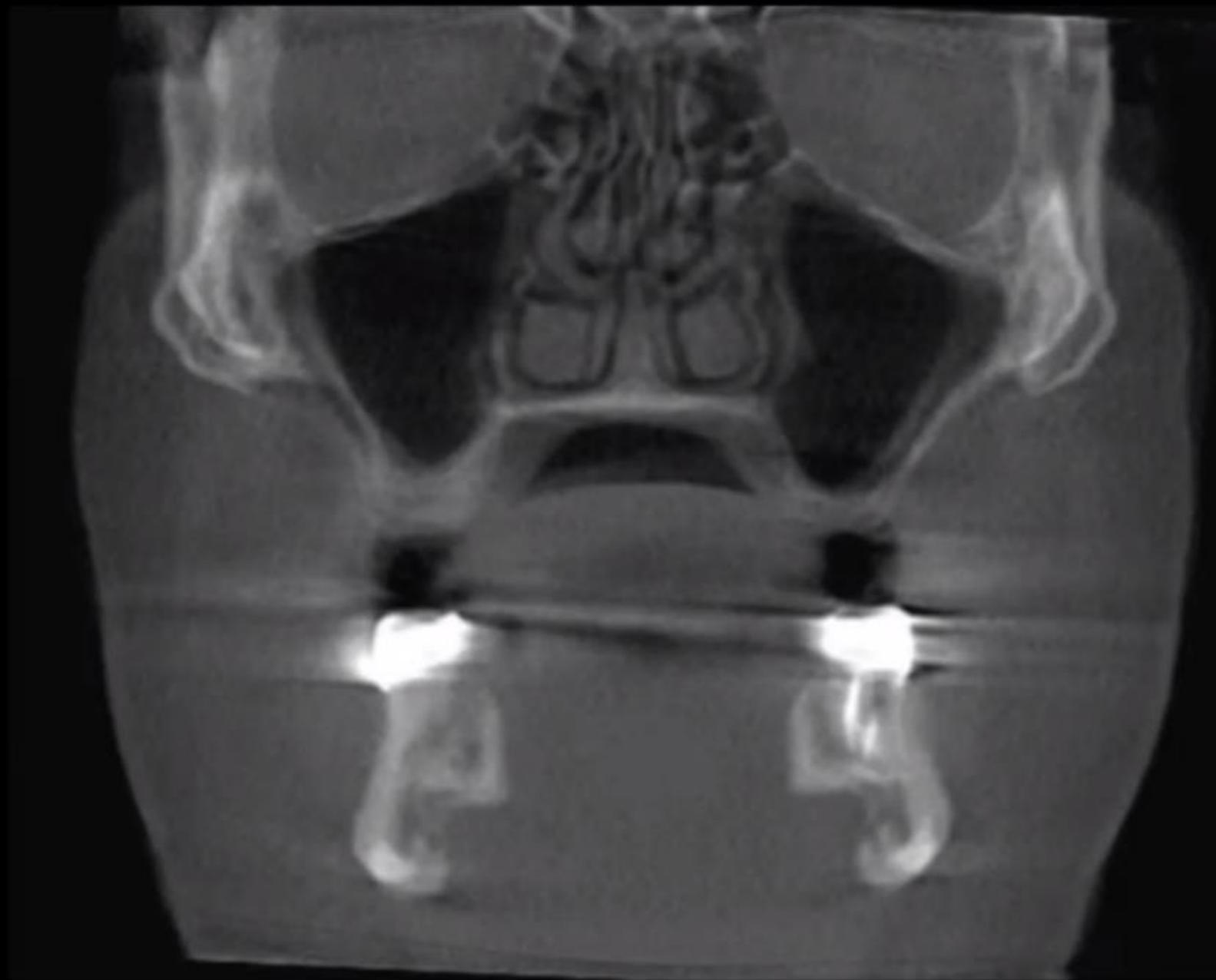


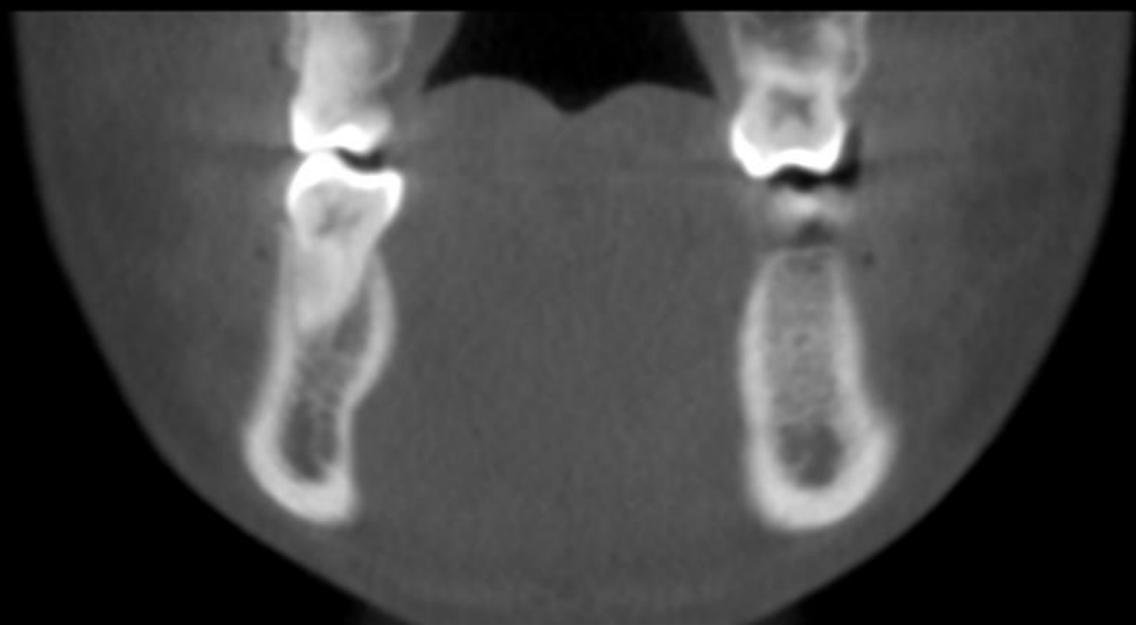
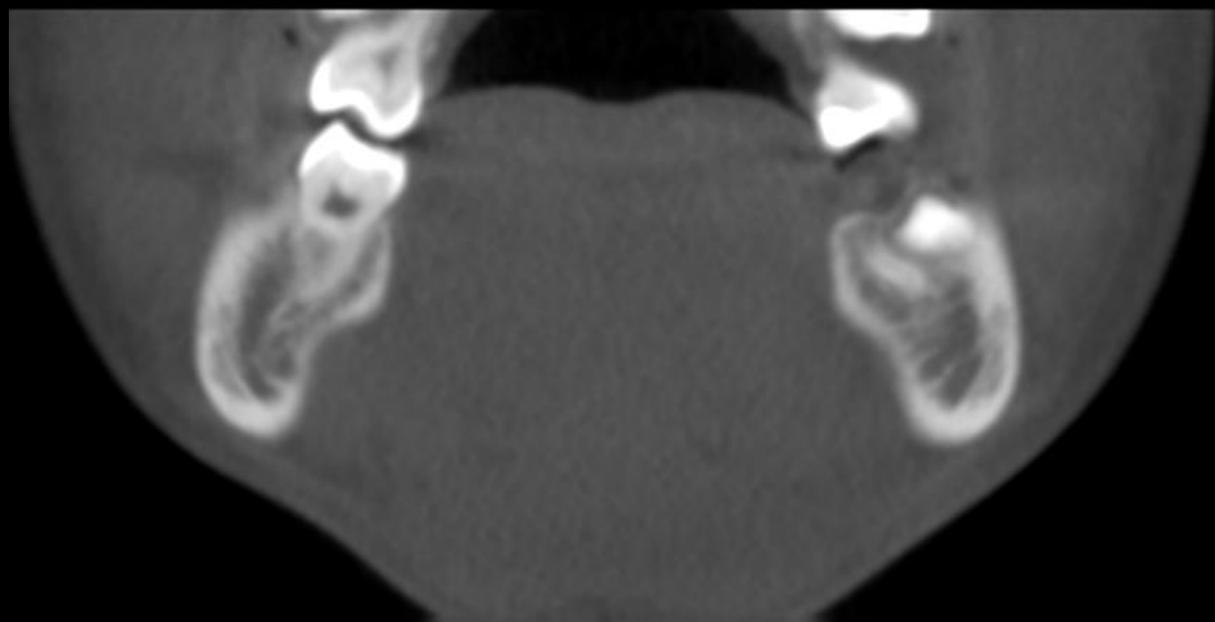
CBCT vs Medical CT











Legislation

EADMFR requires 2 levels of education for dentists:

- Level 1: Prescribers
- Level 2: Practitioners
- 5-year refresher courses recommended

Guidance Notes for Dental Practitioners on the safe use of x-ray equipment (PHE, 2020)

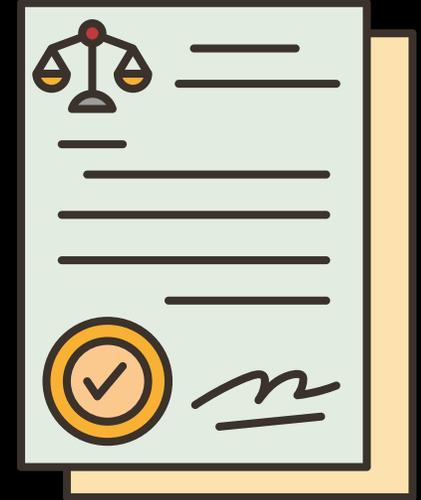
HPA-CRCE-010- Guidance on the Safe Use of Dental Cone Beam CT

European Guideline: Radiation Protection No. 172 i.e. SEDENTEXCT Guidance.

European Society for Endodontology Position Statement

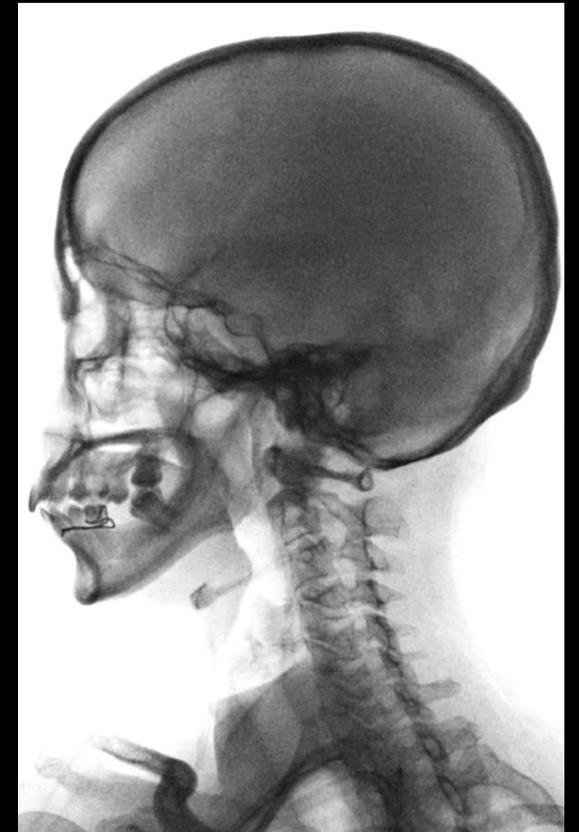
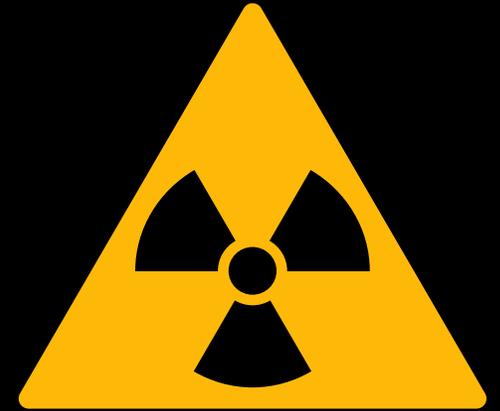
The European Association for Osseointegration (EAO) guidelines for the use of diagnostic imaging in implant dentistry.

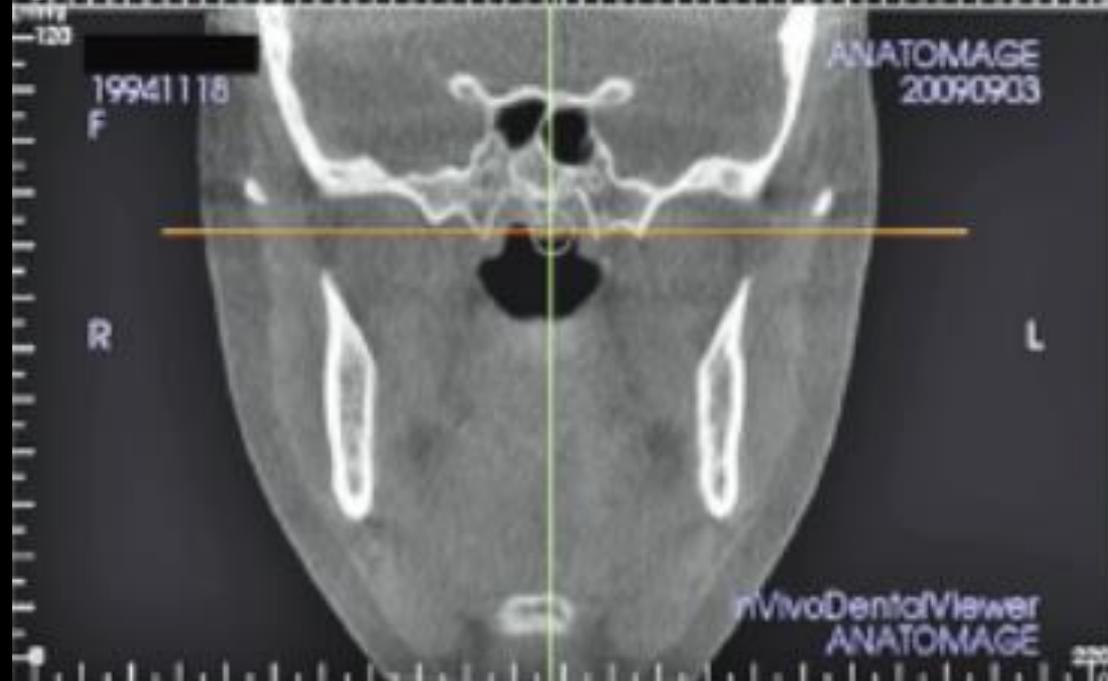
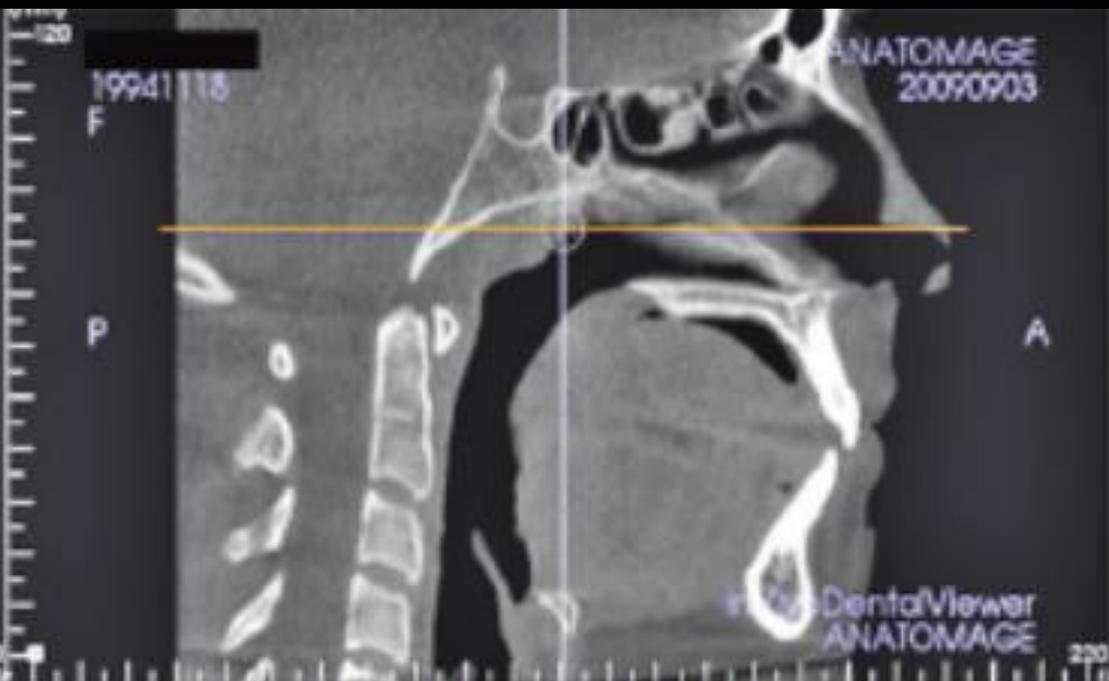
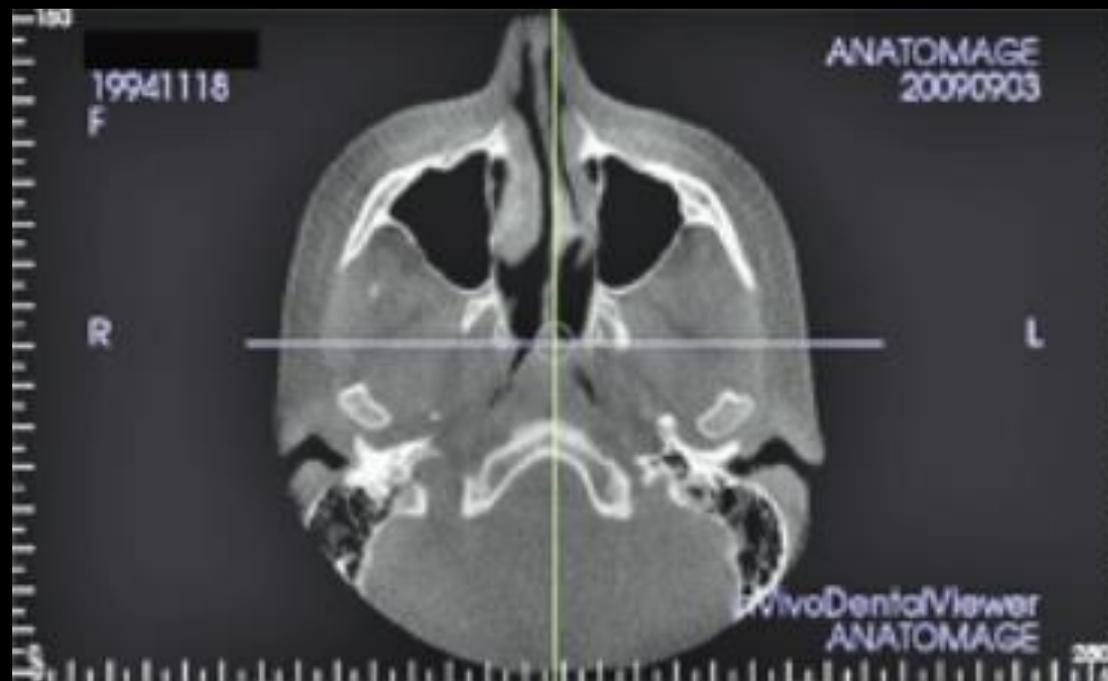
IRMER (2018) and IRR (2018)

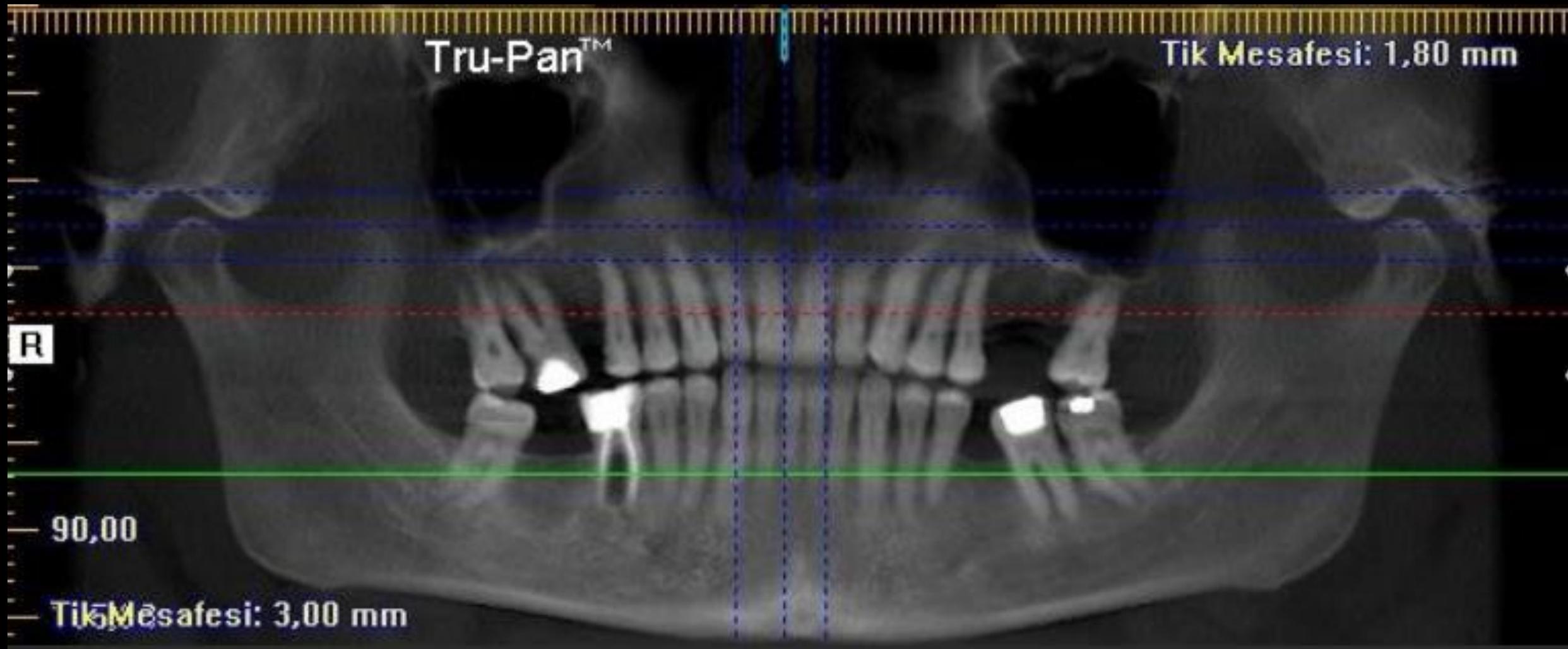


Justification and Optimisation

- **Justify:** Use only when results will affect management
- **Optimise:** Smallest FOV, lowest exposure, largest voxel size
- **Protect:** Apply ALARP principle
- **Follow guidelines** (IRMER, SEDENTEXCT, EADMFR etc.)







Tru-Pan™

Tik Mesafesi: 1,80 mm

R

90,00

Tik Mesafesi: 3,00 mm

Maxilla

Intermaxillary suture

Mandibular ramus

Mandibular canal

Incisive canal

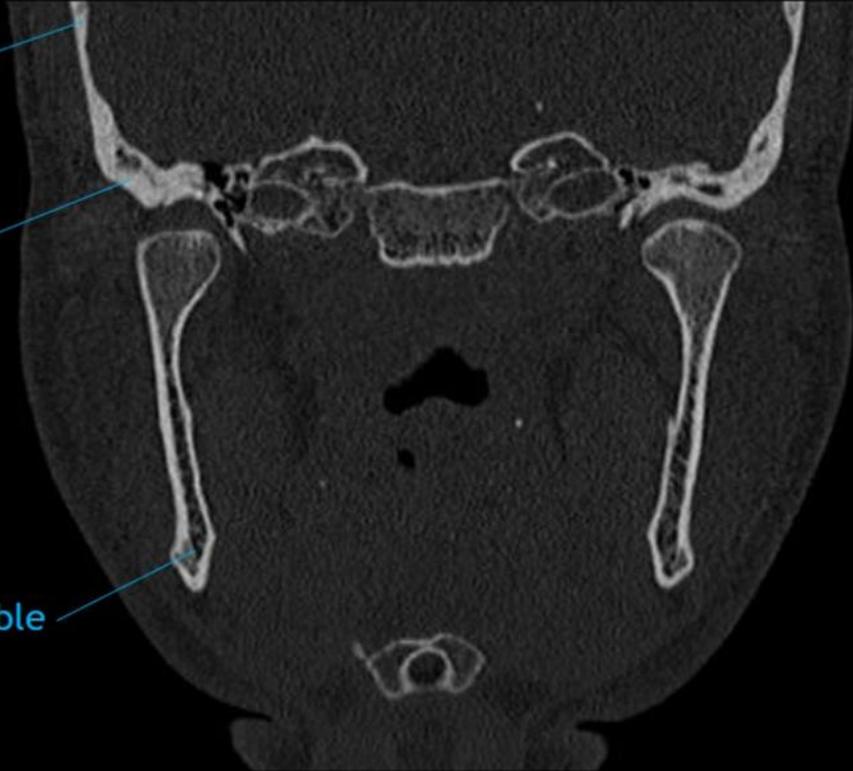
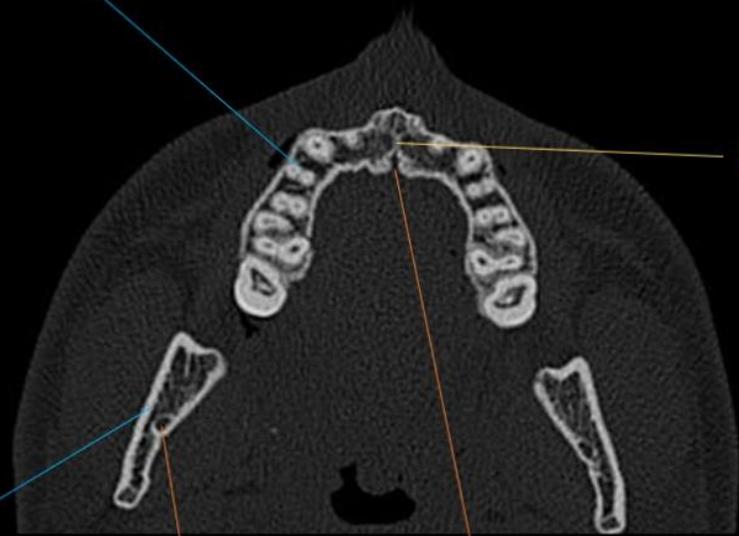
Parietal bone

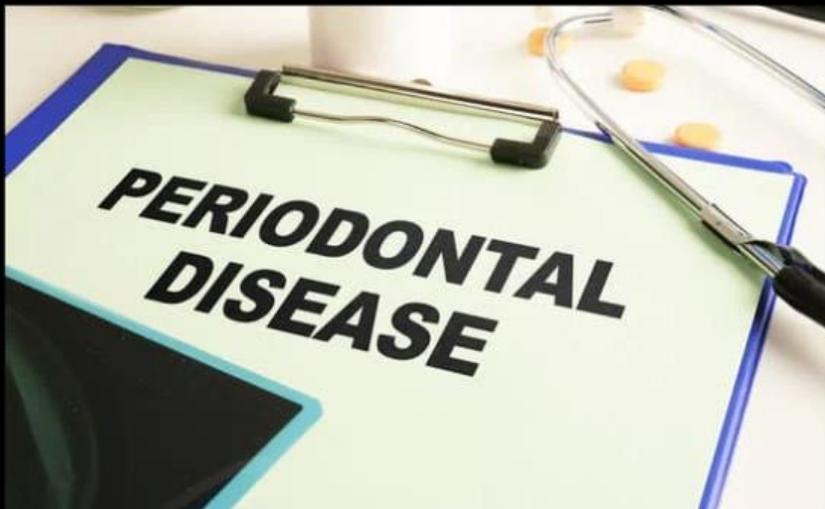
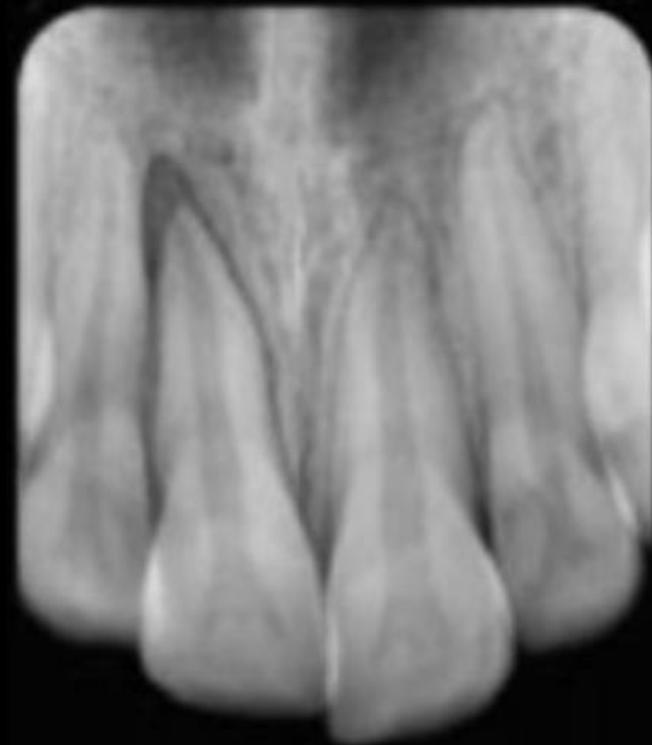
Temporal bone

Mandible

Maxillary Sinus

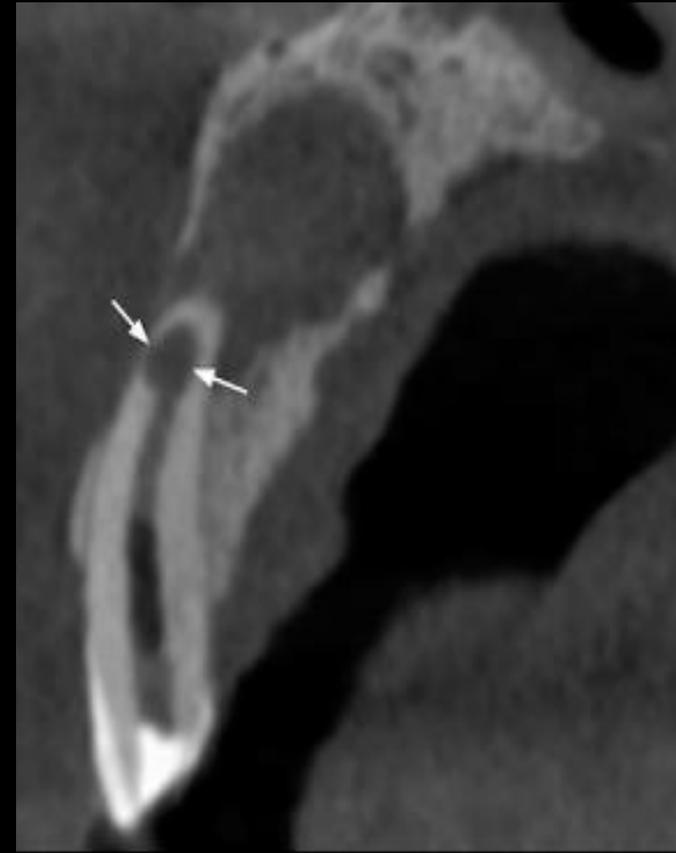
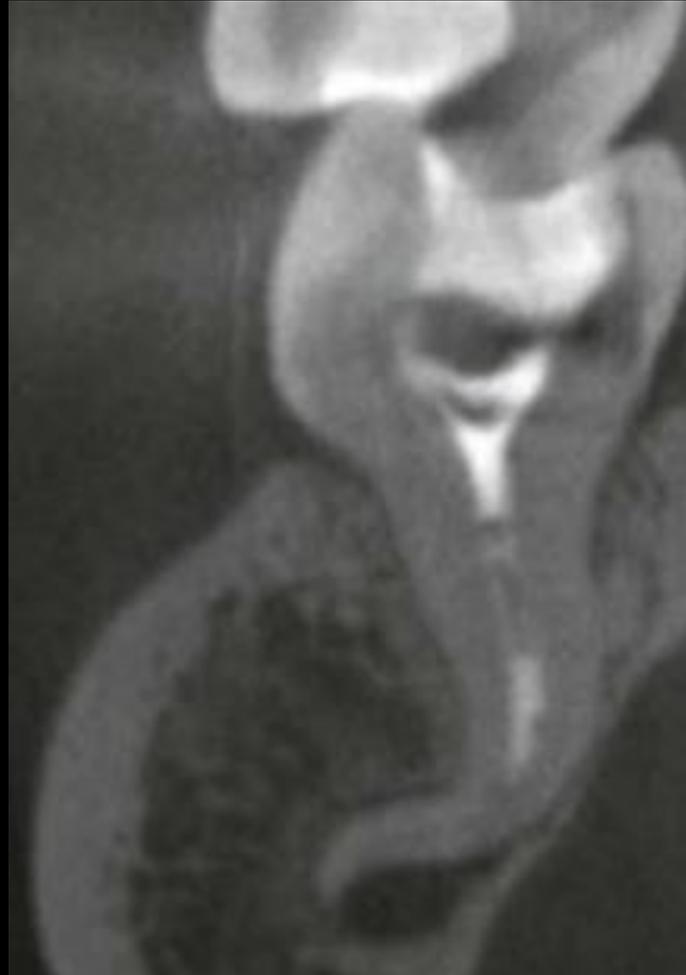
Cervical Spine

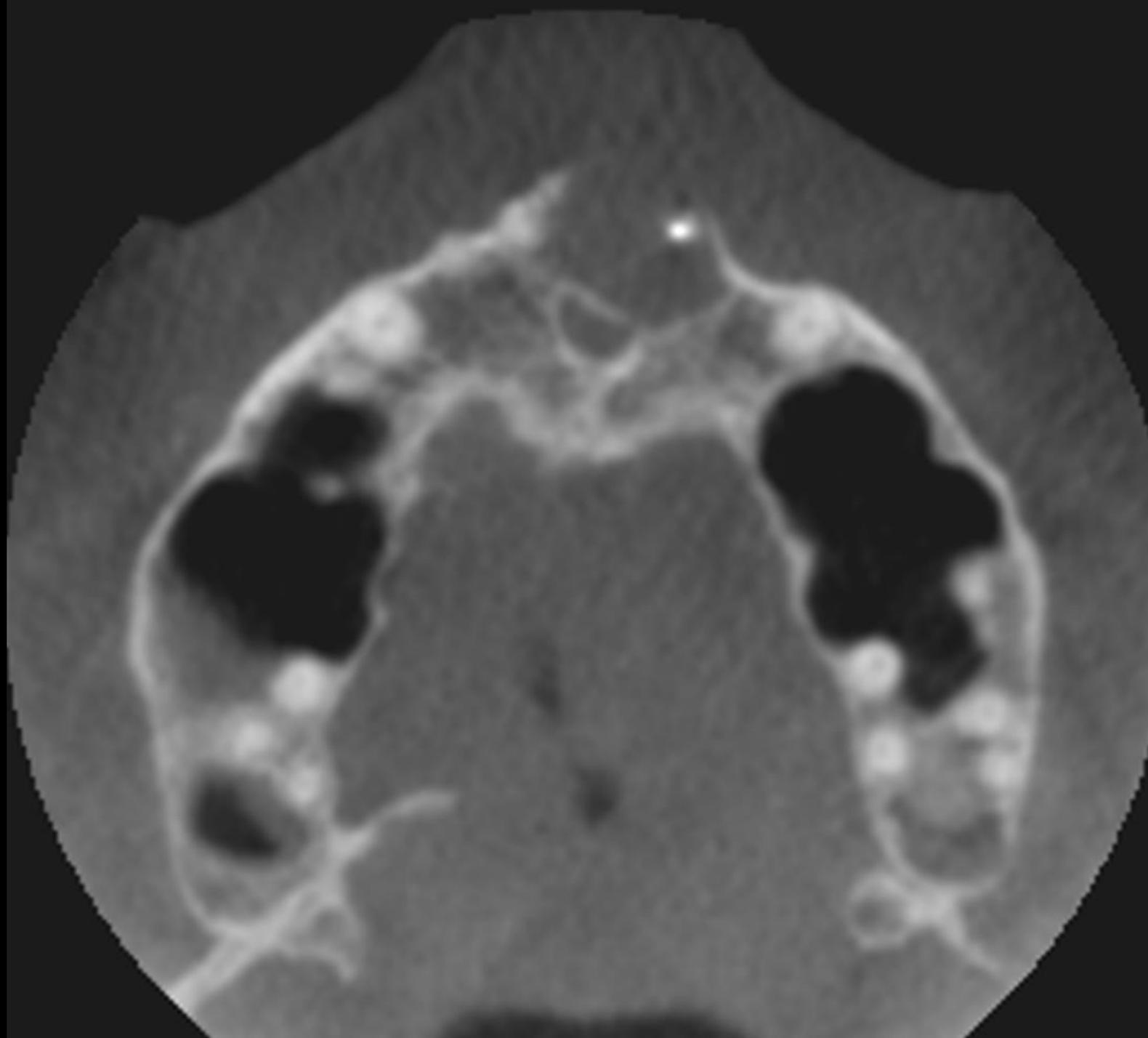




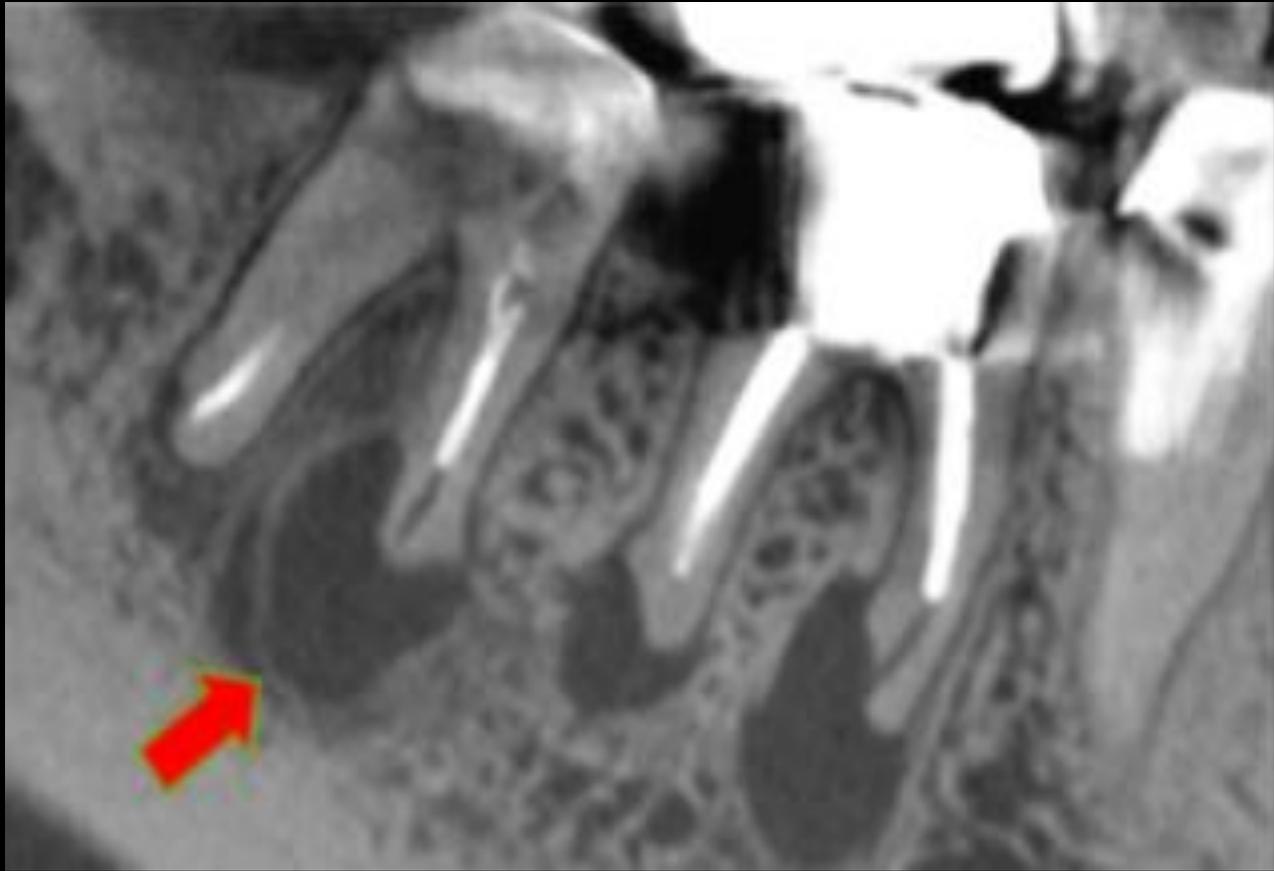


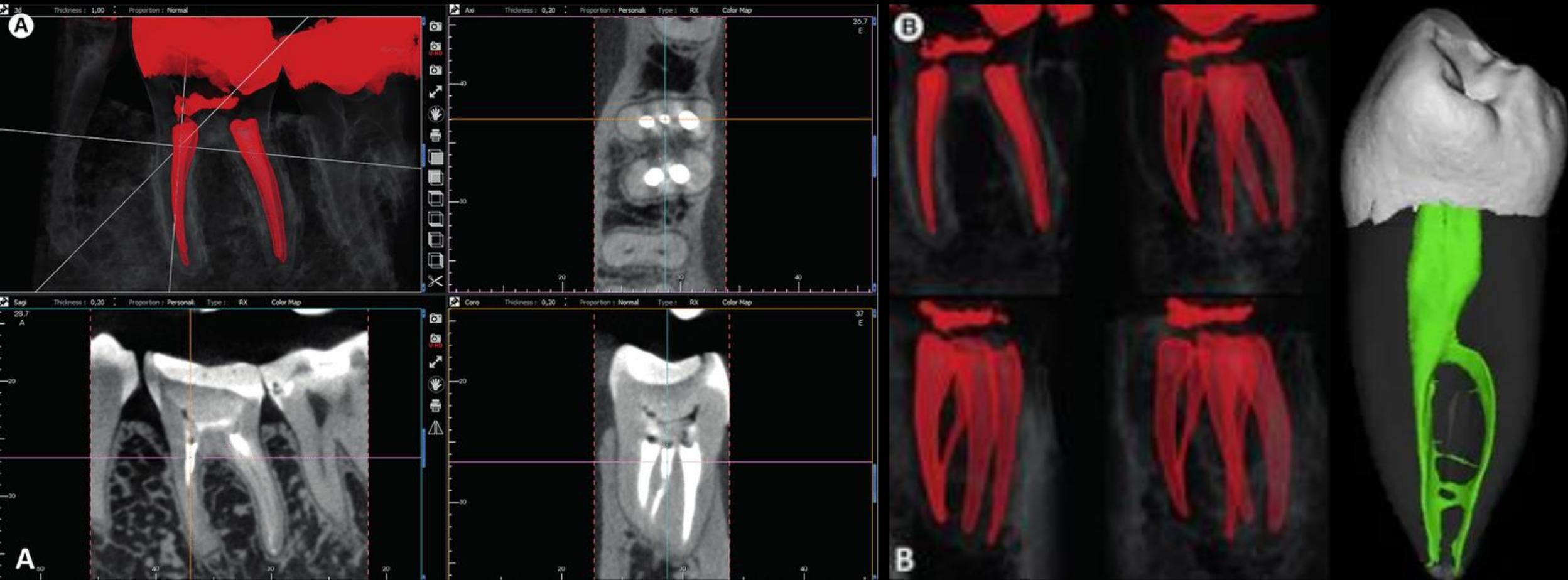
European Society
of Endodontology



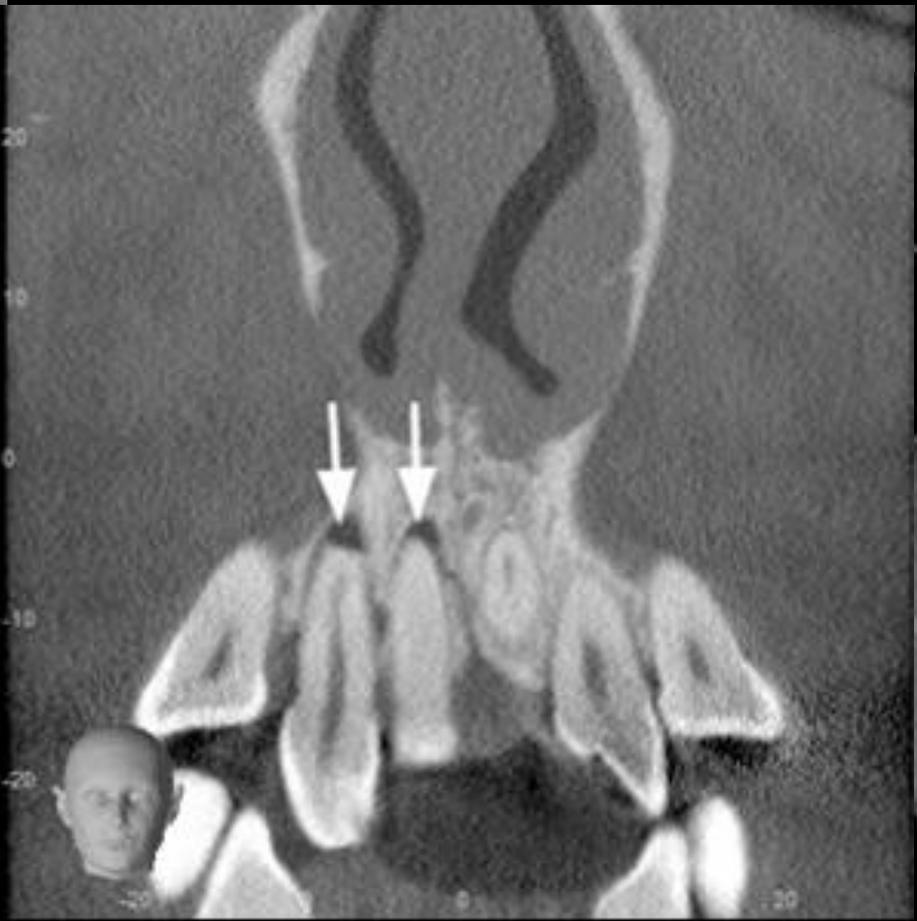
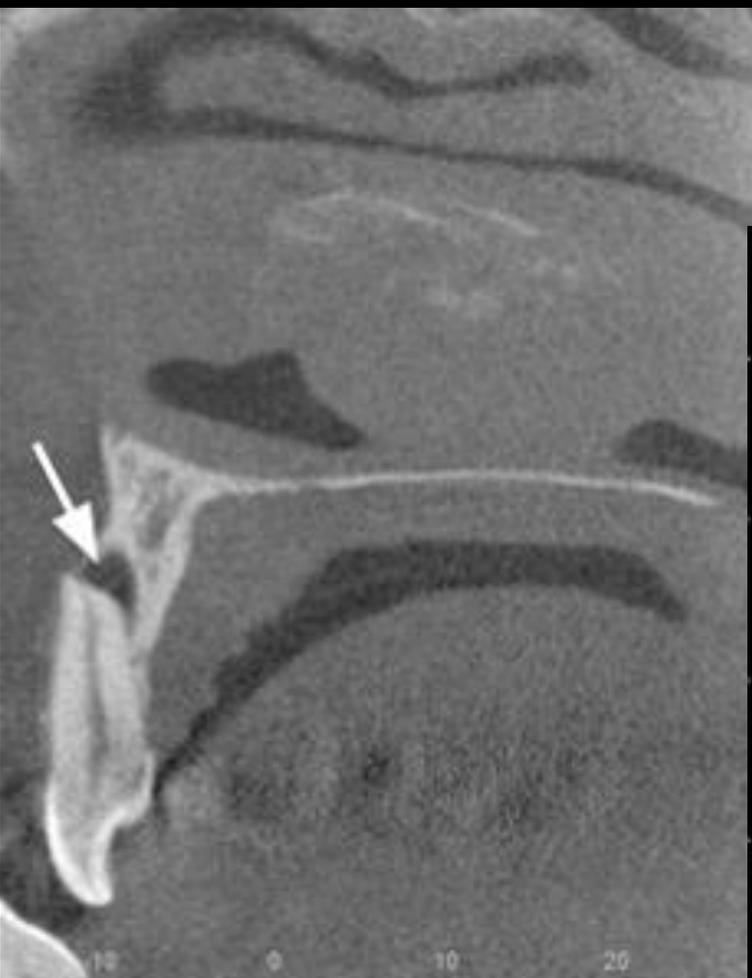


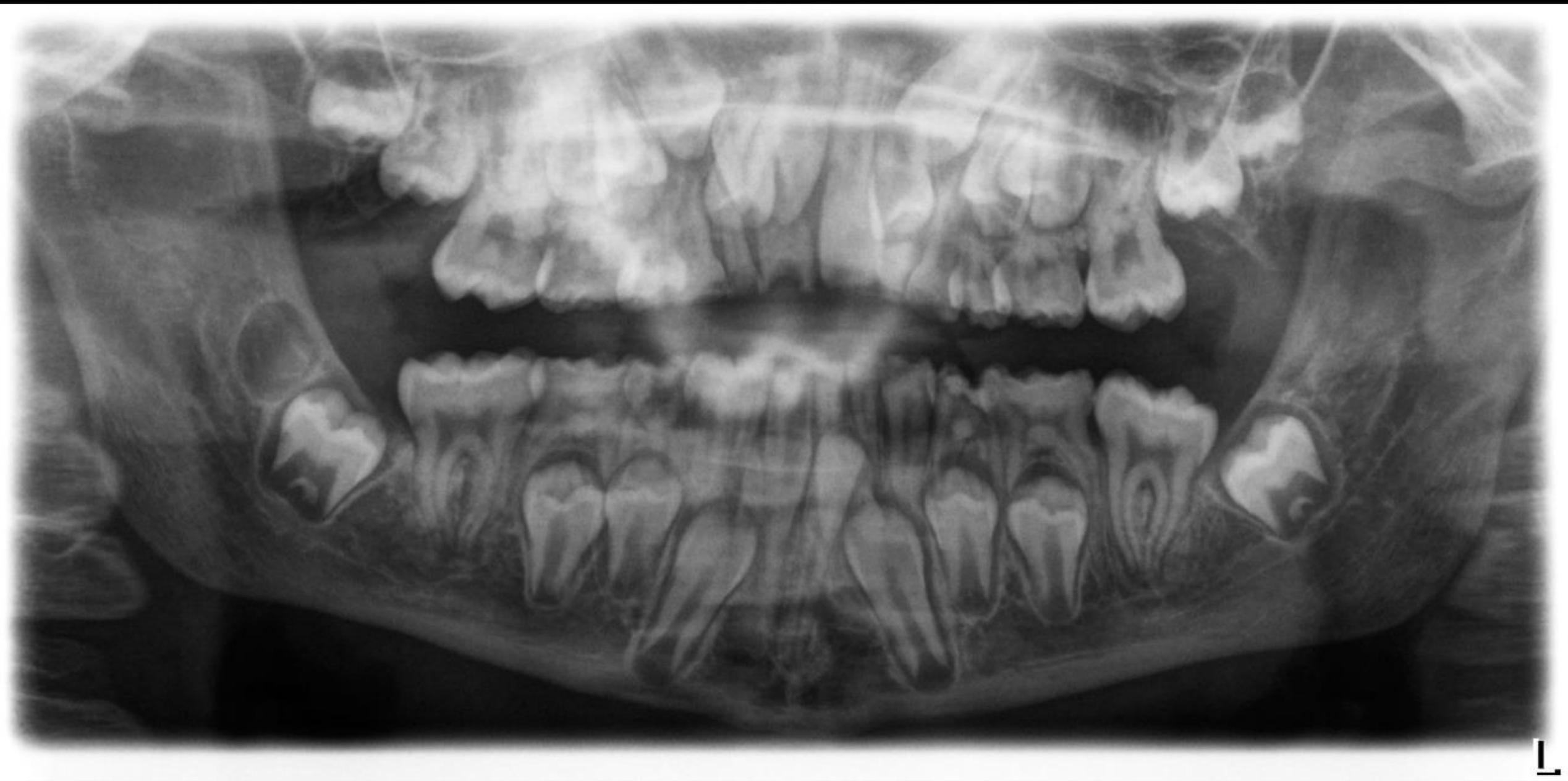


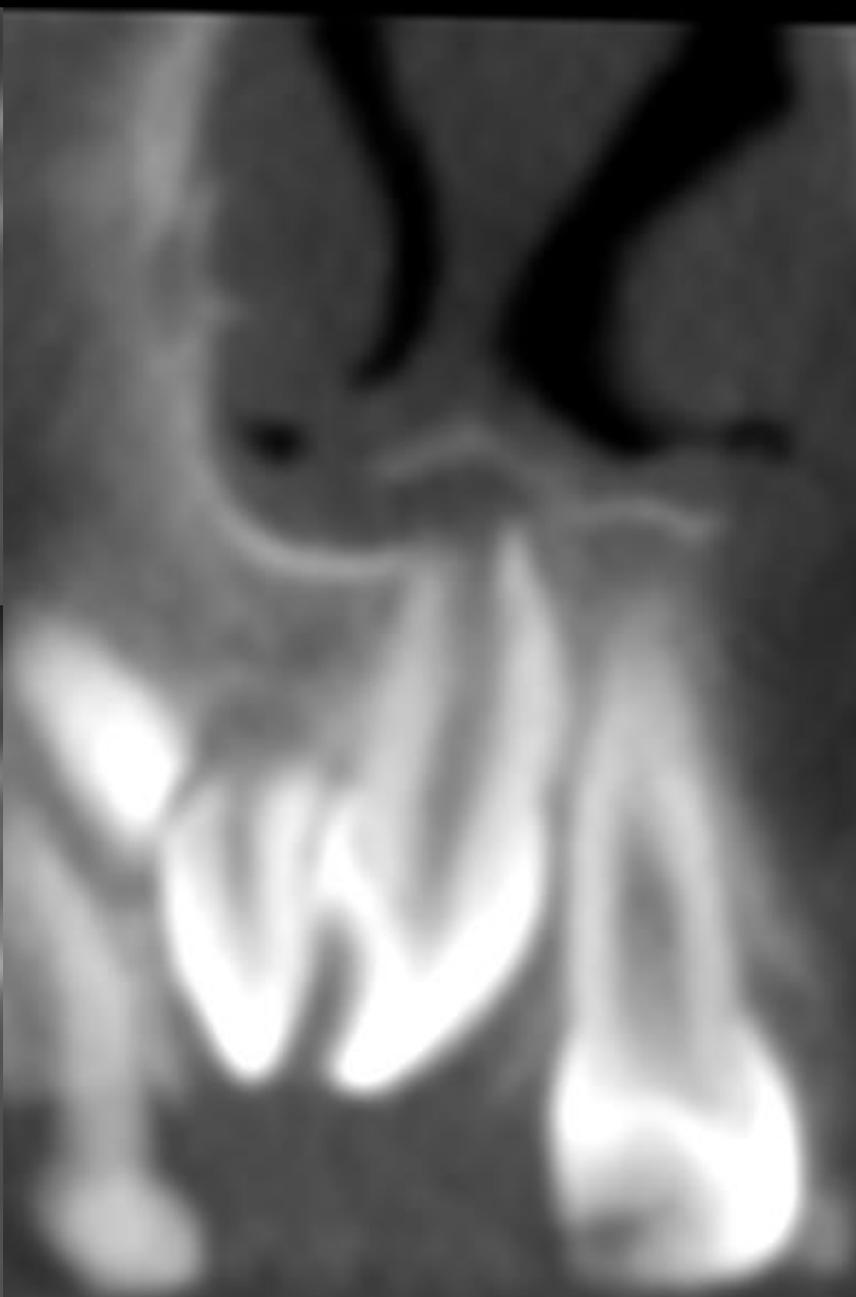
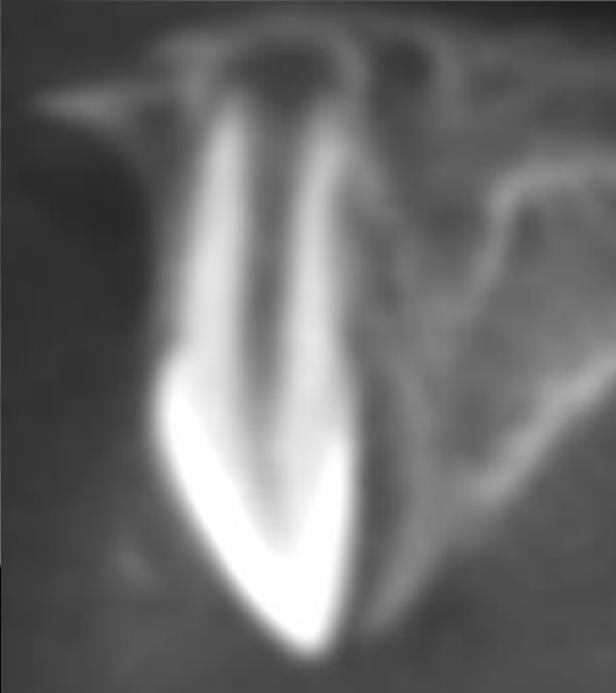
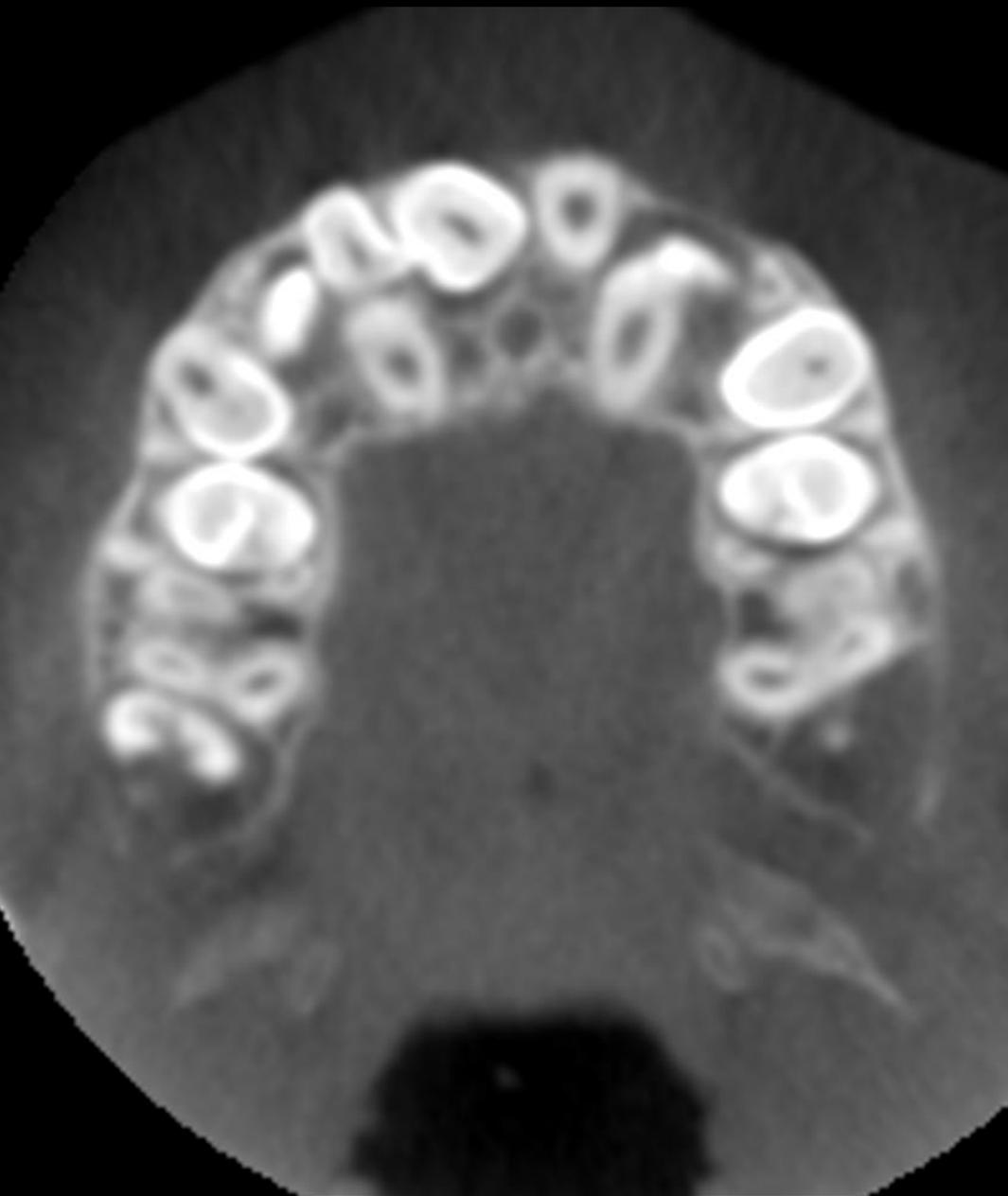




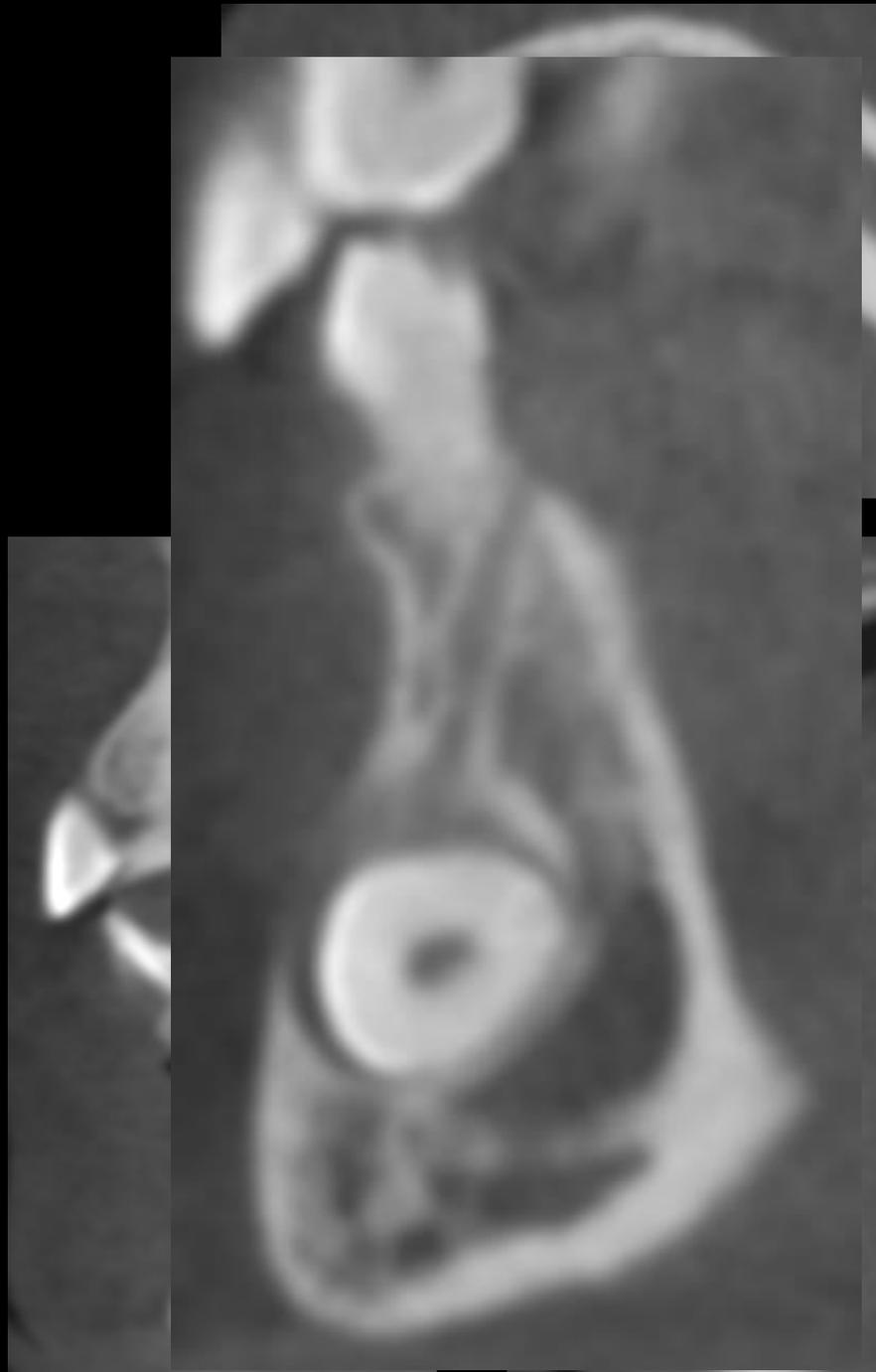
Bueno, Mike & Estrela, Carlos & Azevedo, Brunno & Diogenes, Anibal. (2018). Development of a New Cone-Beam Computed Tomography Software for Endodontic Diagnosis. *Brazilian Dental Journal*. 29. 517-529. 10.1590/0103-6440201802455.

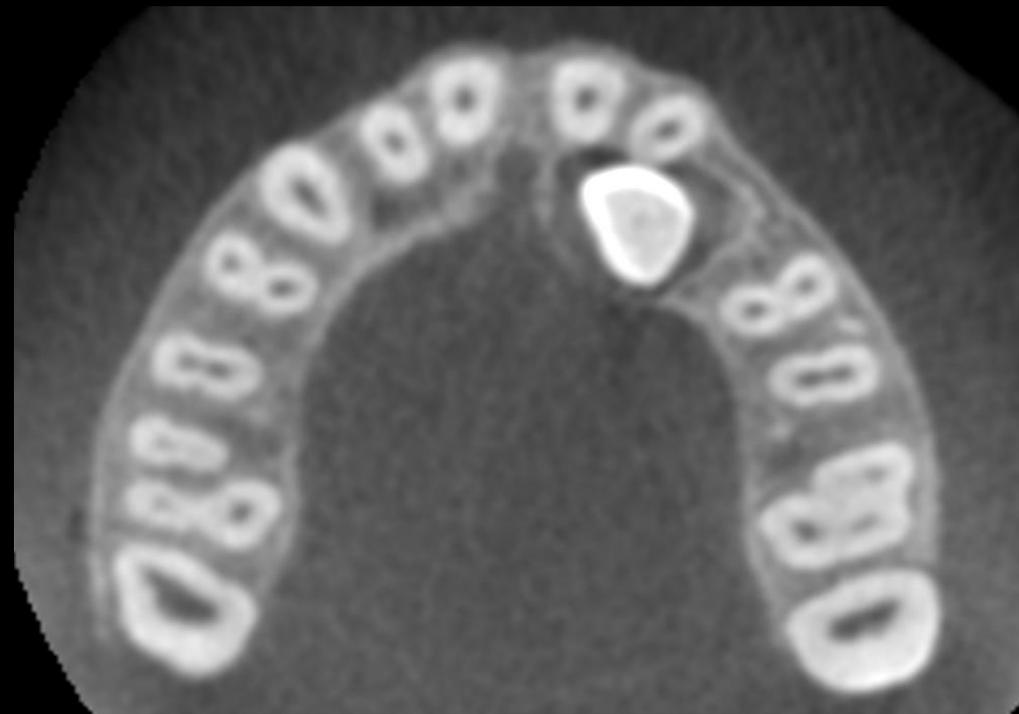


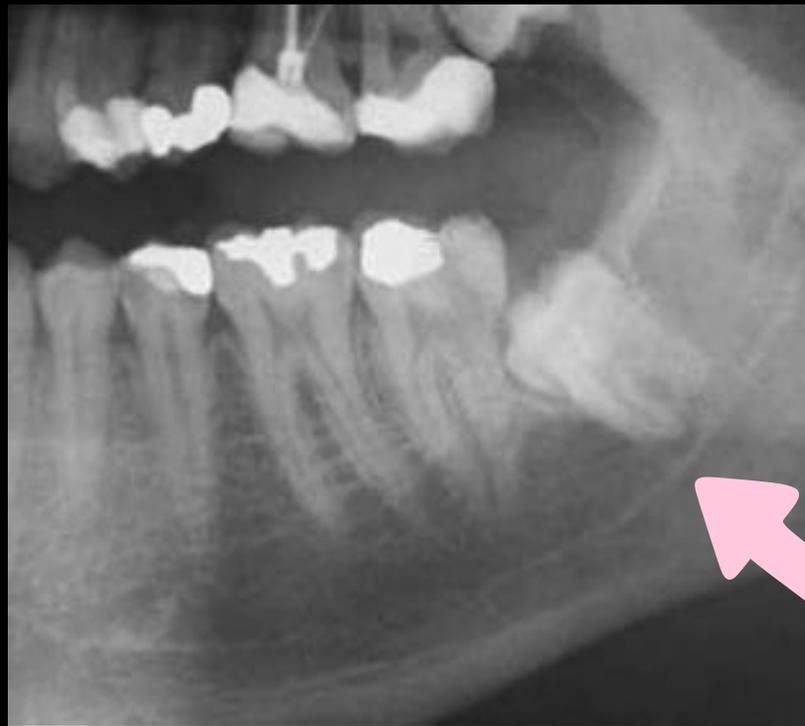


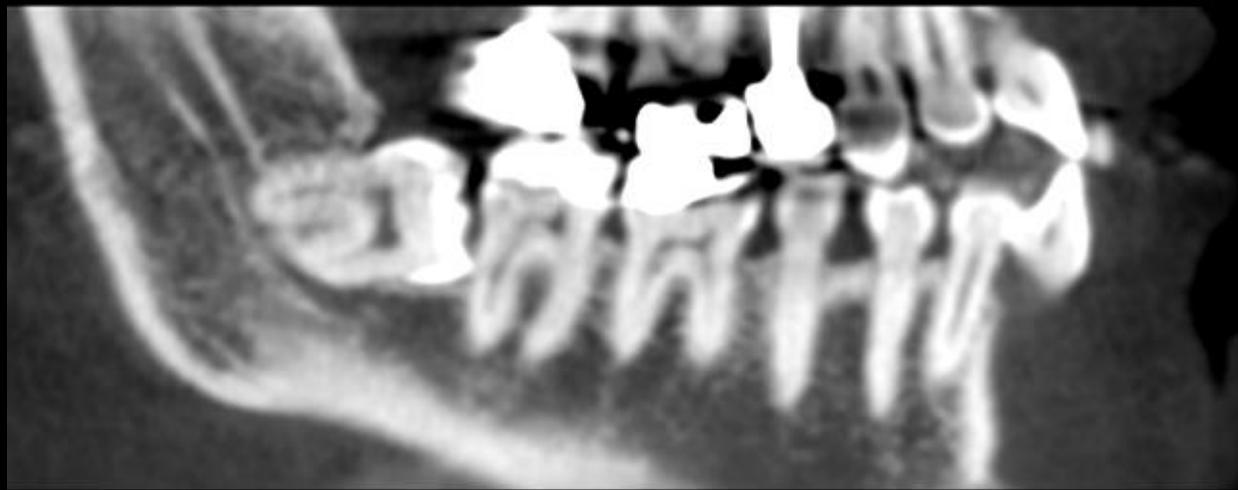
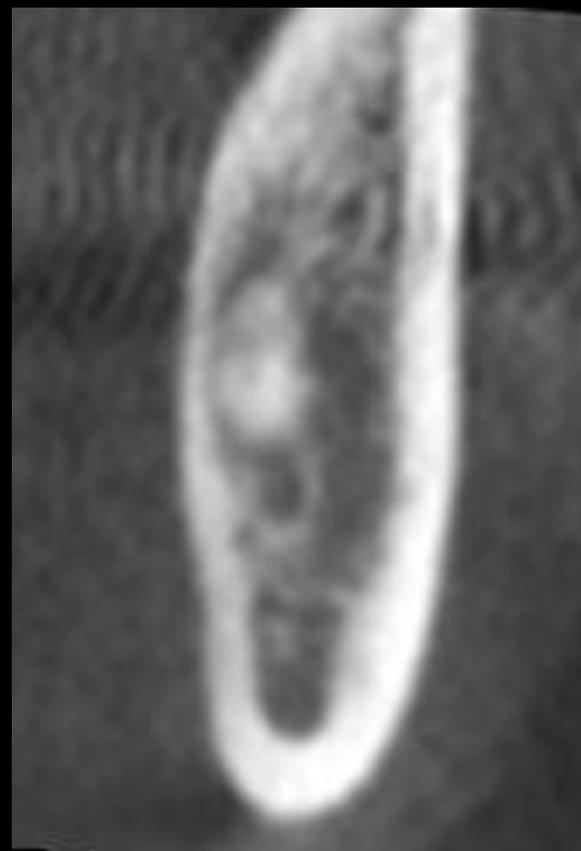


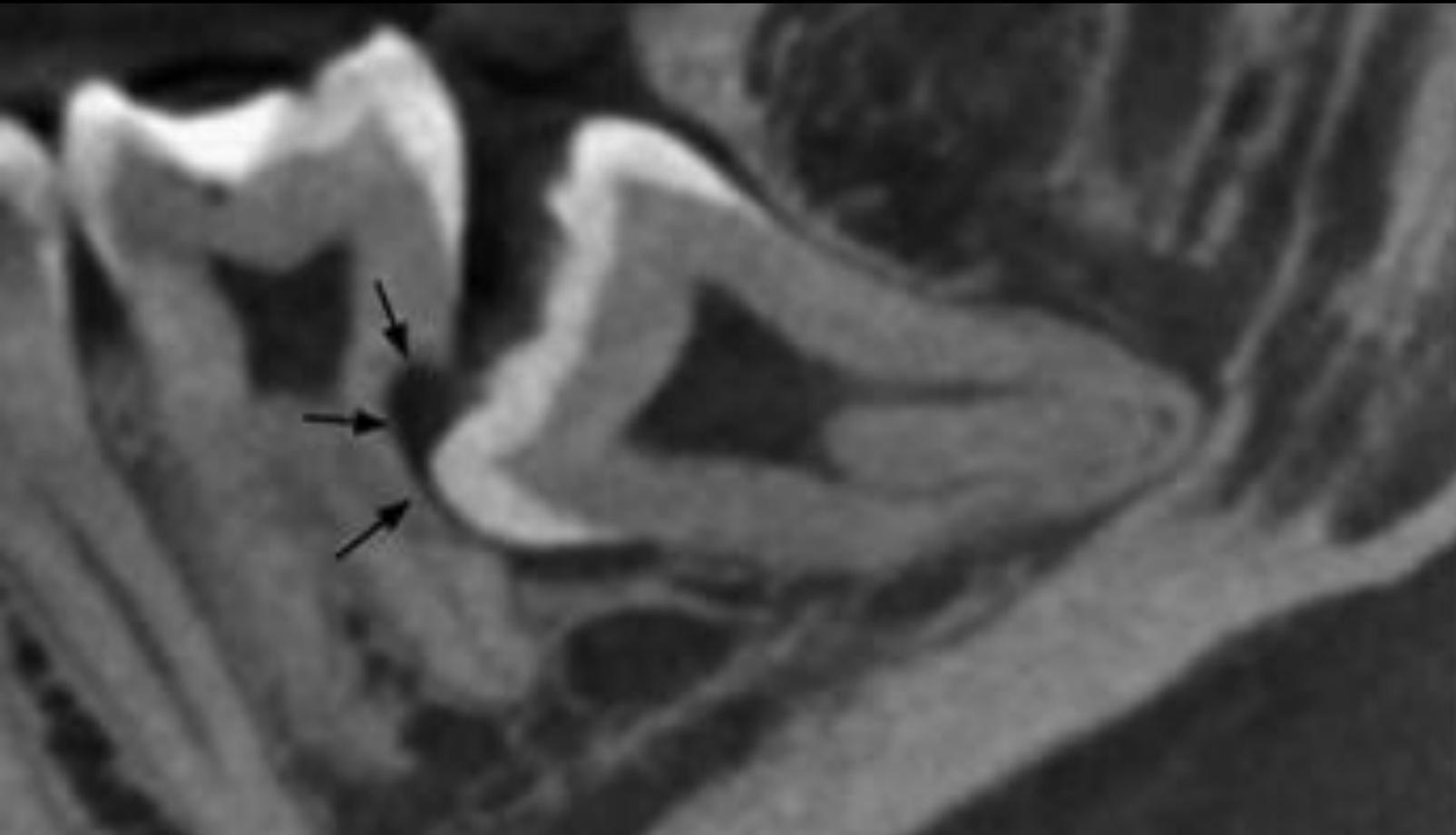


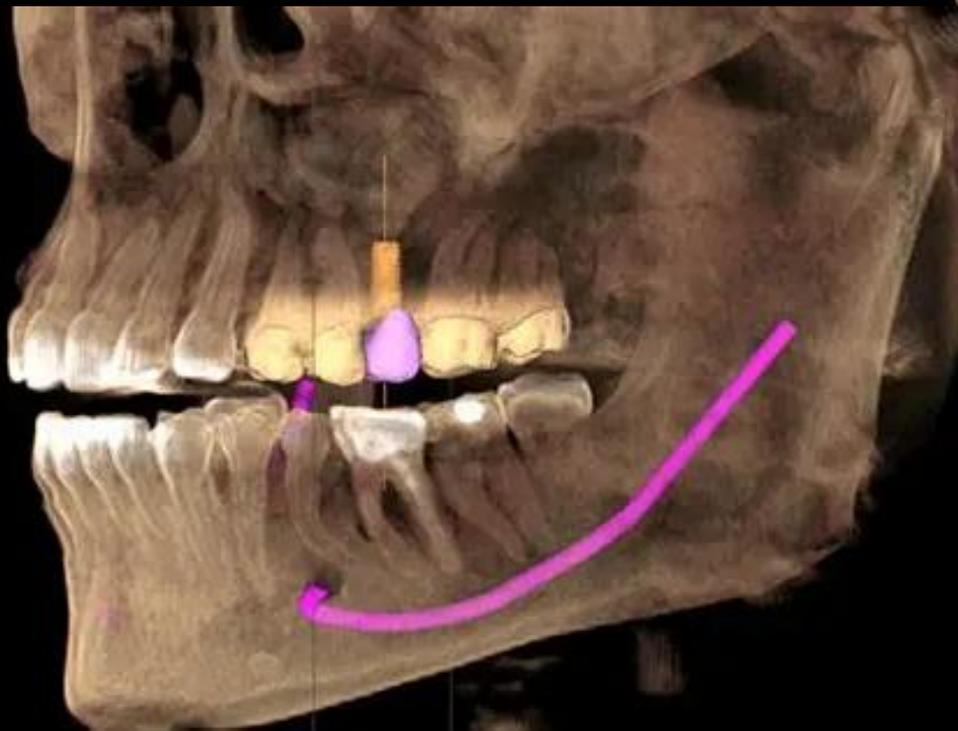


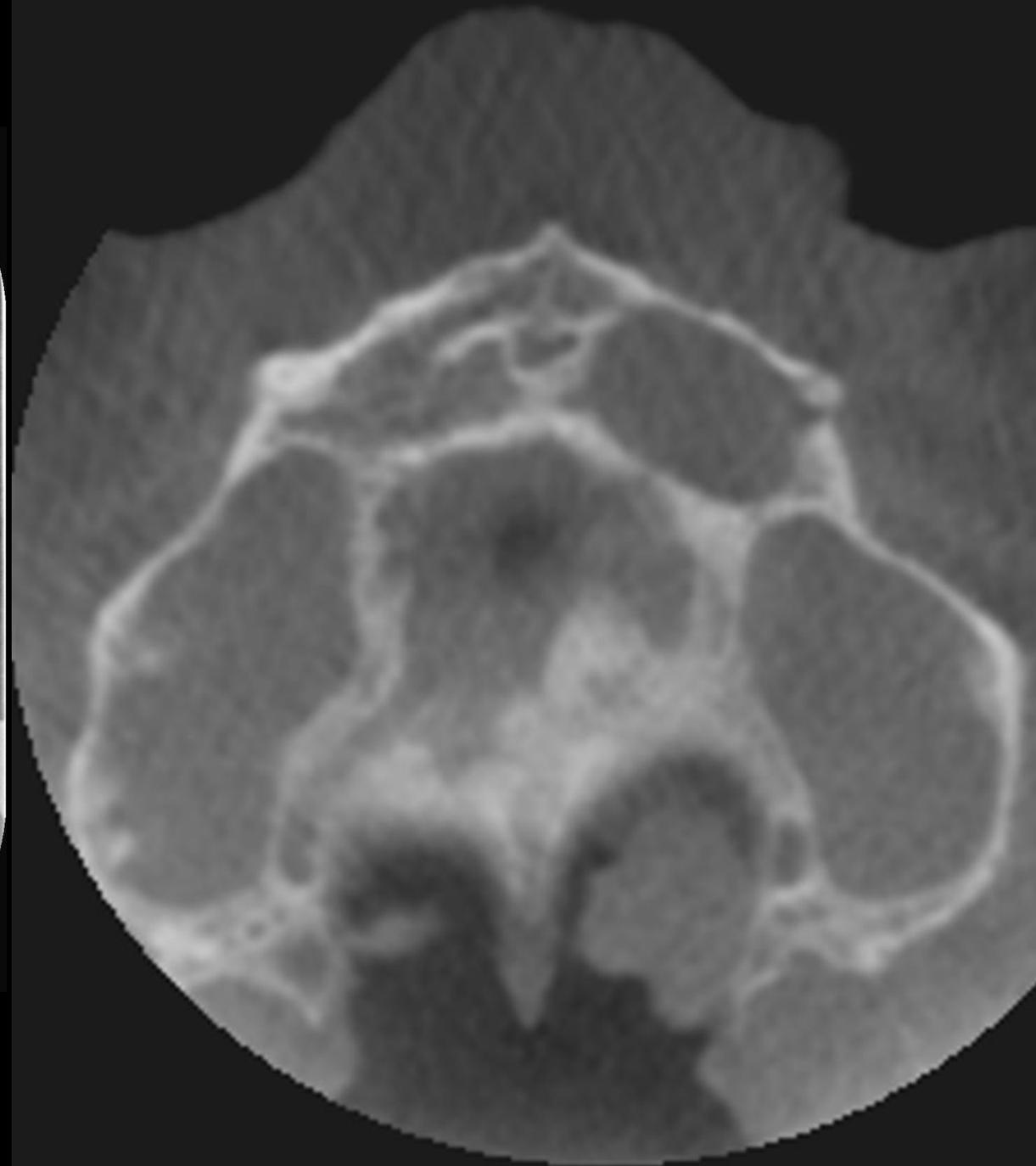


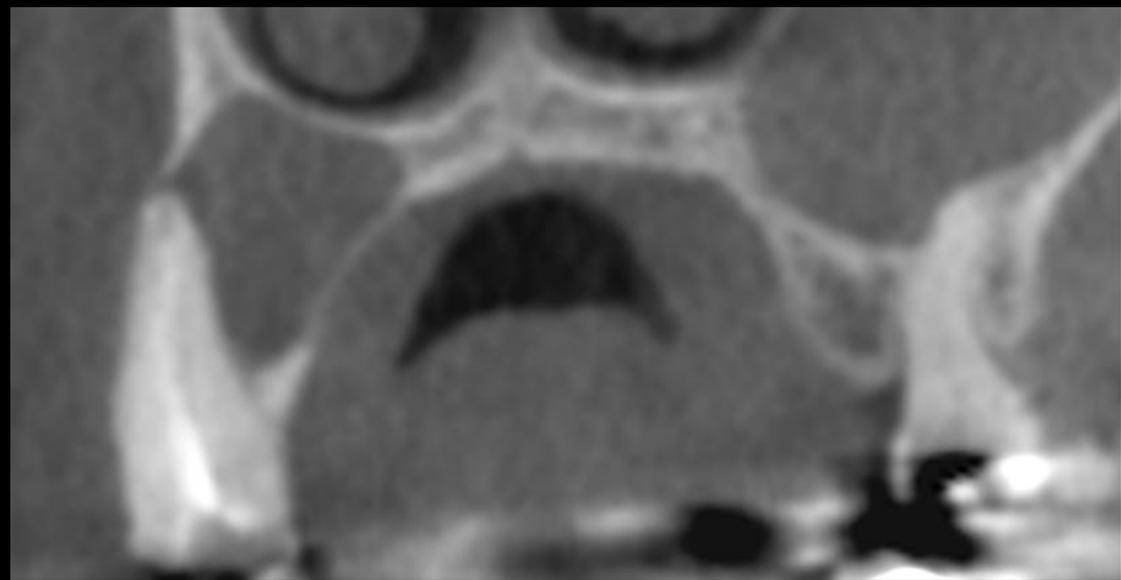
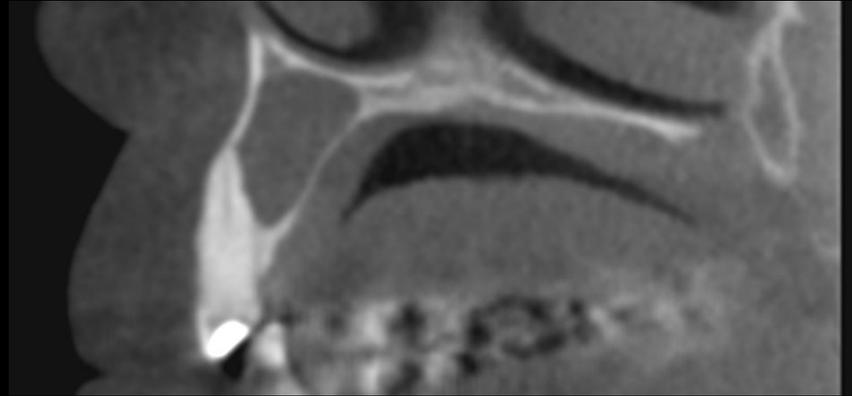
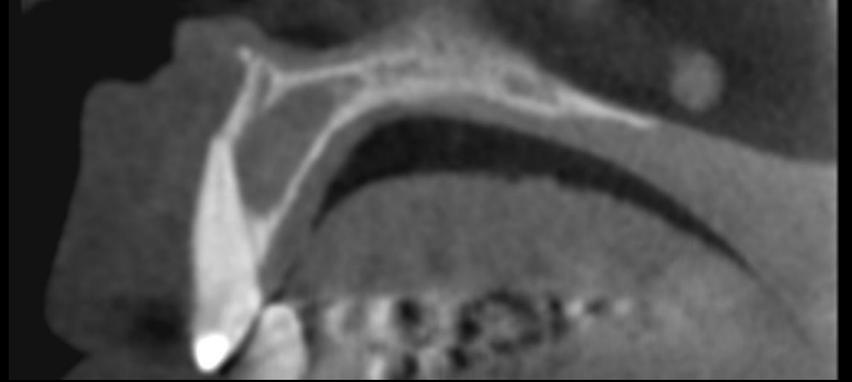




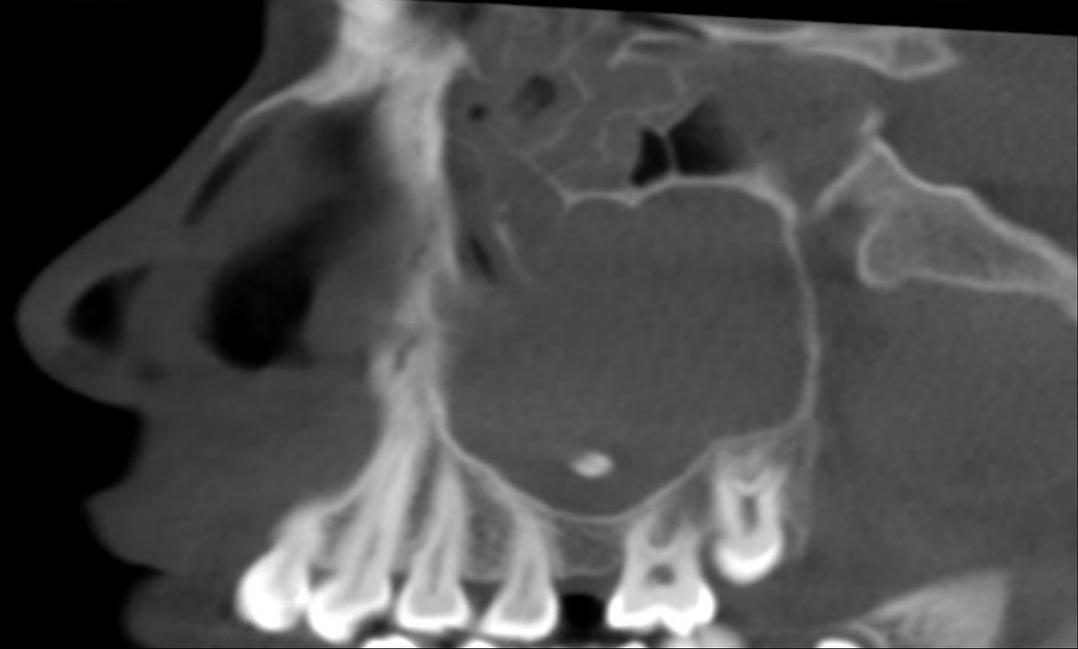
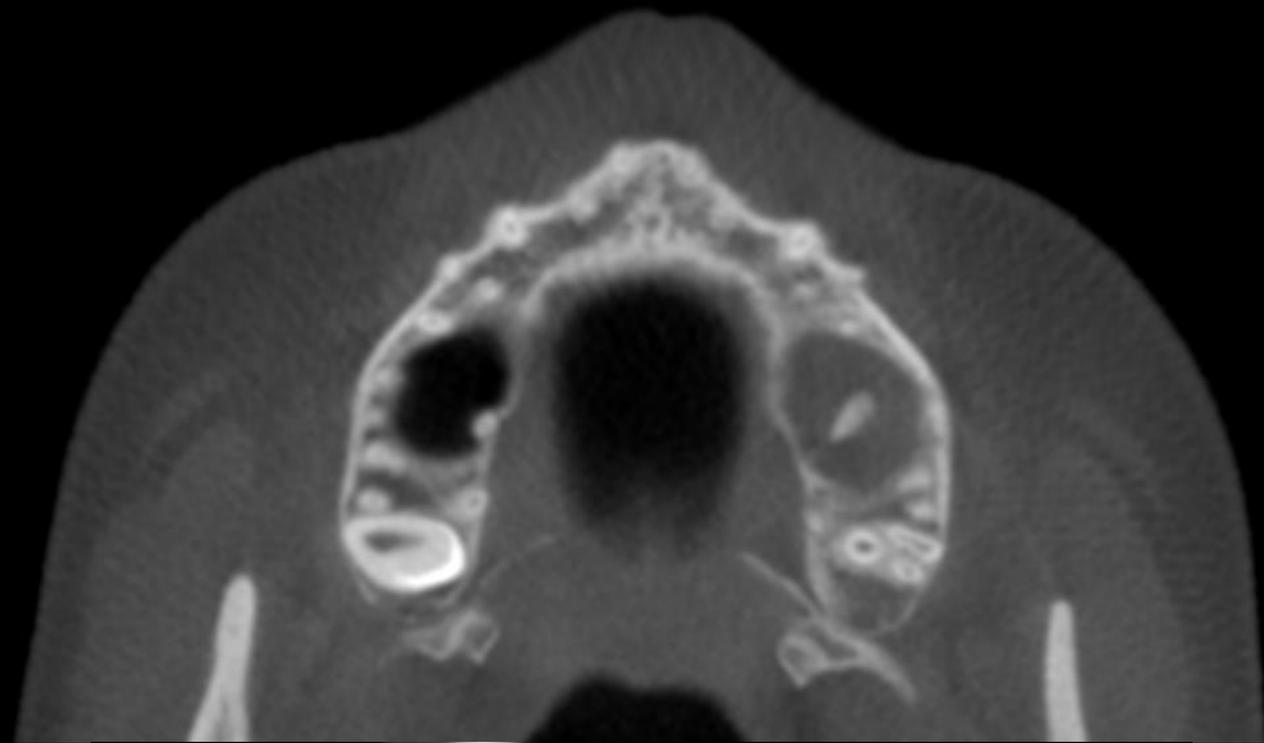
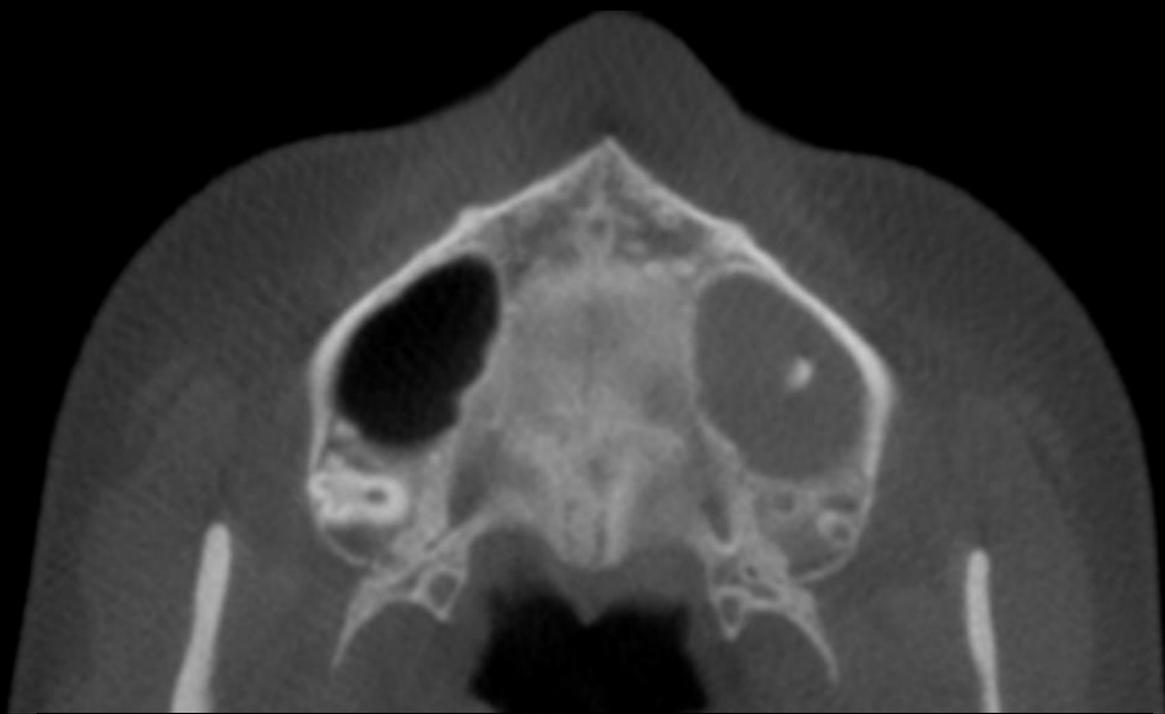


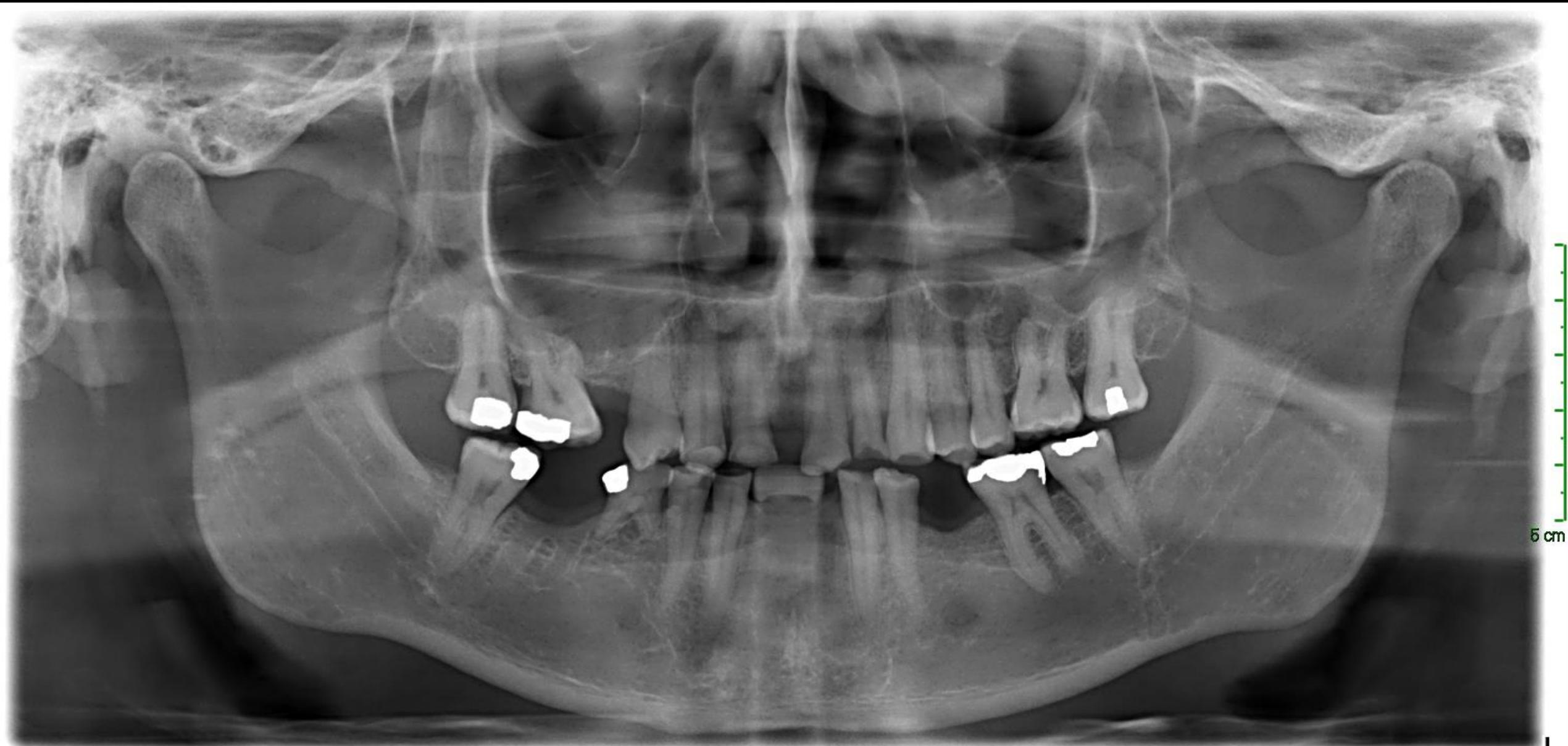


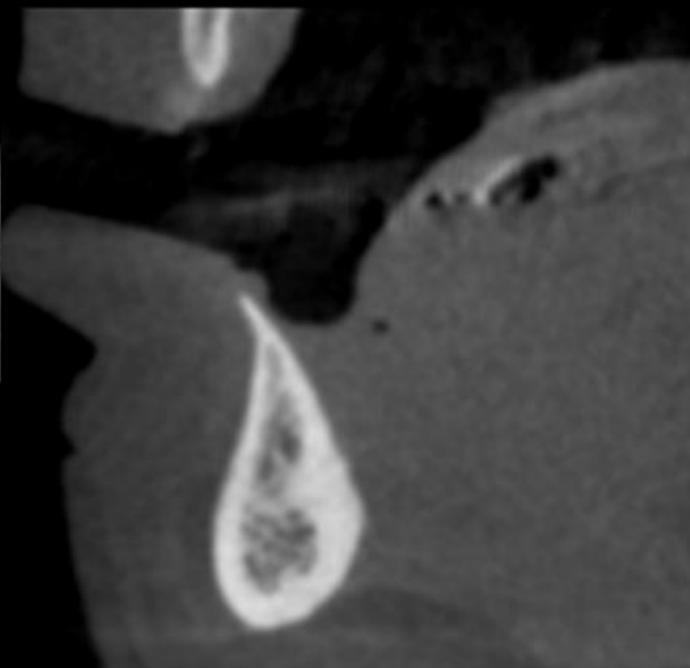
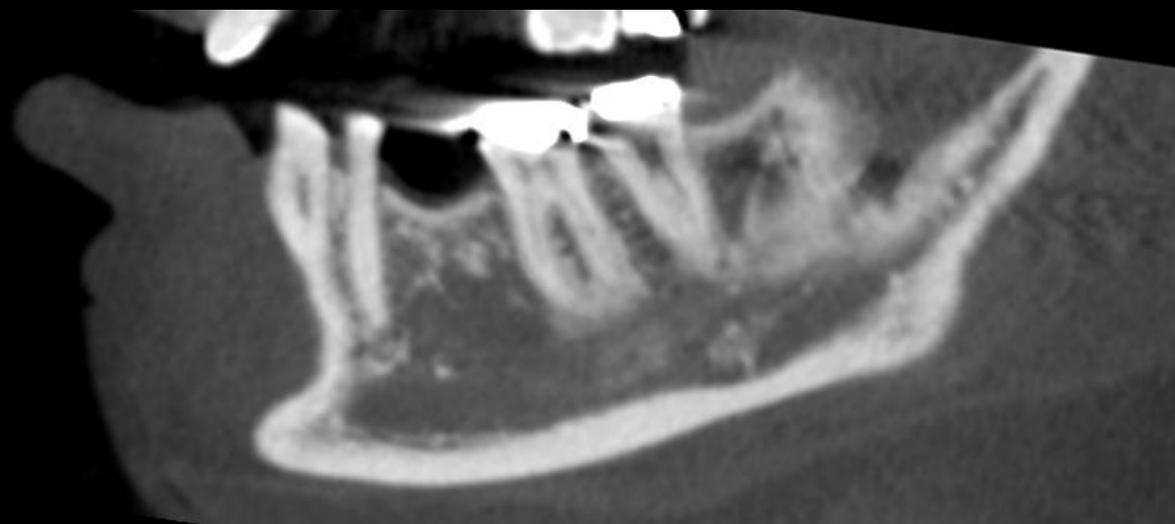


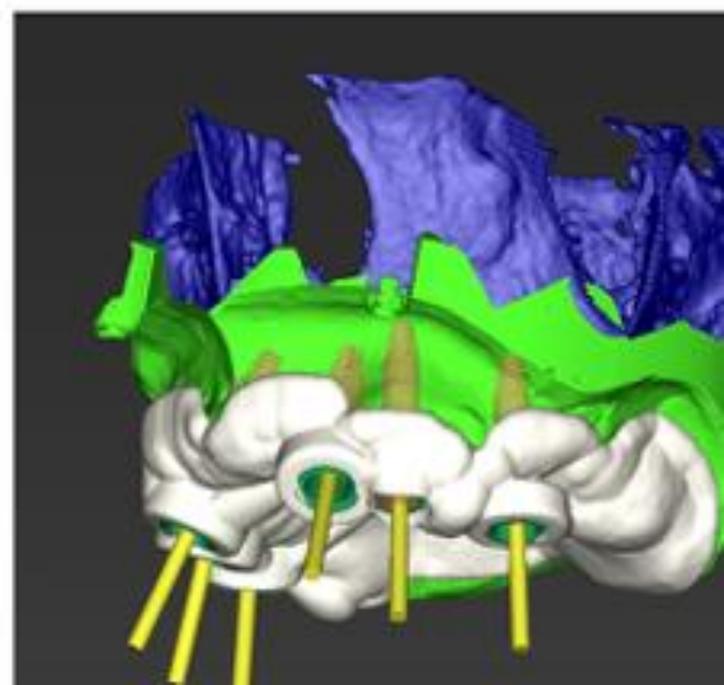
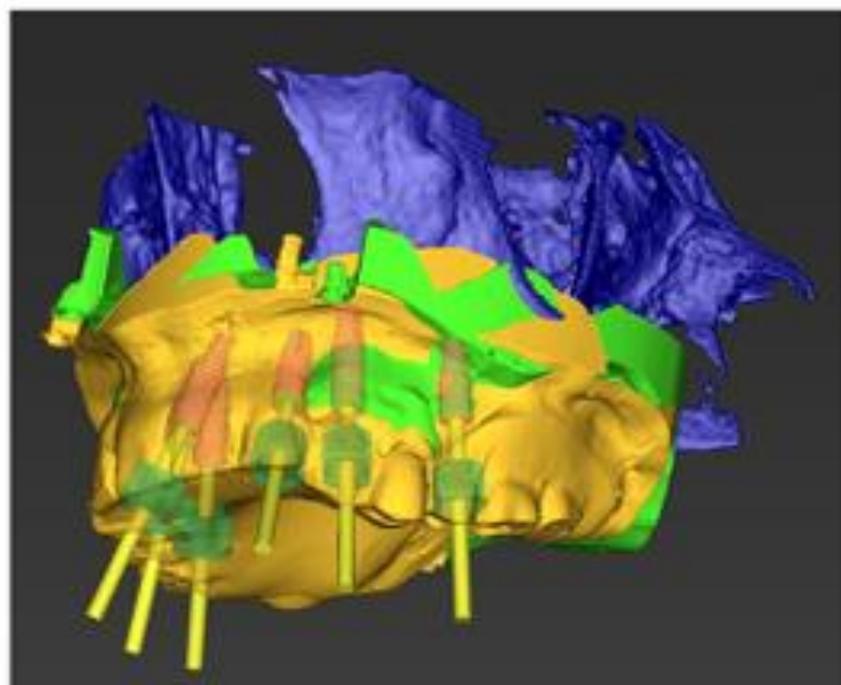
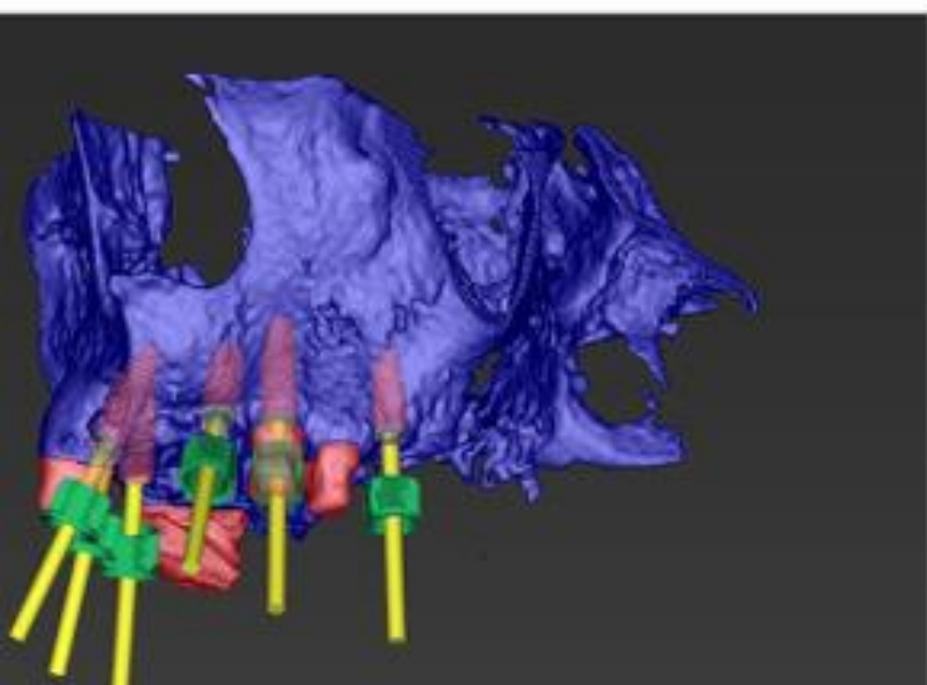
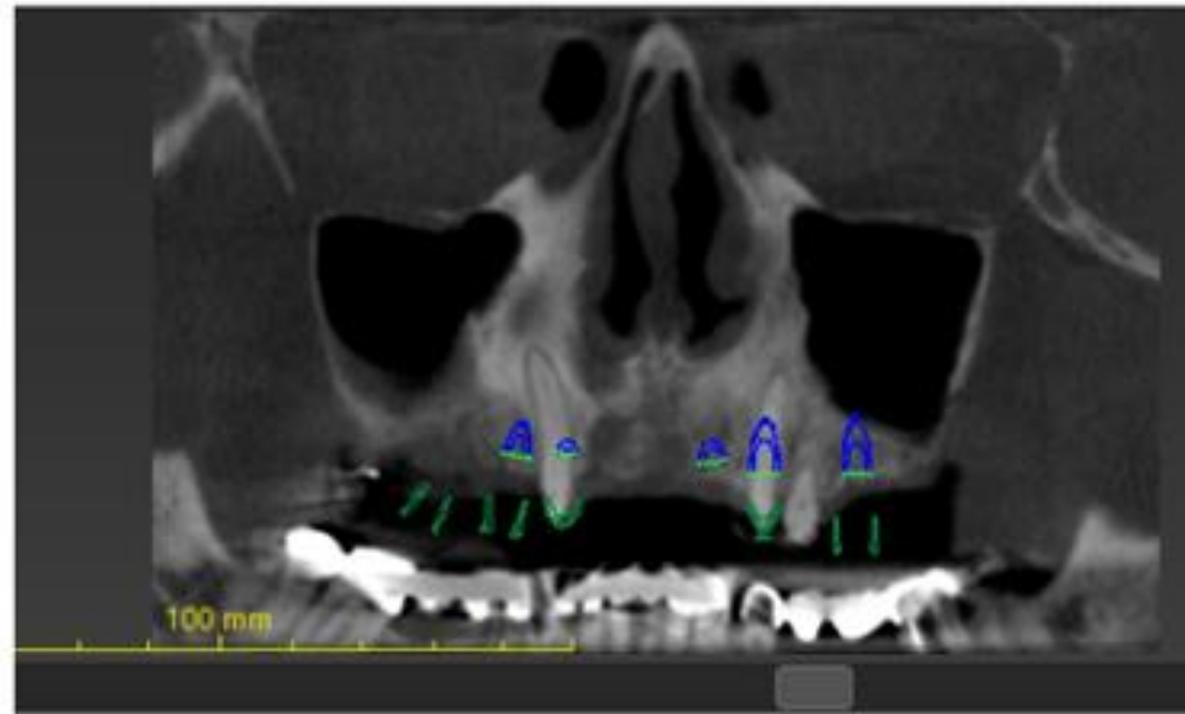
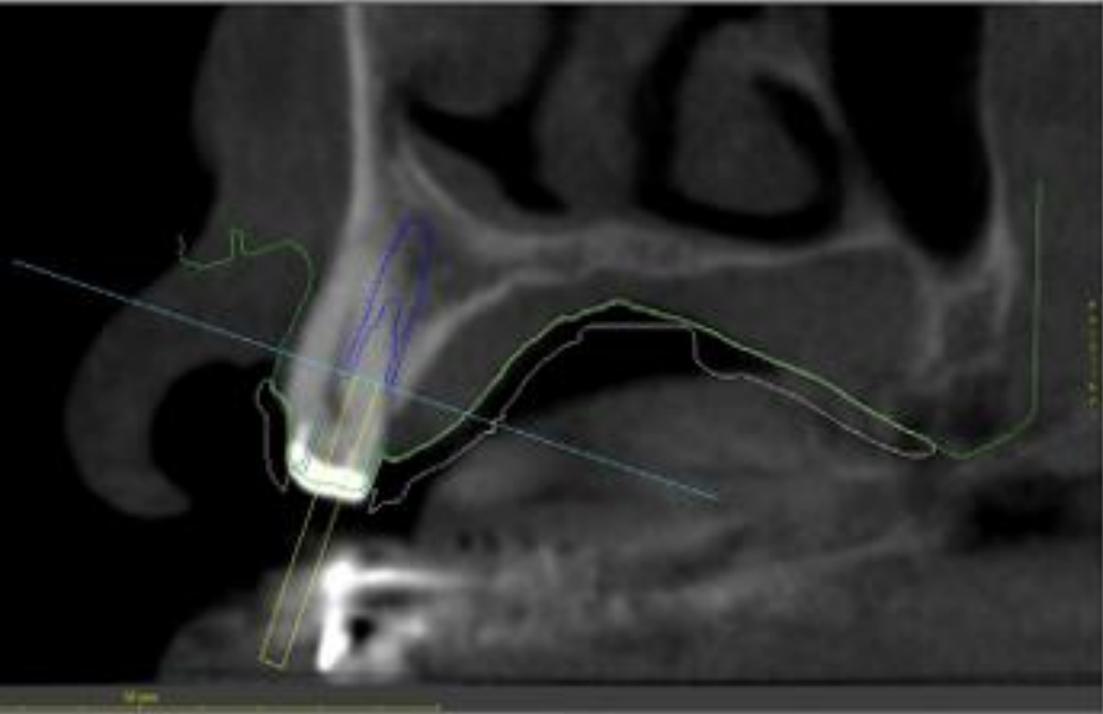


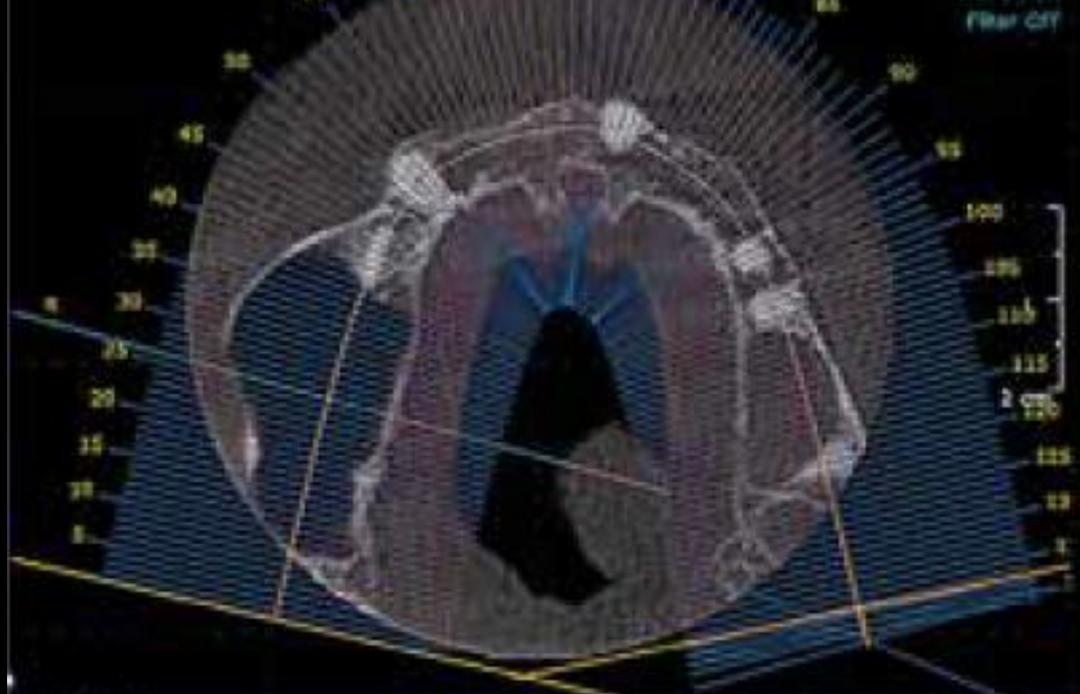




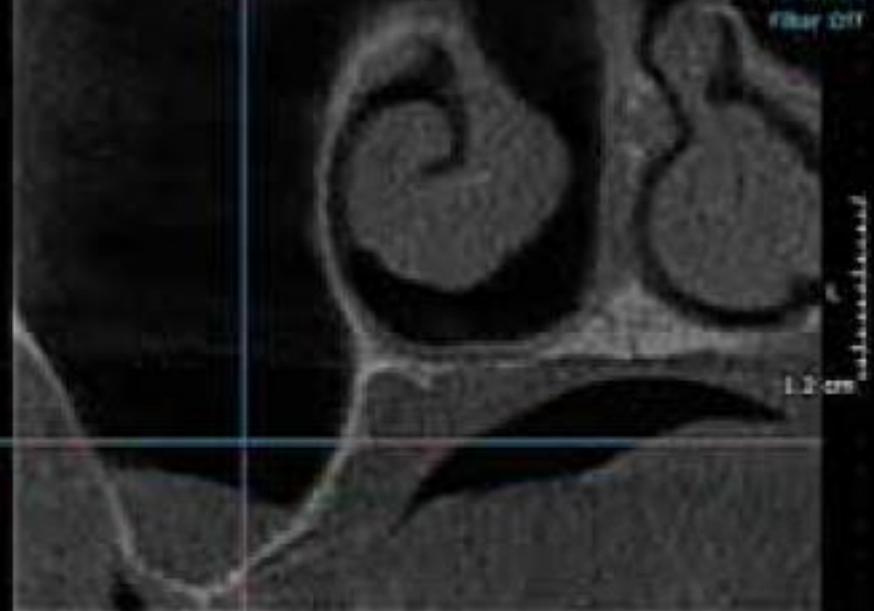






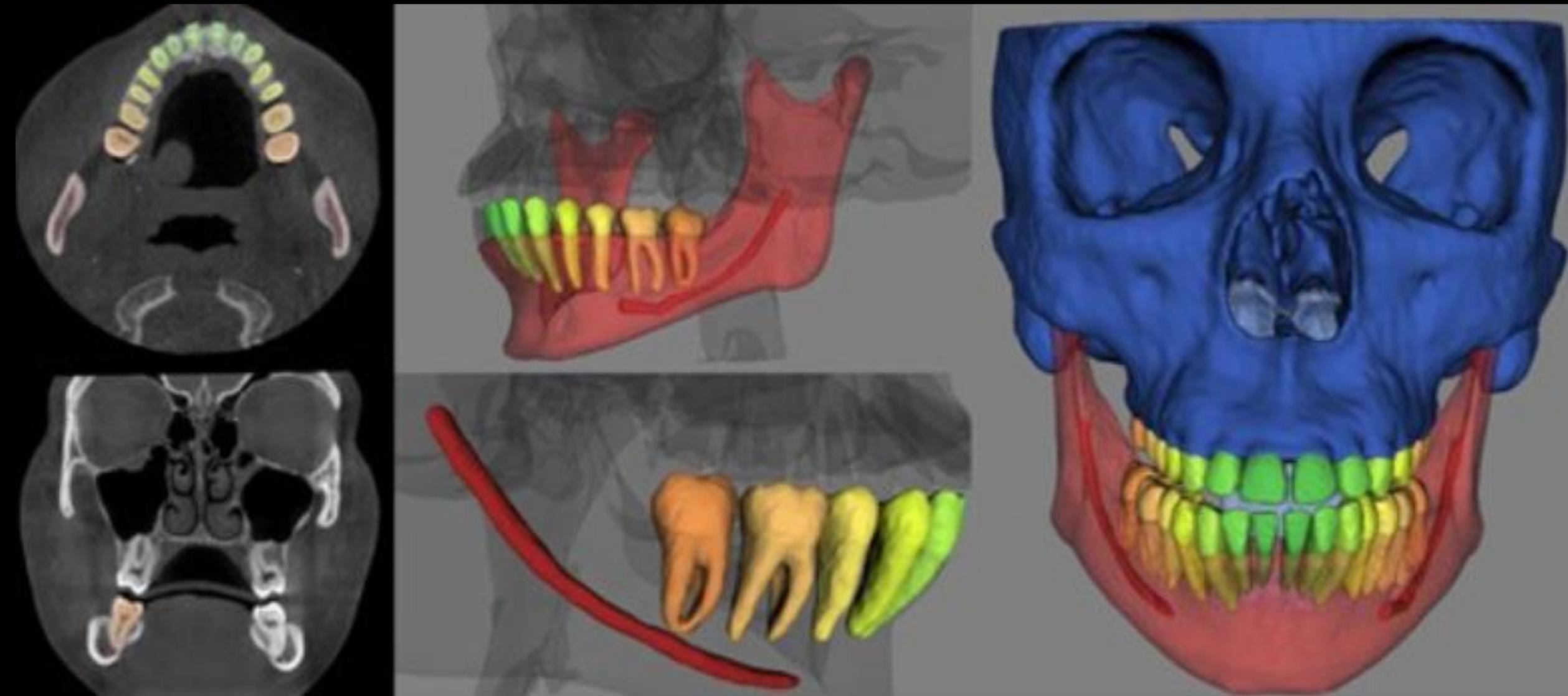


Panorama

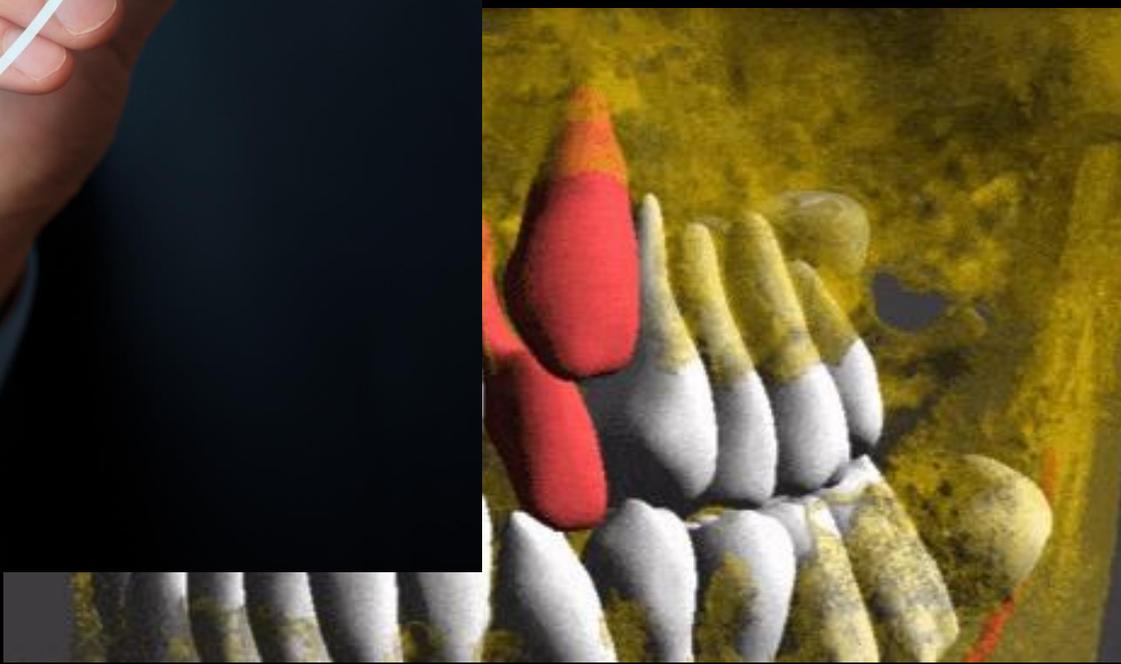
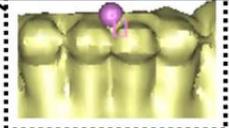
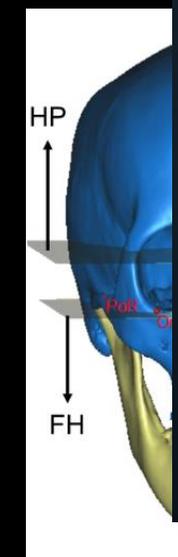
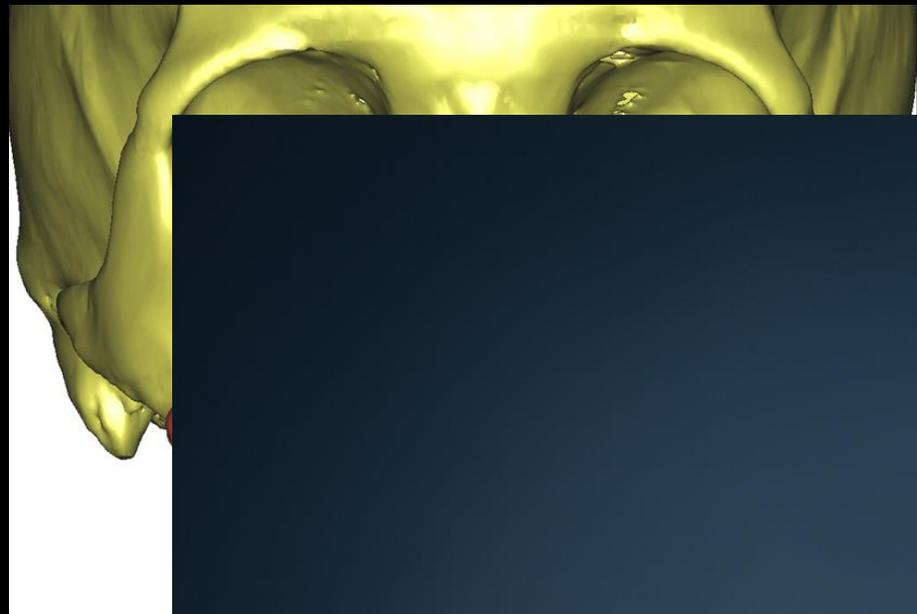


3D





Sohaib Shujaat, Michael M Bornstein, Jeffery B Price, Reinhilde Jacobs, Integration of imaging modalities in digital dental workflows - possibilities, limitations, and potential future developments, *Dentomaxillofacial Radiology*, Volume 50, Issue 7, 1 October 2021, 20210268,



Key Take-Home Messages

- ☑ CBCT has the power to change your practice
- ☑ Use it selectively and safely
- ☑ Balance benefit vs. radiation risk
- ☑ Follow QA and professional guidelines



The image shows two men in a control room or laboratory. They are seated at a long desk with multiple computer monitors. The man on the right is wearing a white lab coat over a light blue shirt and is using a mouse. The man on the left is wearing a white t-shirt. The monitors display various medical scans, including a large brain scan on the left and several smaller scans on the right. In the background, there are more monitors displaying data and charts. The overall lighting is blue and dim, creating a professional and focused atmosphere.

THANK YOU