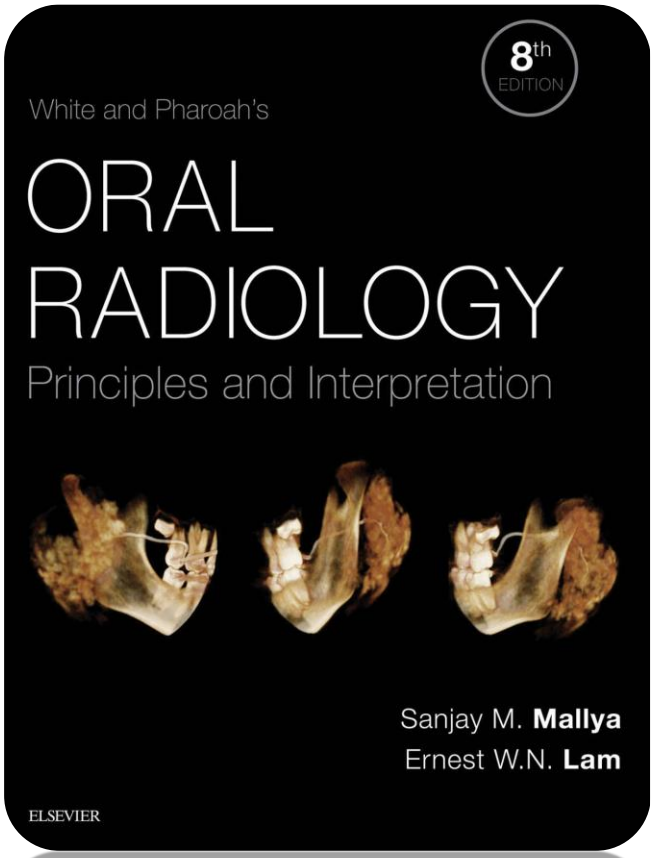
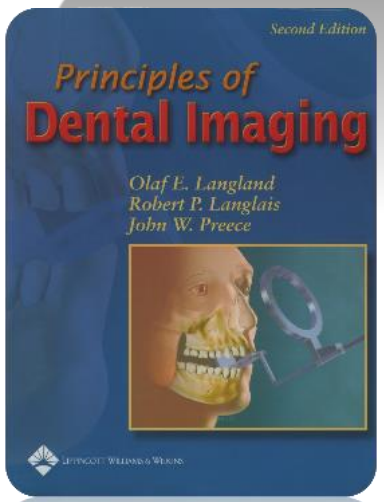
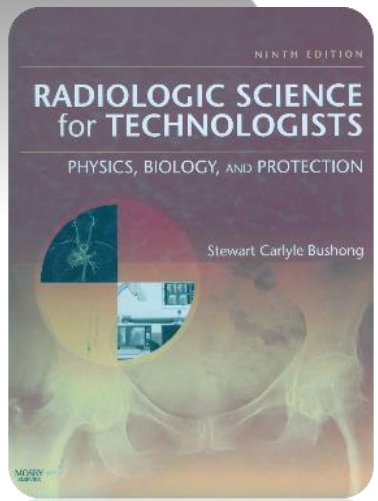



# In the name of God

Tahmineh Razi (DDS. MSc)

Email: tahmine_razi@yahoo.com

- The perceived nature or severity of an abnormality (including its size and accessibility)

- The ability of the imaging technique to accurately reveal the characteristic diagnostic features of the abnormality (sensitivity and specificity)

- The amount of image detail required (resolution)

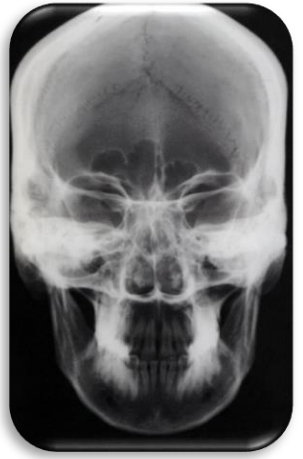
- The radiation dose to the patient

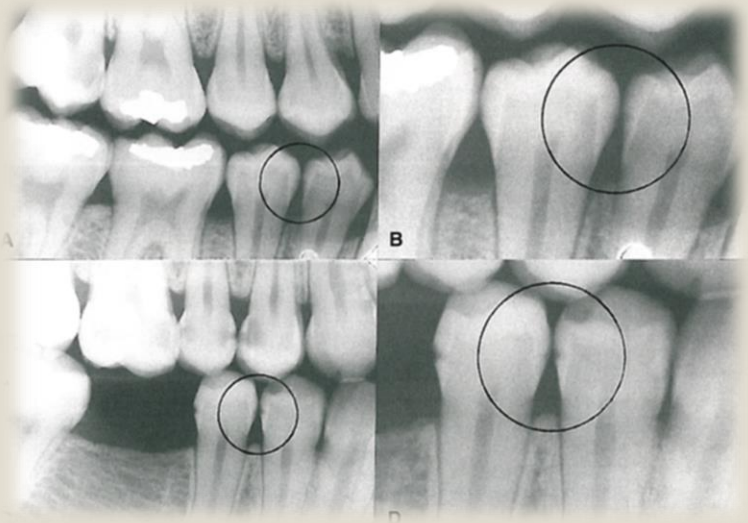
## Radiologic Examinations

# Diagnostic images:

- Intraoral radiographies

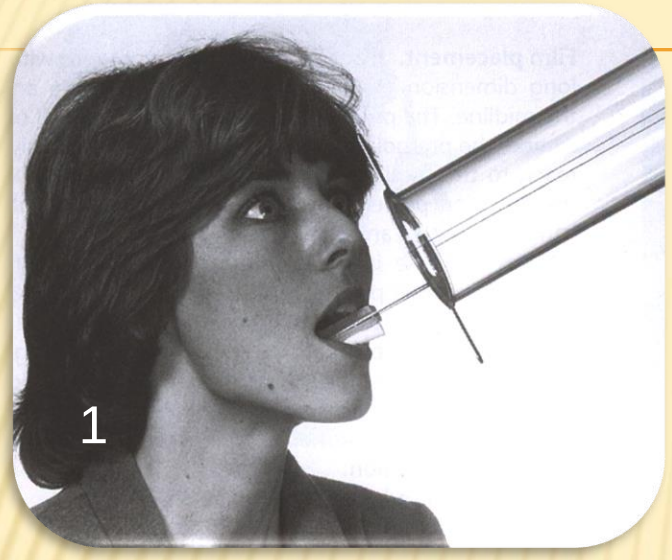
- Extaraoral radiographies



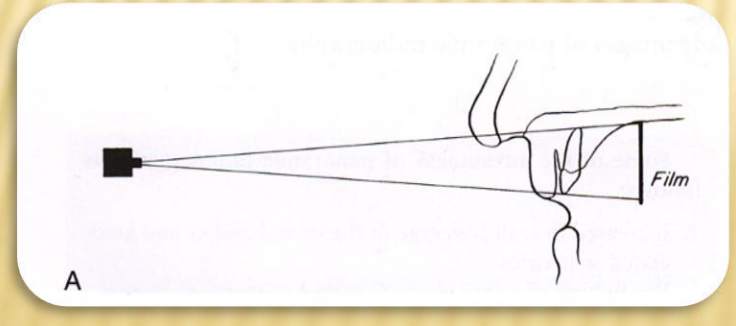

B

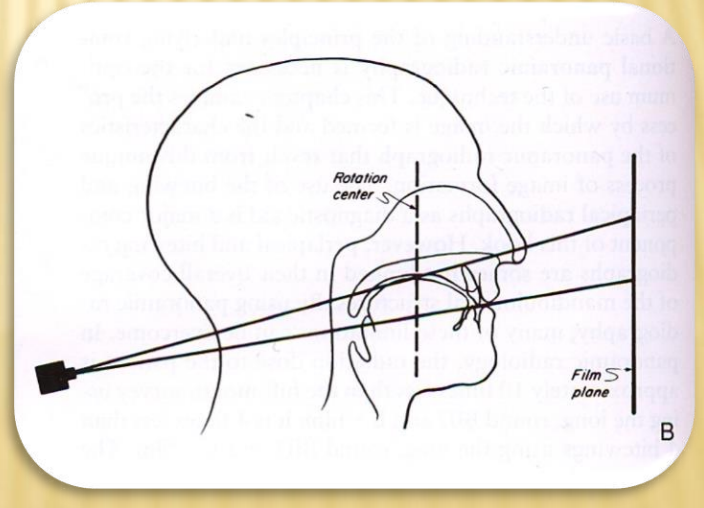
# Advantages and disadvantages

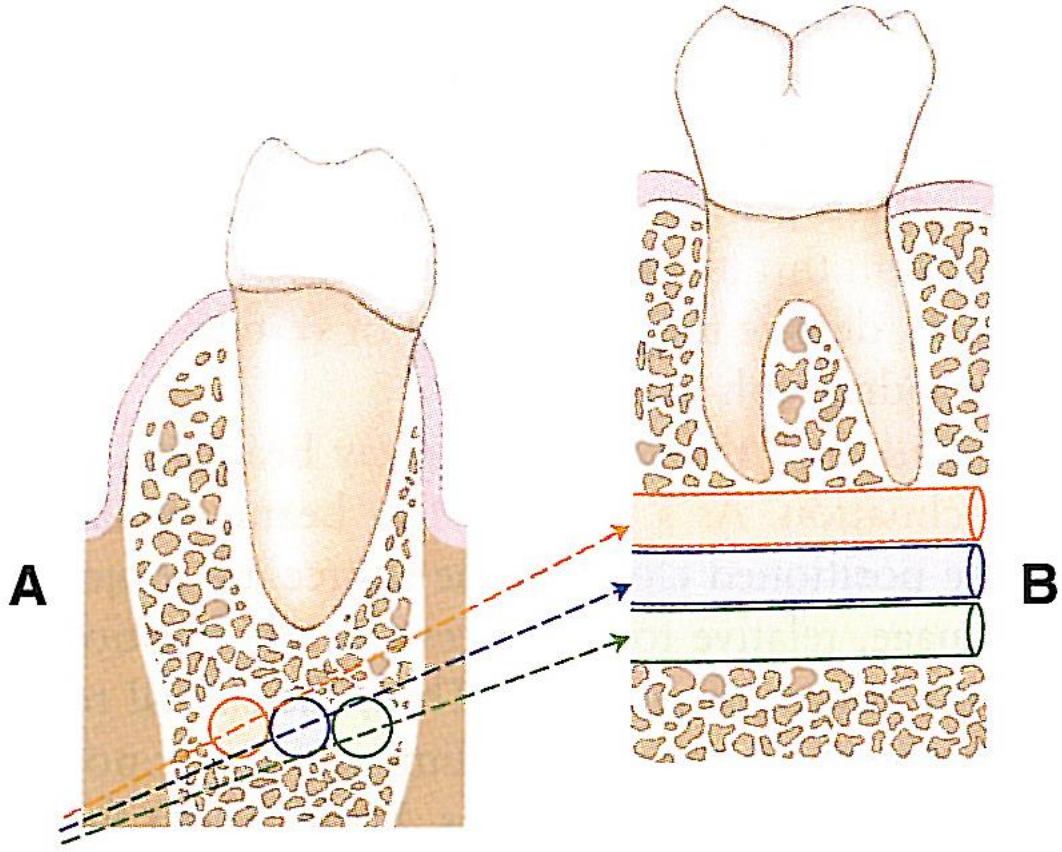

R 001811 23.04.09 P1000 PAN STD L+06 NR
68/ 8 TAHNINE RAZI DR. RAZI RADIOLOGY
L


1


2

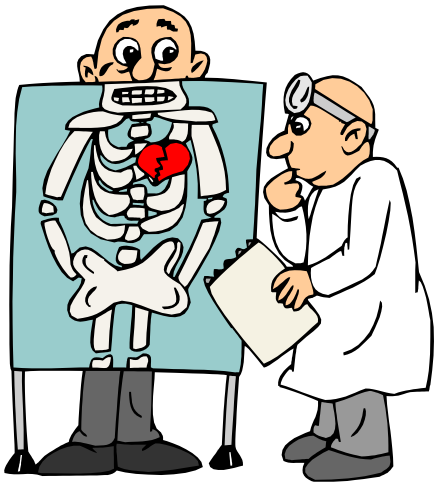

Film
A


Rotation center
Film plane
B


A
B

# Orthopantomograph

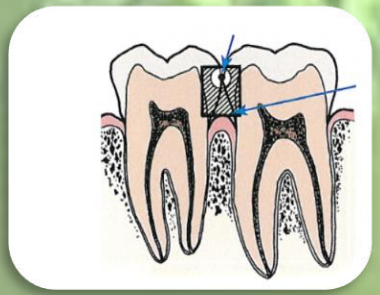
OPG



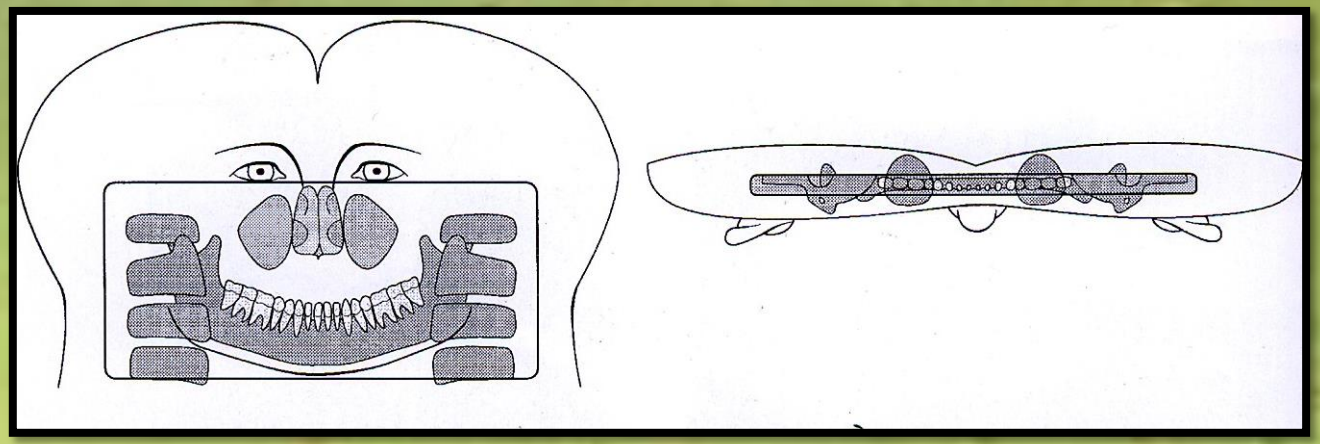
- ✓ تصویر پانورامیک
- ✓ Panoramic image
- ✓ پانورامیک عهسی ایستییرم

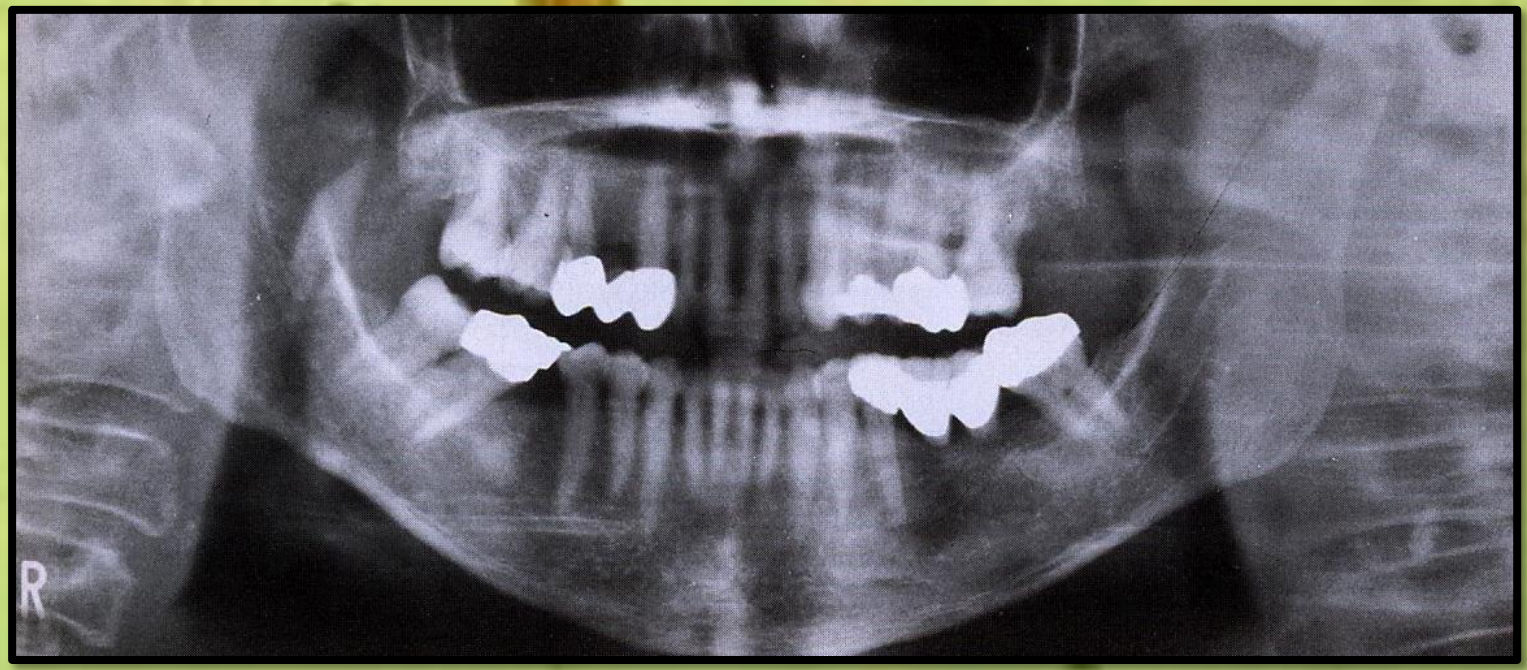
# Occult Disease

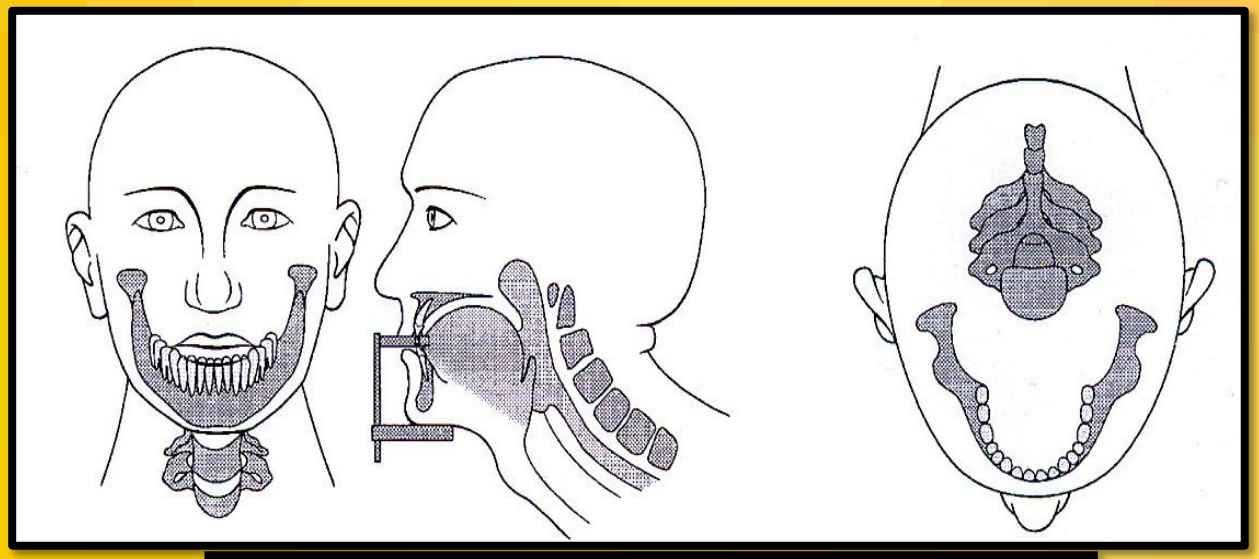
- **Screening imaging** (mammography)
- **Occult disease** (interproximal caries)



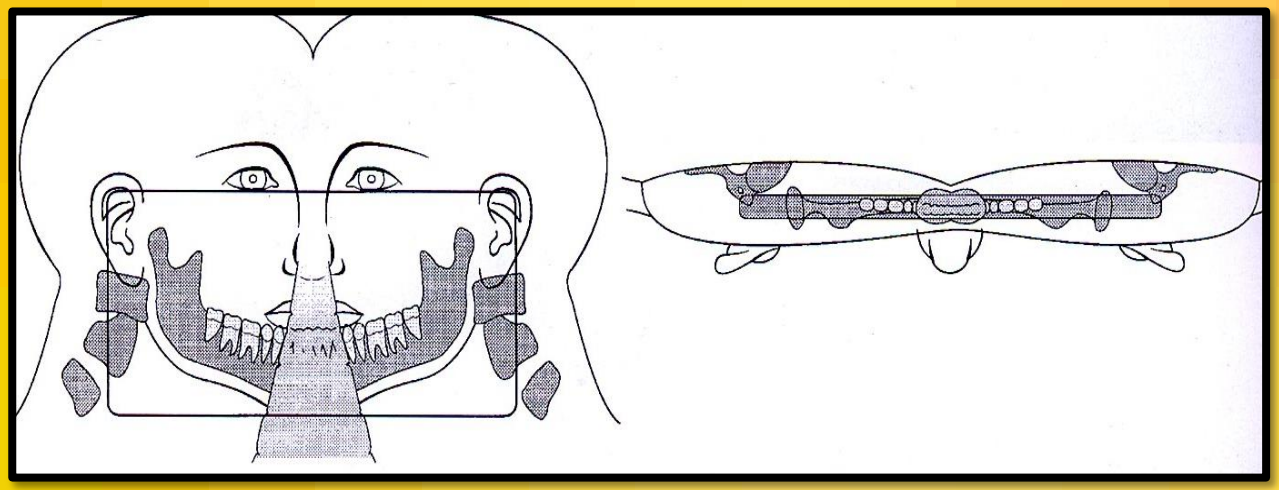
Our philosophy is that the prescription of diagnostic imaging should be based on the need for diagnostic information for patients on a case-by-case basis.

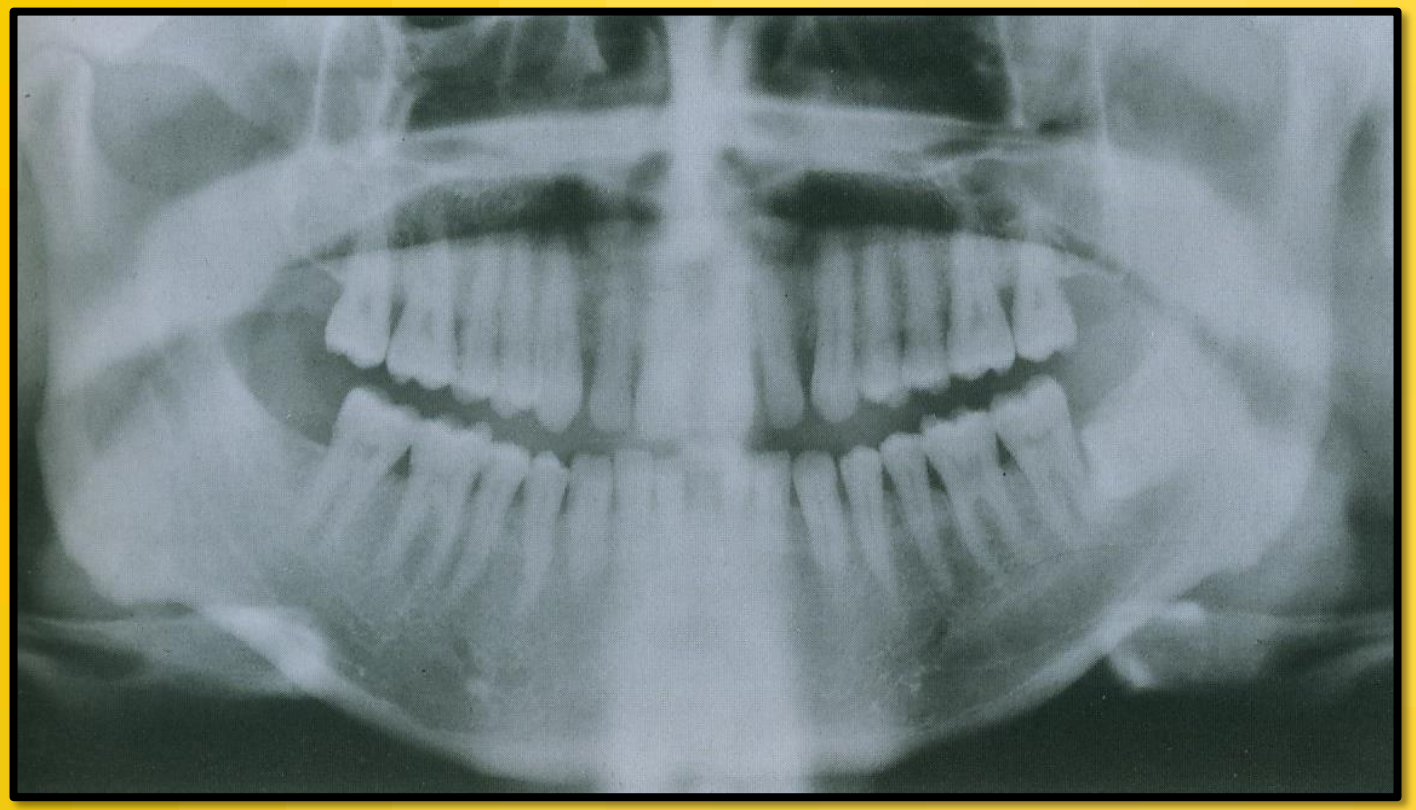



R

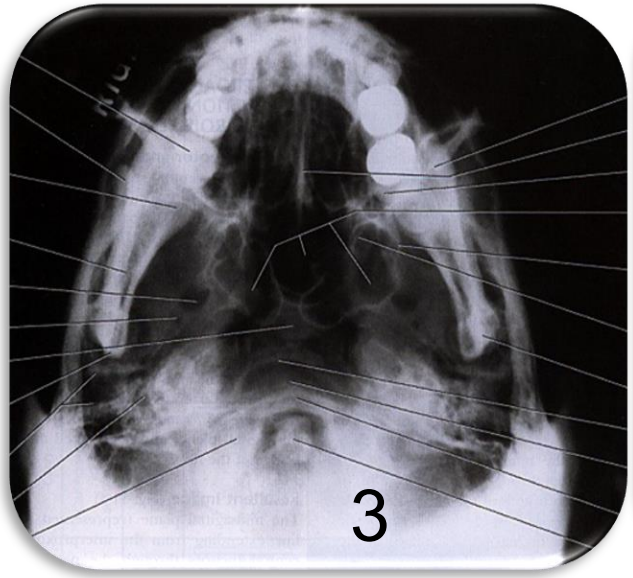


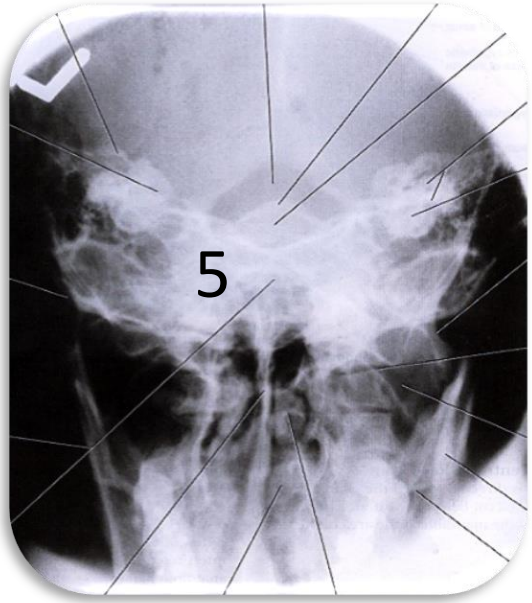
Slumping

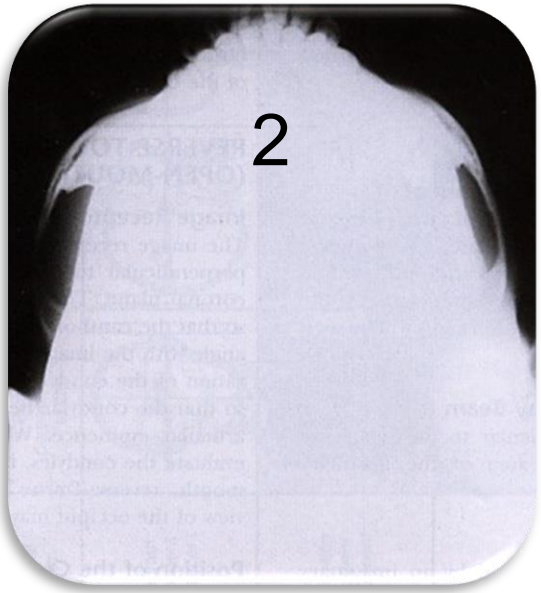




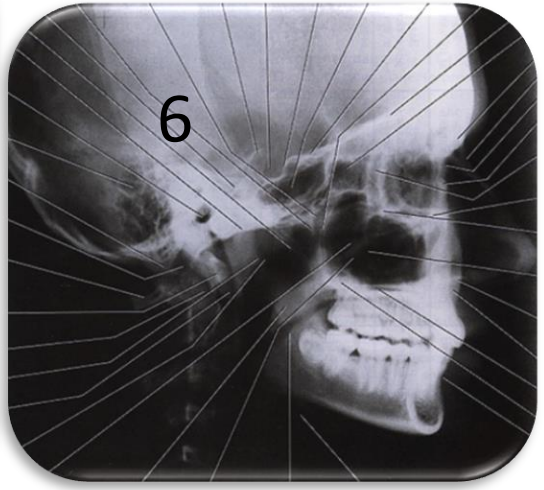

1


3


5

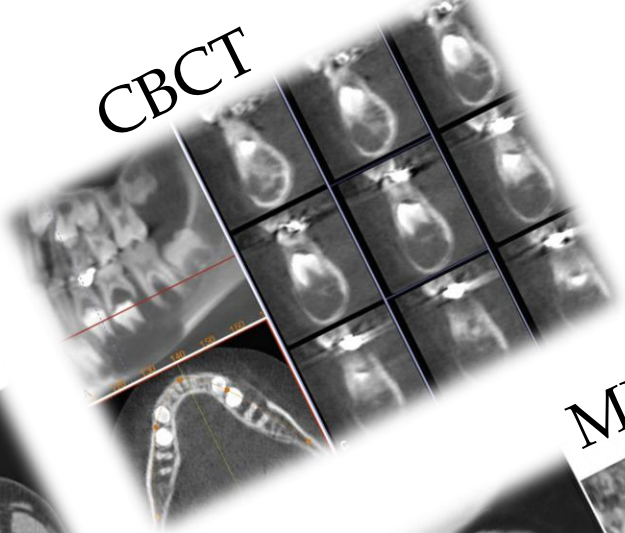

2


4

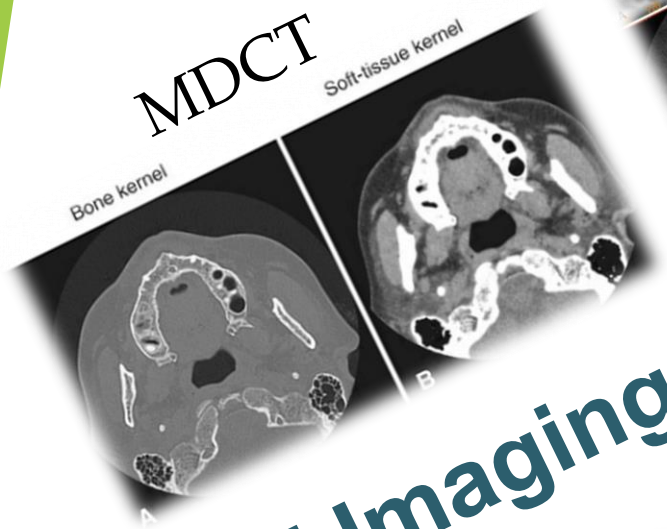

6

# Advanced Imaging

CBCT



MDCT




MRI

Nuclear medicine

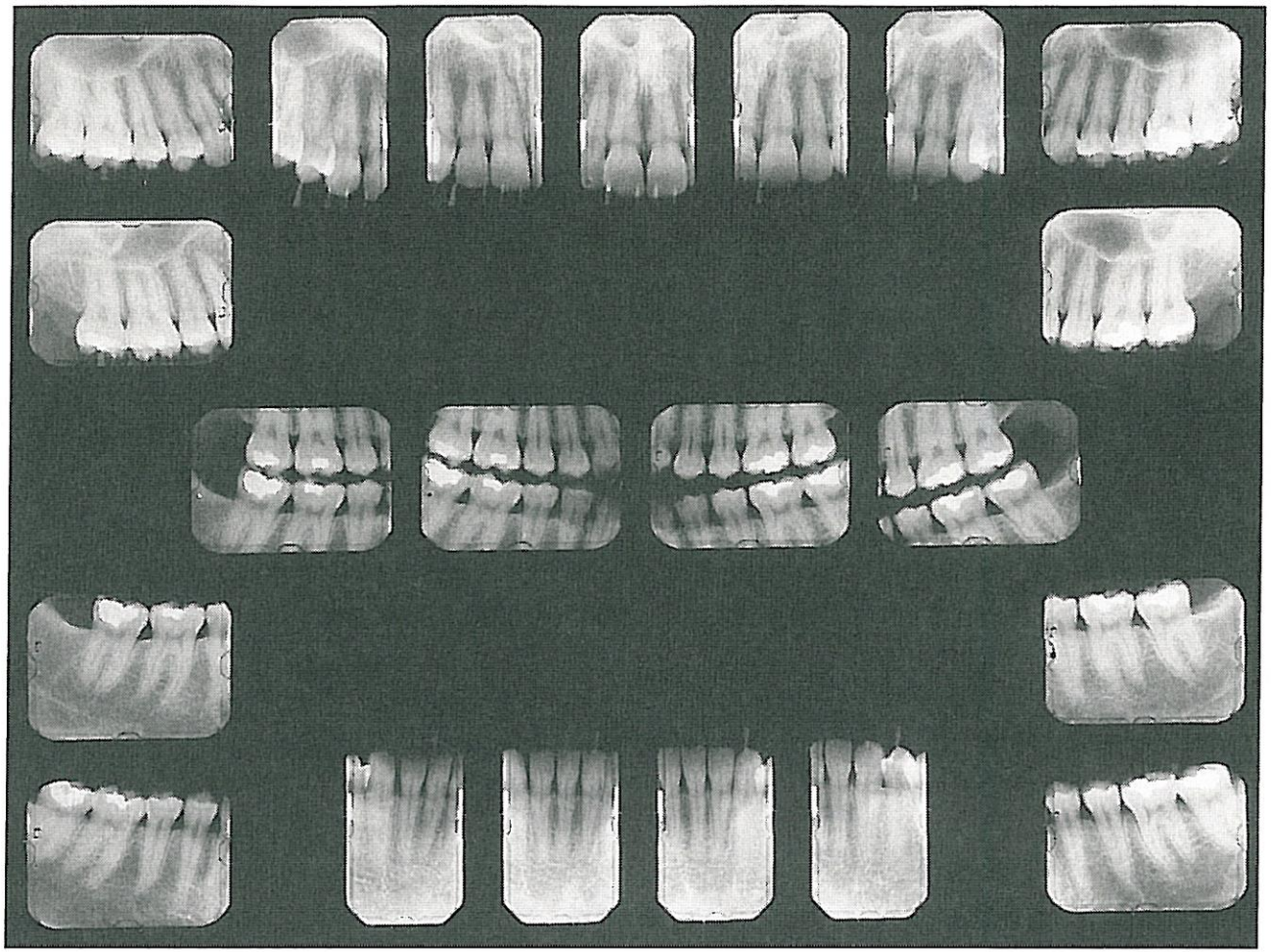
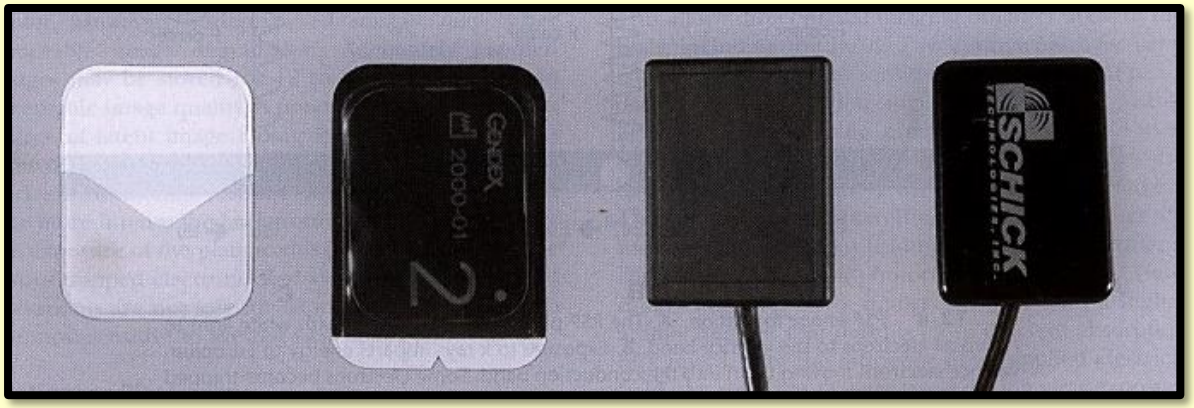
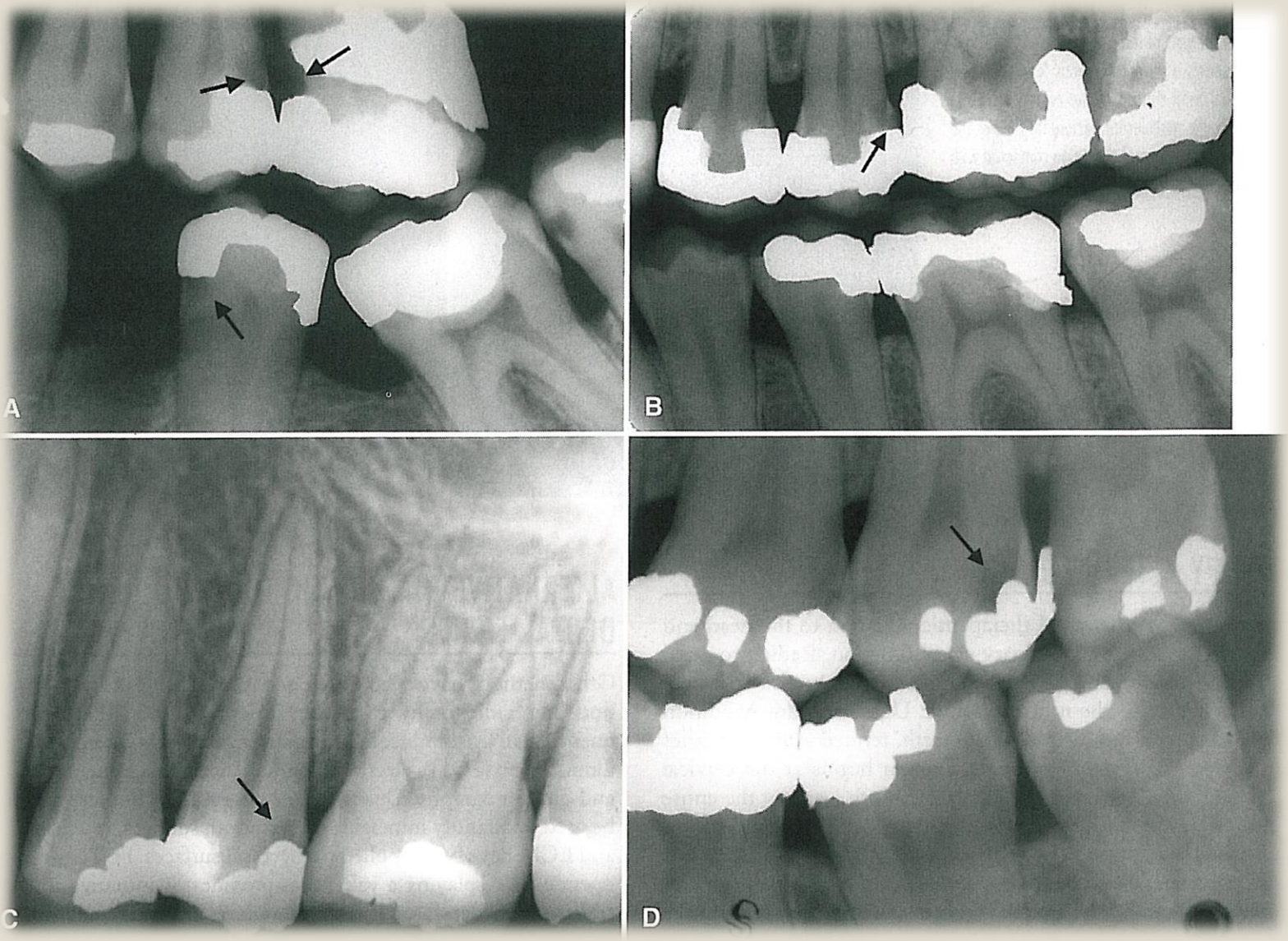


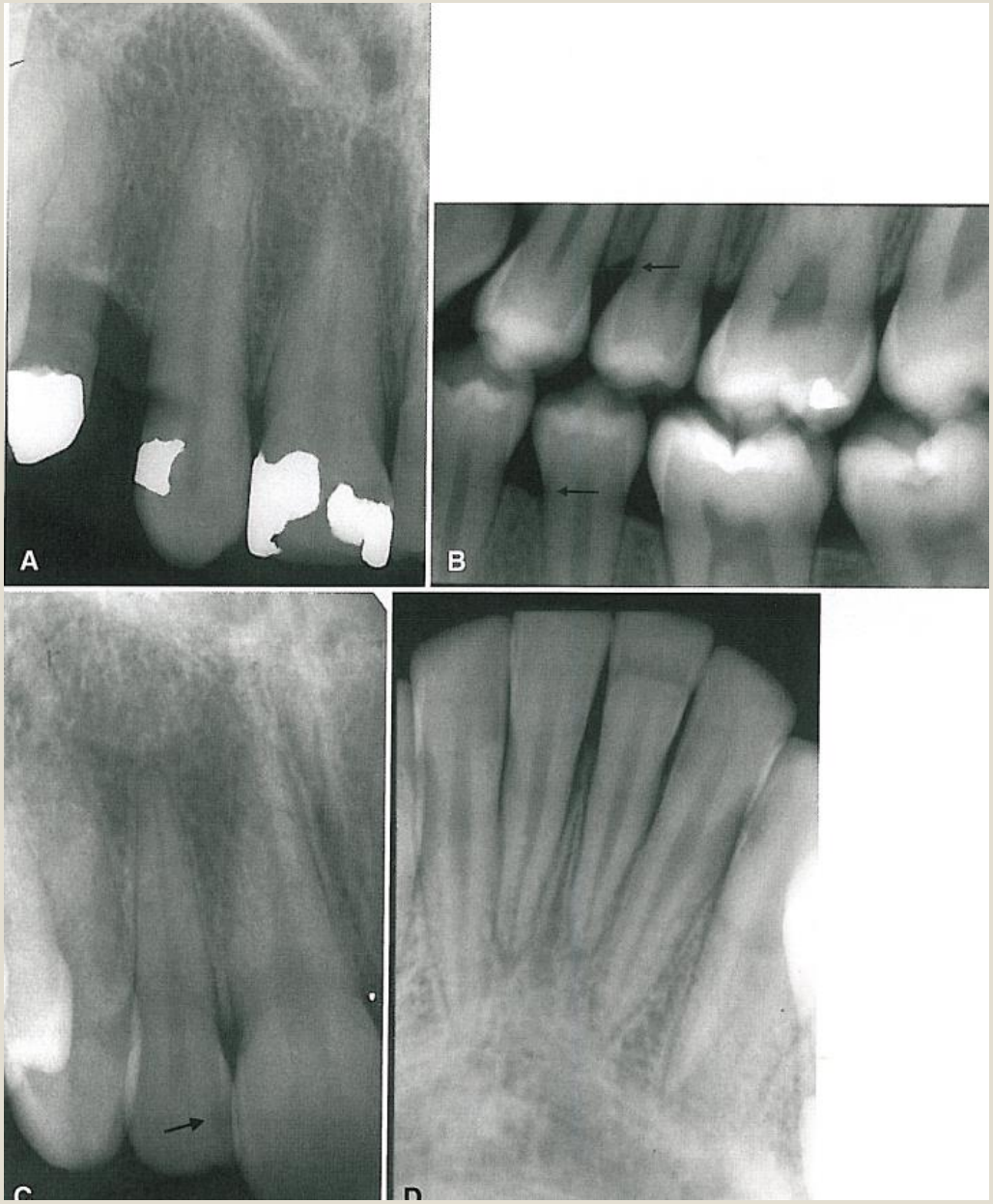
FIGURE 7-1 Mounted full-mouth set of film radiographs consisting of 17 periapical views and 4 bitewing views. Digital images may be positioned in various arrangements depending on the software and preferences of the user.

# Digital images:

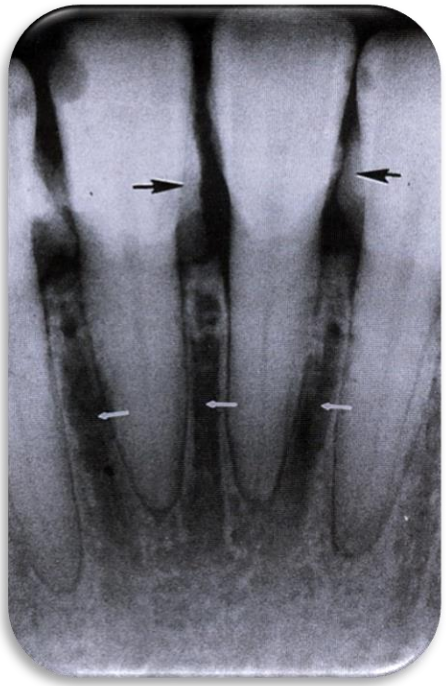


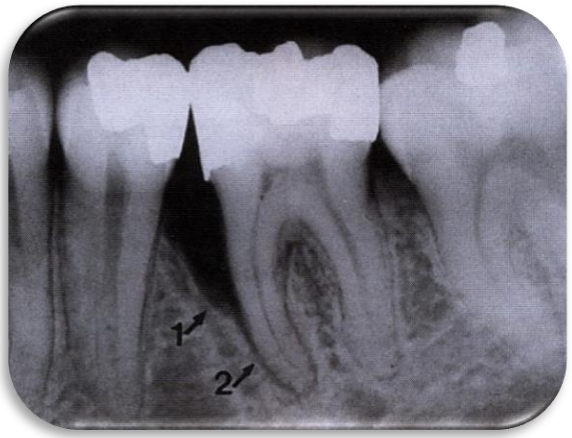
# Caries (the most common dental disease)

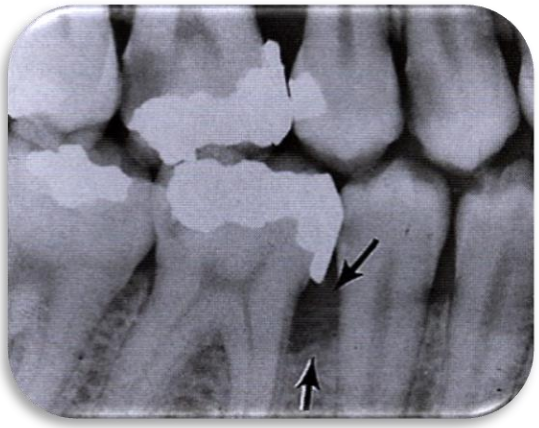


A
B
C
D

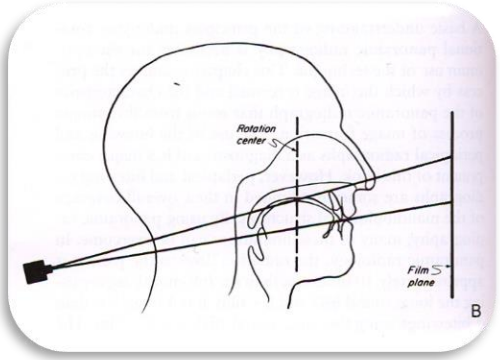

A
B
C
D

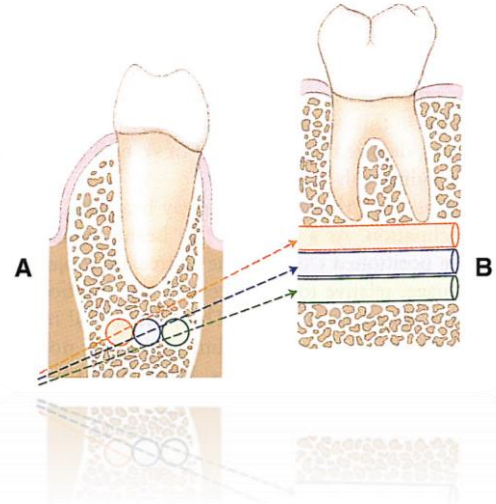
# Periodontal diseases:





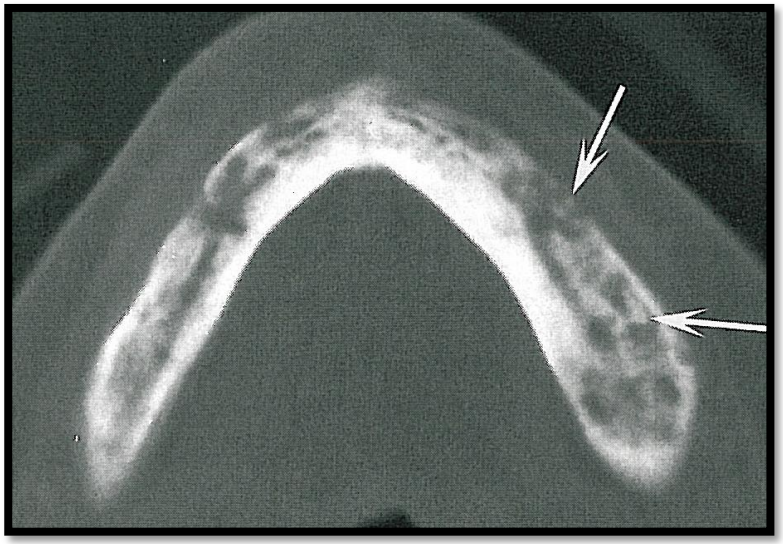


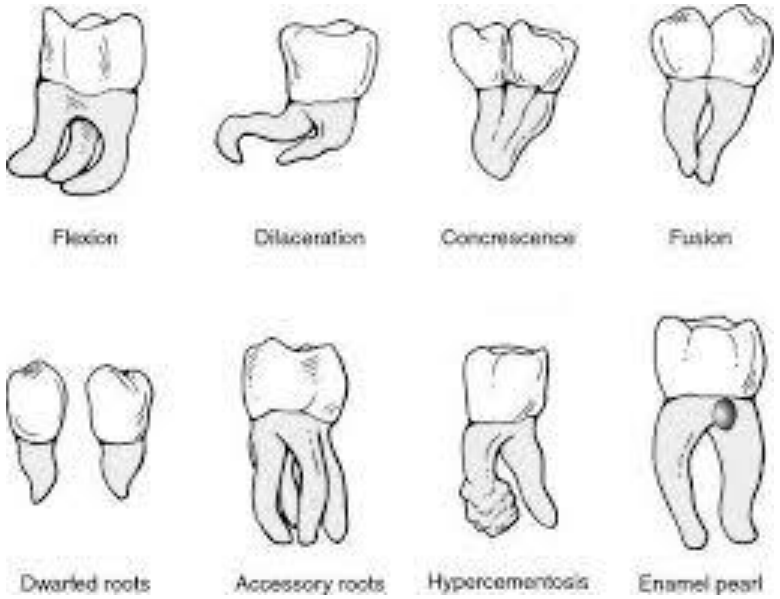
# Periapical inflammation disease:

- Periapical

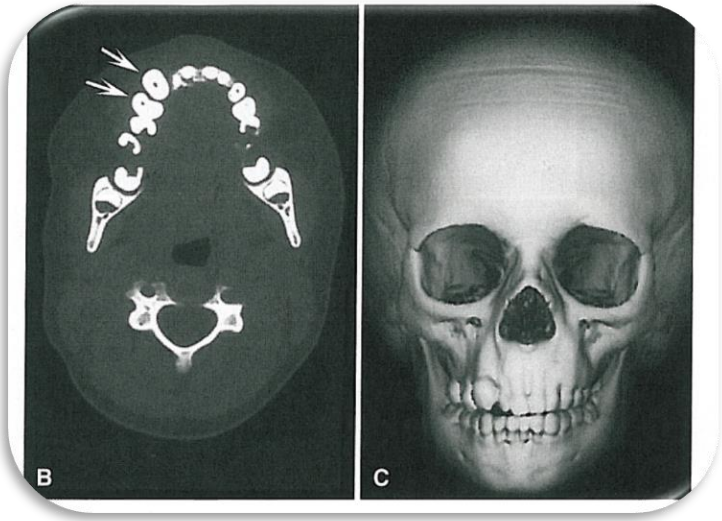
- CBCT



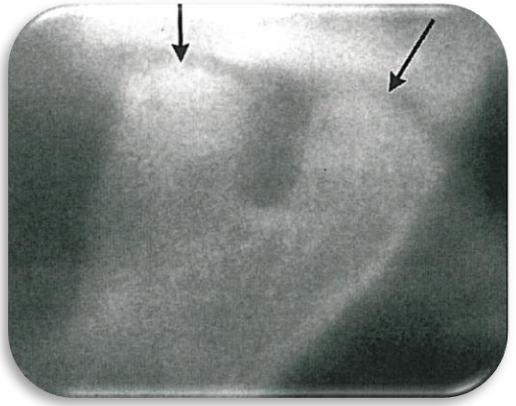
# Abnomalities:

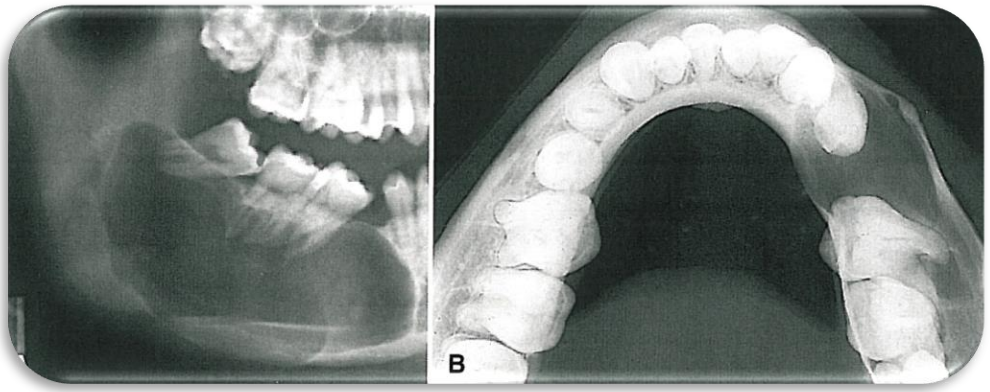
# GROWTH AND DEVELOPMENT AND DENTAL MALOCCLUSION





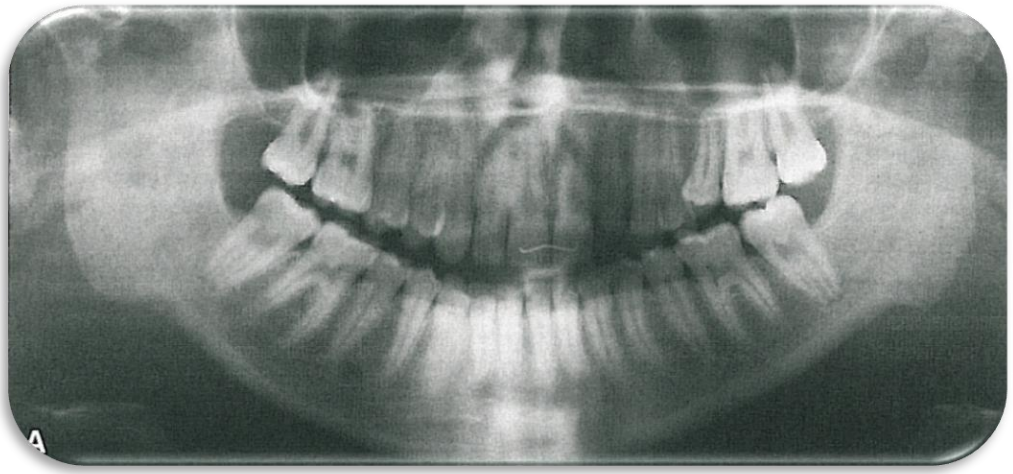
# Jaw diseases

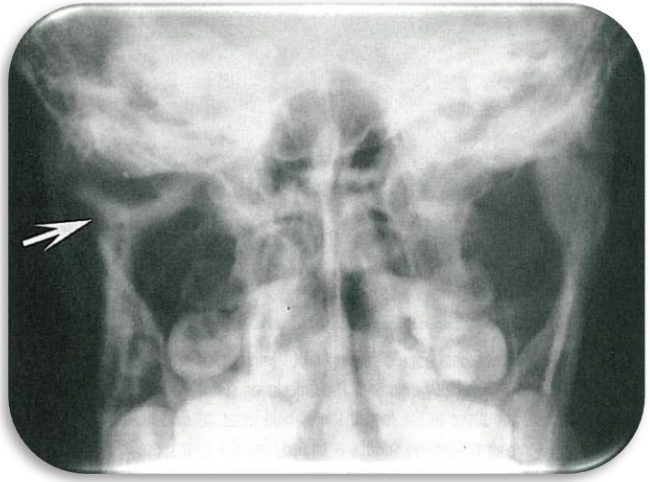


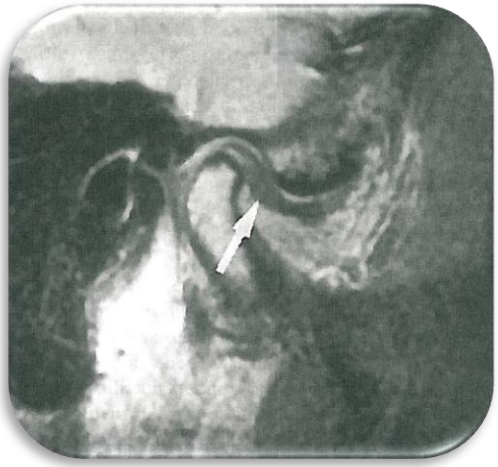


CRACK!
CRACK!
CRACK!

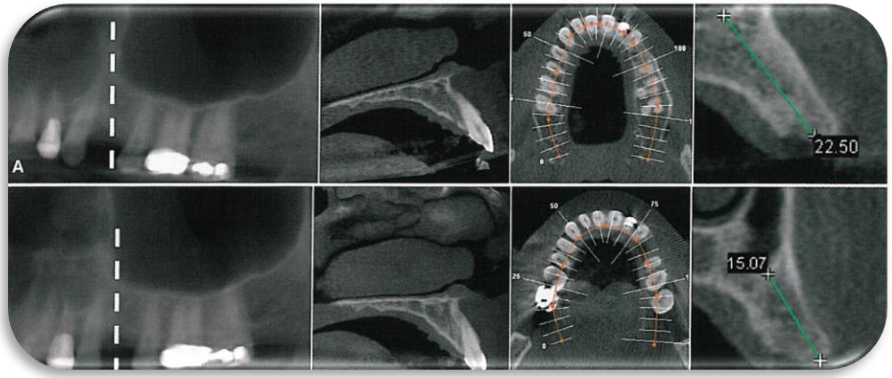
# TMJ (TMD)

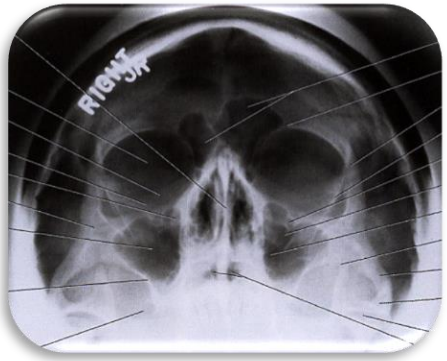


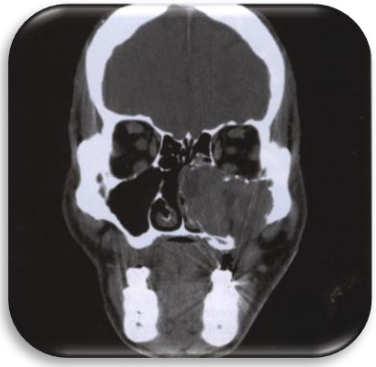


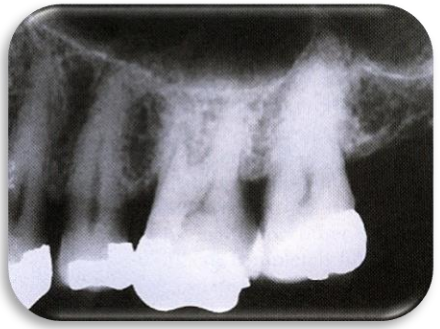


# Paranasal sinuses

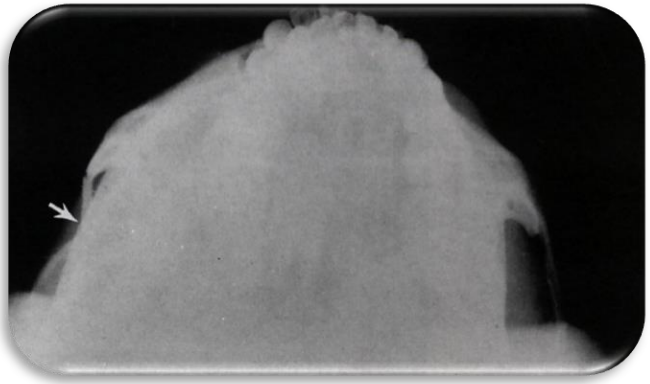


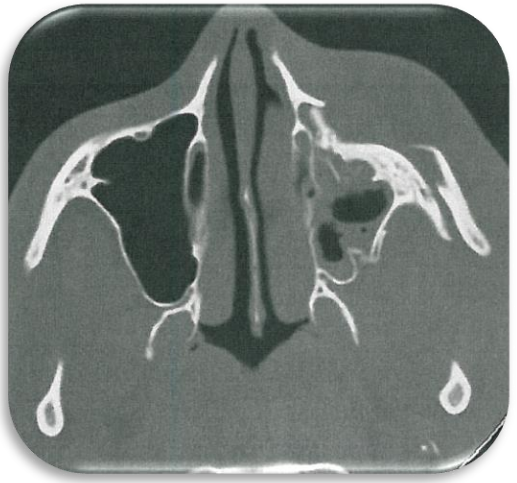



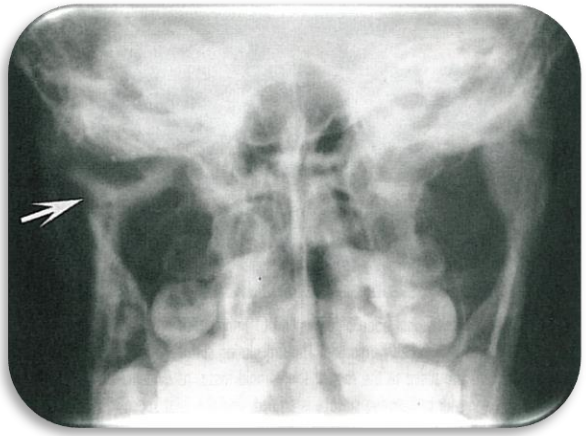



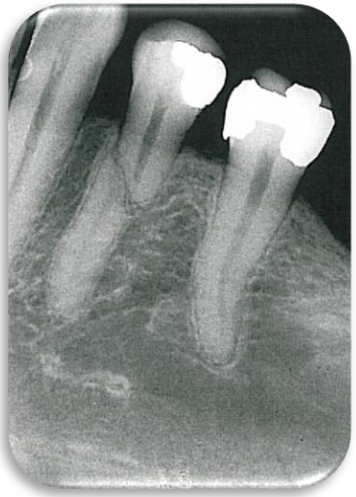


# Trauma

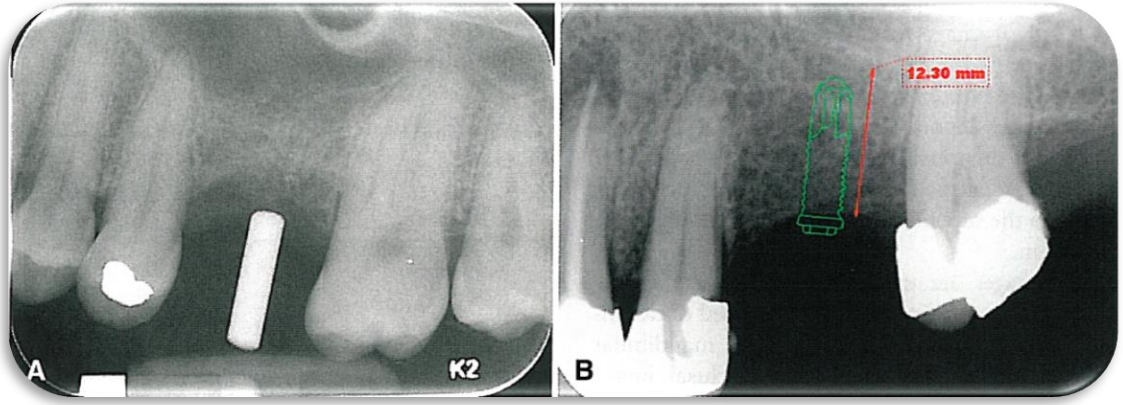


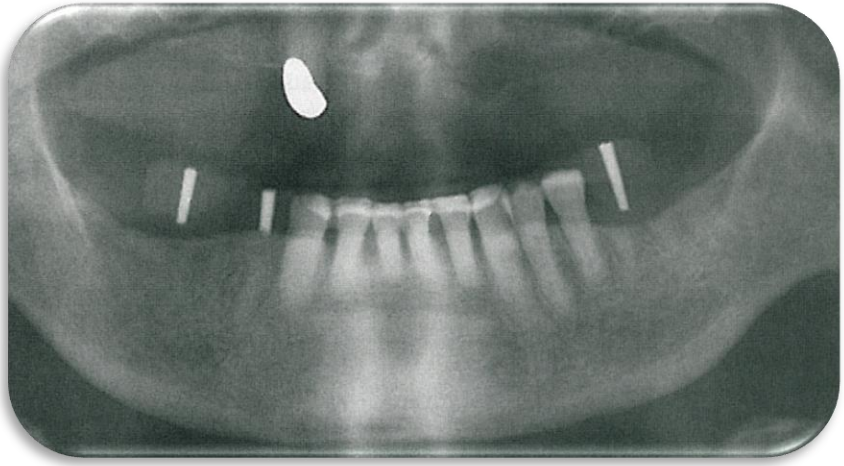


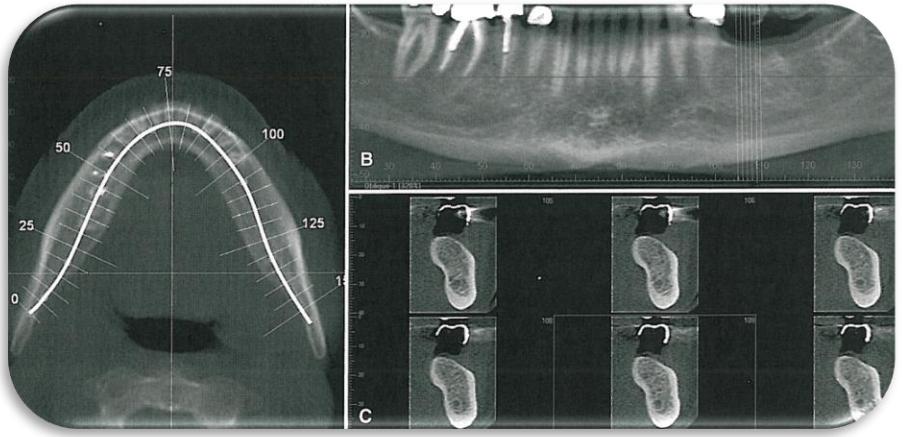




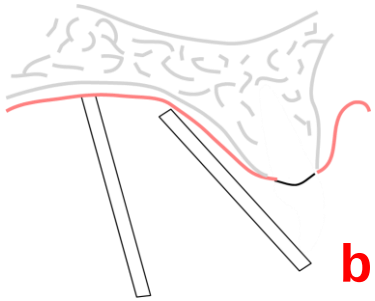
# Implant



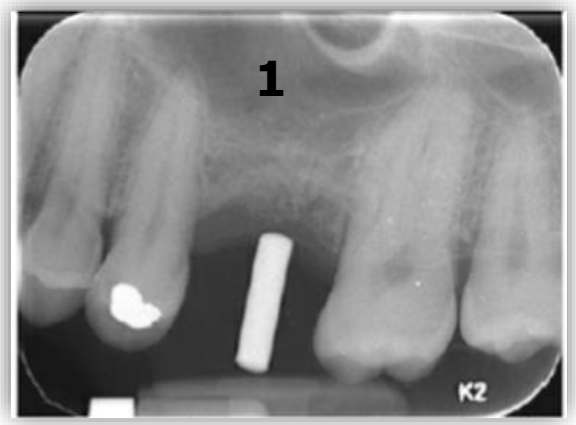


| Imaging Technique | Advantages | Disadvantages | Recommendation |
|---|---|---|---|
| Periapical imaging | • Readily available<br>• High resolution<br>• Minimal distortion<br>• Lowest financial cost and radiation exposure | • Restricted anatomic coverage<br>• Cannot assess buccolingual dimension<br>• Subject to elongation and foreshortening<br>• Anatomic superimposition<br>• Difficult to reproduce projection geometry<br>• May be limited by patient compliance and anatomy | • Initial assessment of single edentulous space or short edentulous span<br>• Intraoperative imaging during implant placement<br>• Initial postoperative radiograph and recall imaging |



bisecting

paralleling

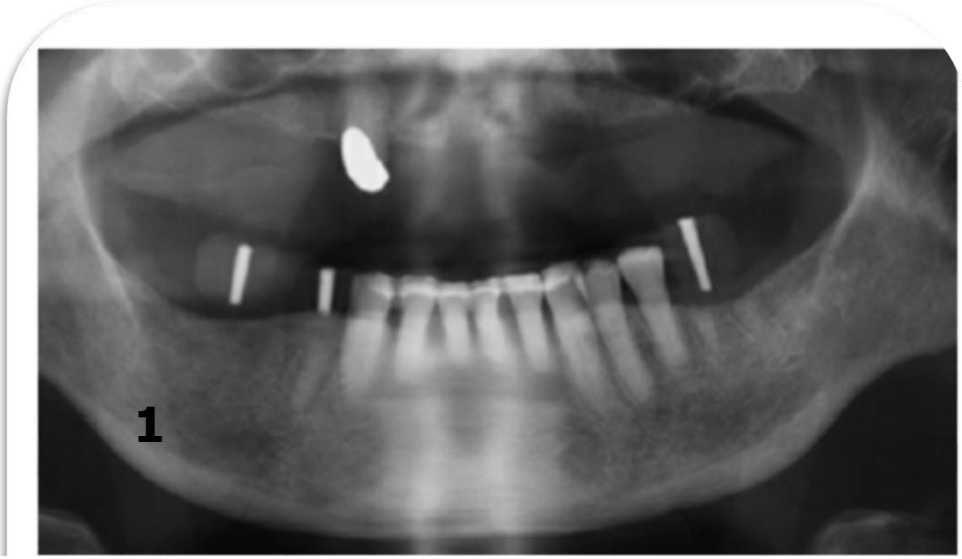


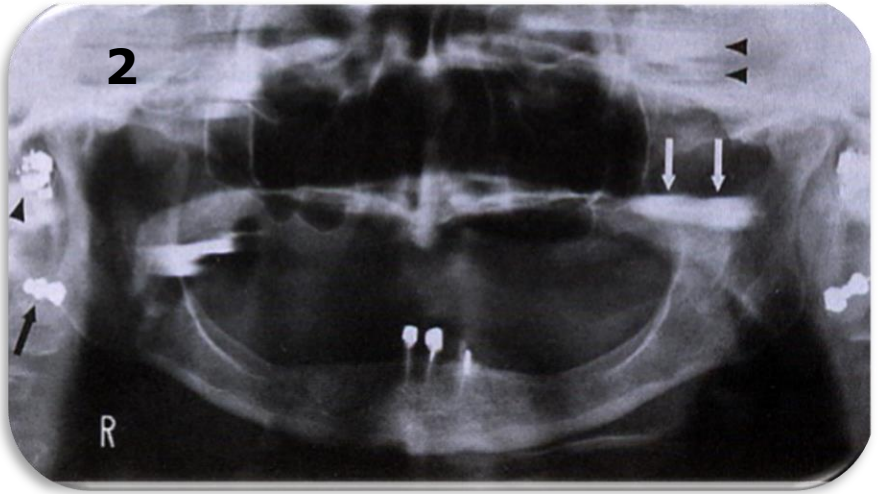


Elongation

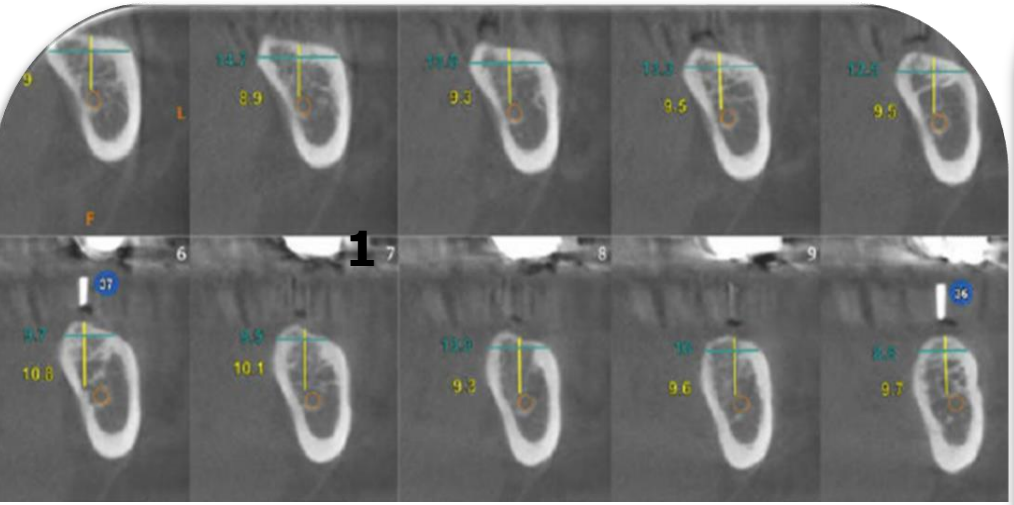
Foreshortenning

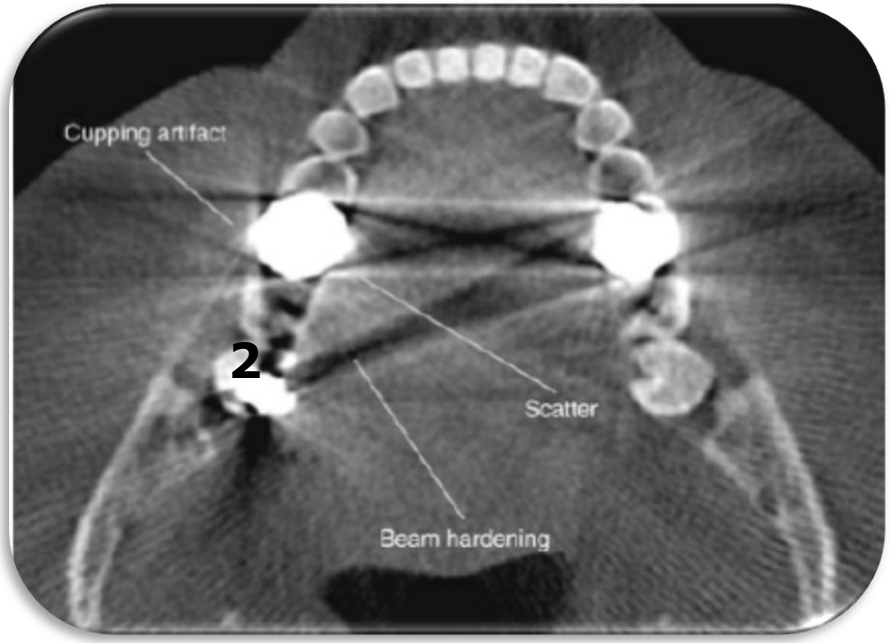
| | | | |
|---|---|---|---|
| Panoramic imaging | • Readily available<br>• Broad anatomic coverage<br>• Low financial cost and radiation exposure | • Image distortion<br>• Anatomic superimposition and ghost images<br>• Lower | • Initial examination of multiple edentulous spaces<br>• Radiographic follow-up of multiple implants |
| | | • Cannot assess buccolingual dimension<br>• Technique sensitive | |

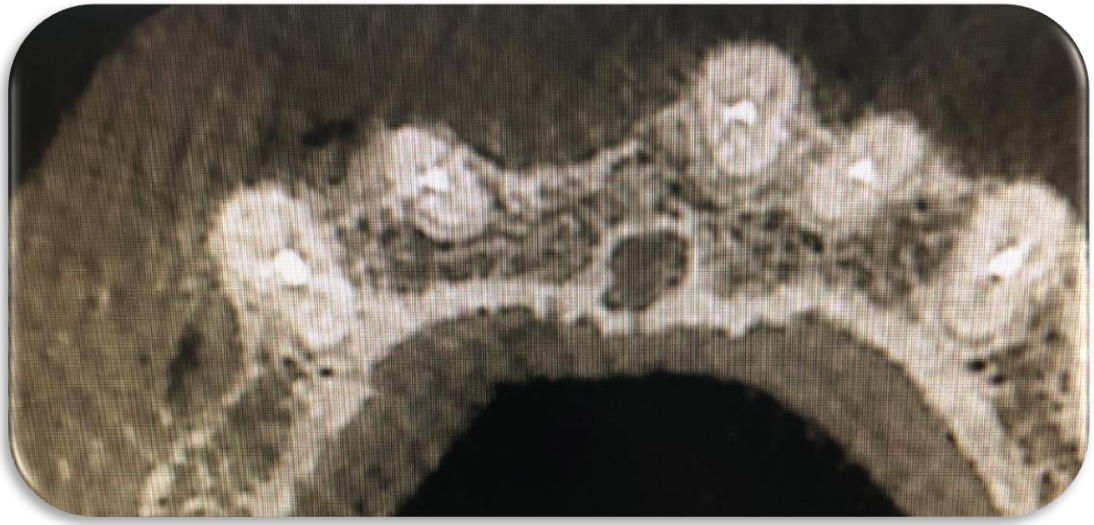


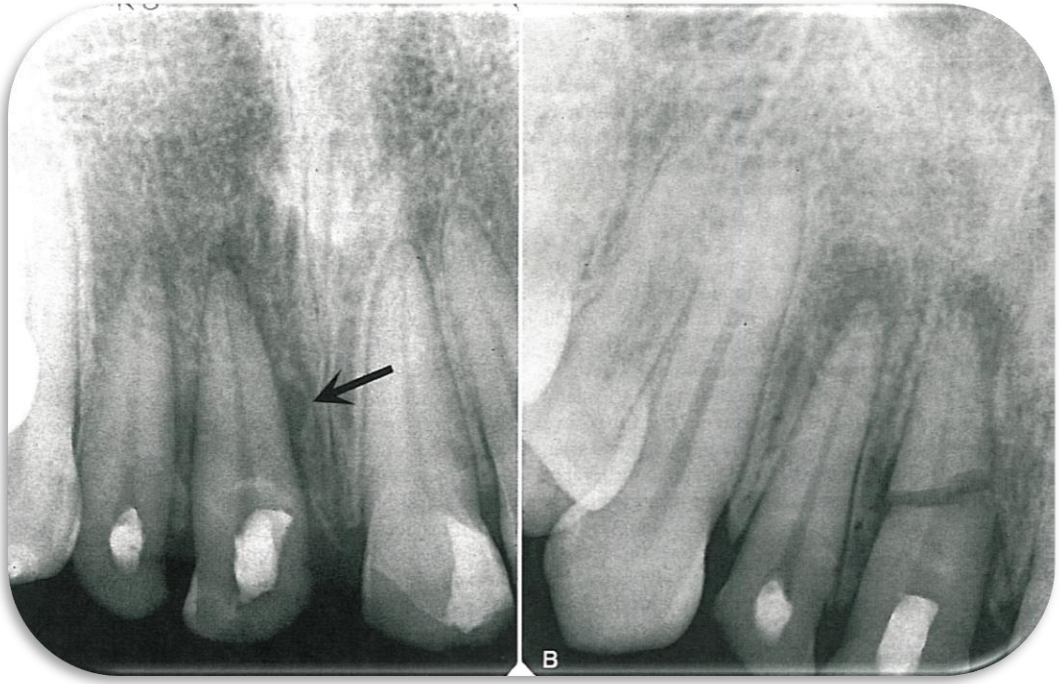



| | | | |
|---|---|---|---|
| CBCT imaging | • Variable field of view: from single edentulous site to full jaws (manufacturer-dependent)<br>• 3D tomographic imaging: no superimposition<br>• Dimensionally accurate<br>• Increasingly accessible<br>• Simulate implant surgery with specialized software | • Moderate financial cost and radiation exposure<br>• Susceptible to beam hardening artifacts<br>• Technique-sensitive (especially to patient motion)<br>• Special training for interpretation<br>• Not calibrated for bone density measurements (HU)<br>• Poor soft tissue contrast | • Following initial examination, CBCT is recommended for thorough radiologic assessment<br>• Recommended before and after bone augmentation<br>• Postoperatively, recommended for symptomatic implants (implant mobility, altered sensation, displaced implant)<br>• Not appropriate for asymptomatic recall imaging |






B

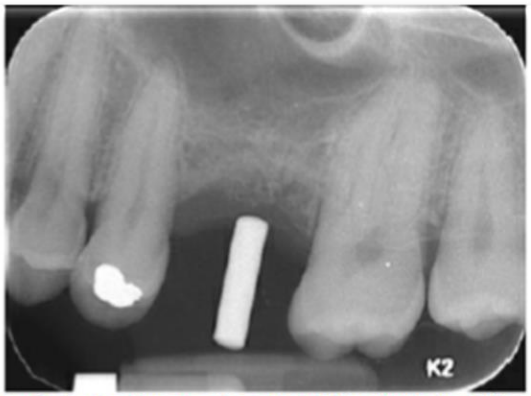



FIG. 15.1 Periapical image of a potential implant site in the posterior left maxilla. An imaging guide containing a cylindrical radiopaque marker has been inserted intraorally to depict the desired angle of implant placement.

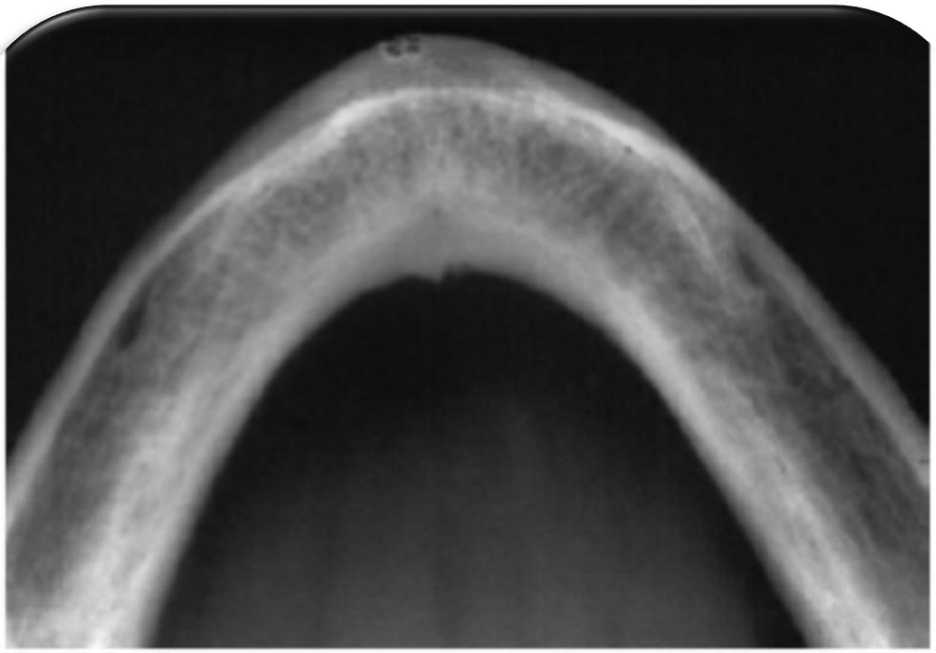
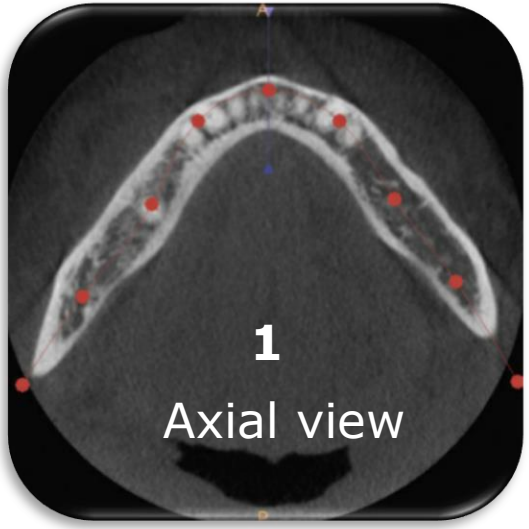
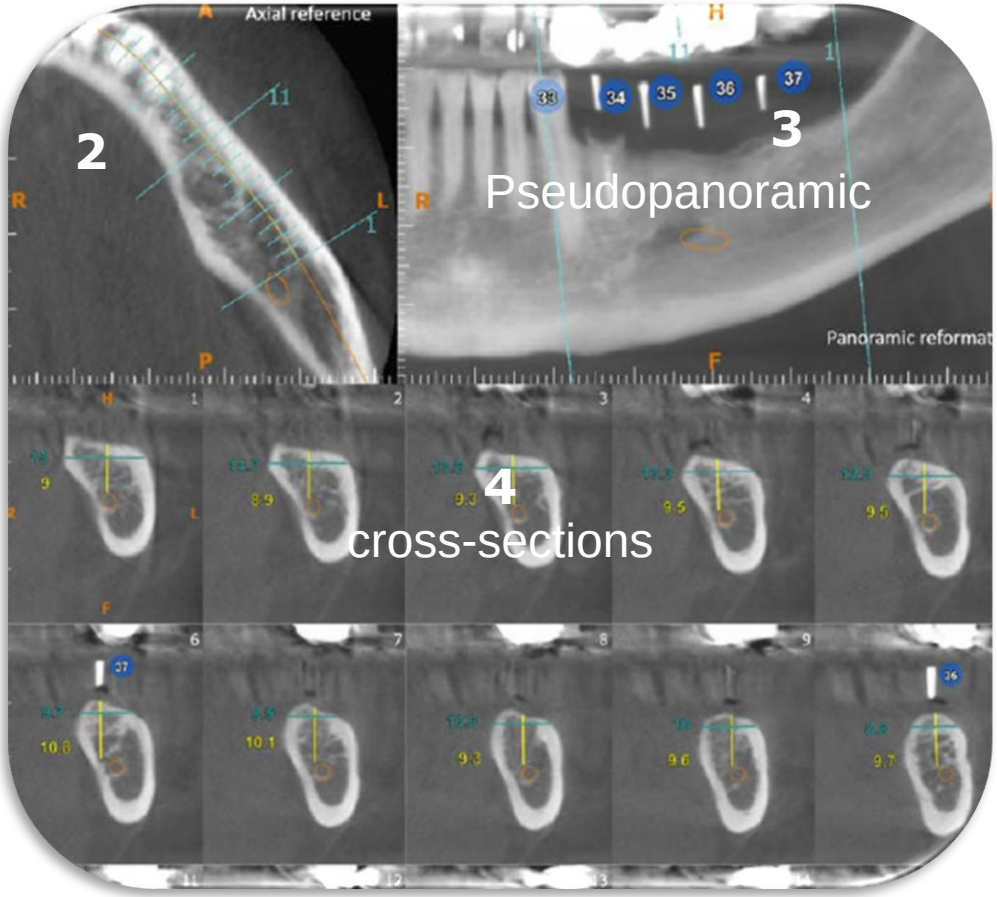


FIG. 15.2 Cross-sectional occlusal radiograph of the edentulous mandible. Note that only the widest buccolingual contours of the mandible are visualized; these are usually located inferior to the desired implant site. This could result in an overestimation of the amount of buccolingual bone available.

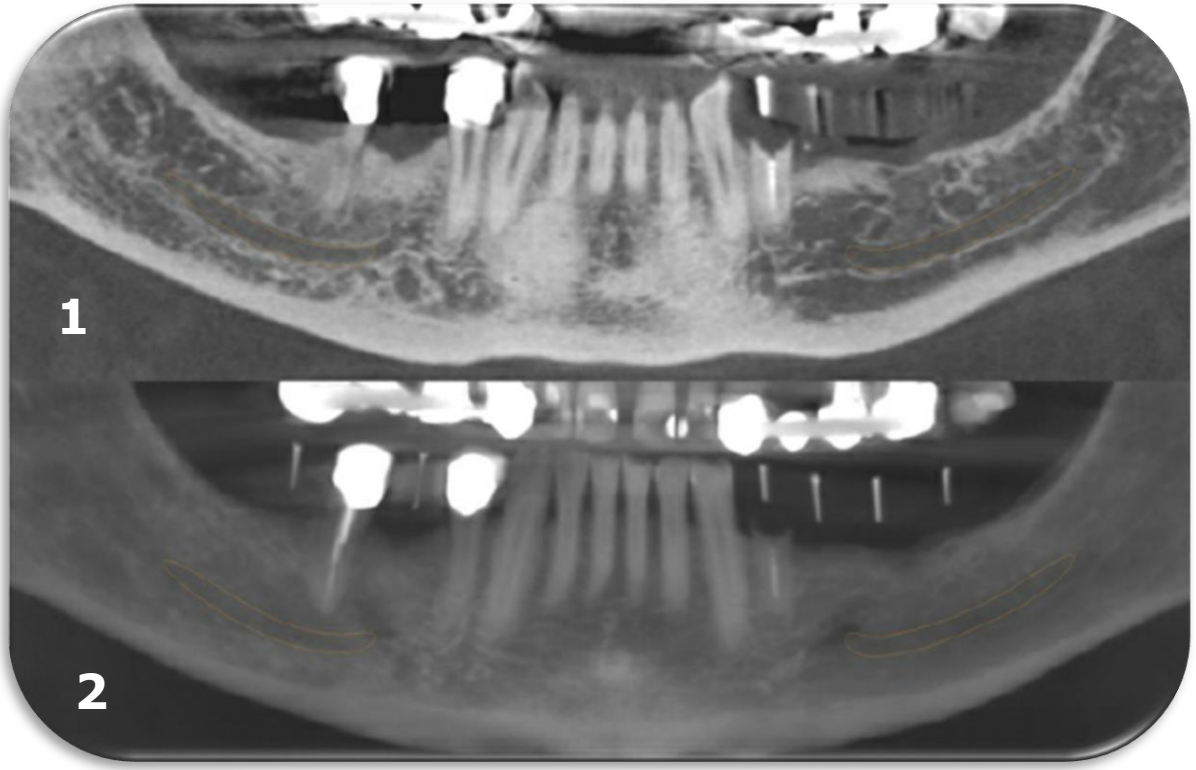
# CBCT








- ✓ thickness
- ✓ step
- ✓ slice


1
2


3


Perfectly Fitting Surgical Guide
For Successful Implant Surgery

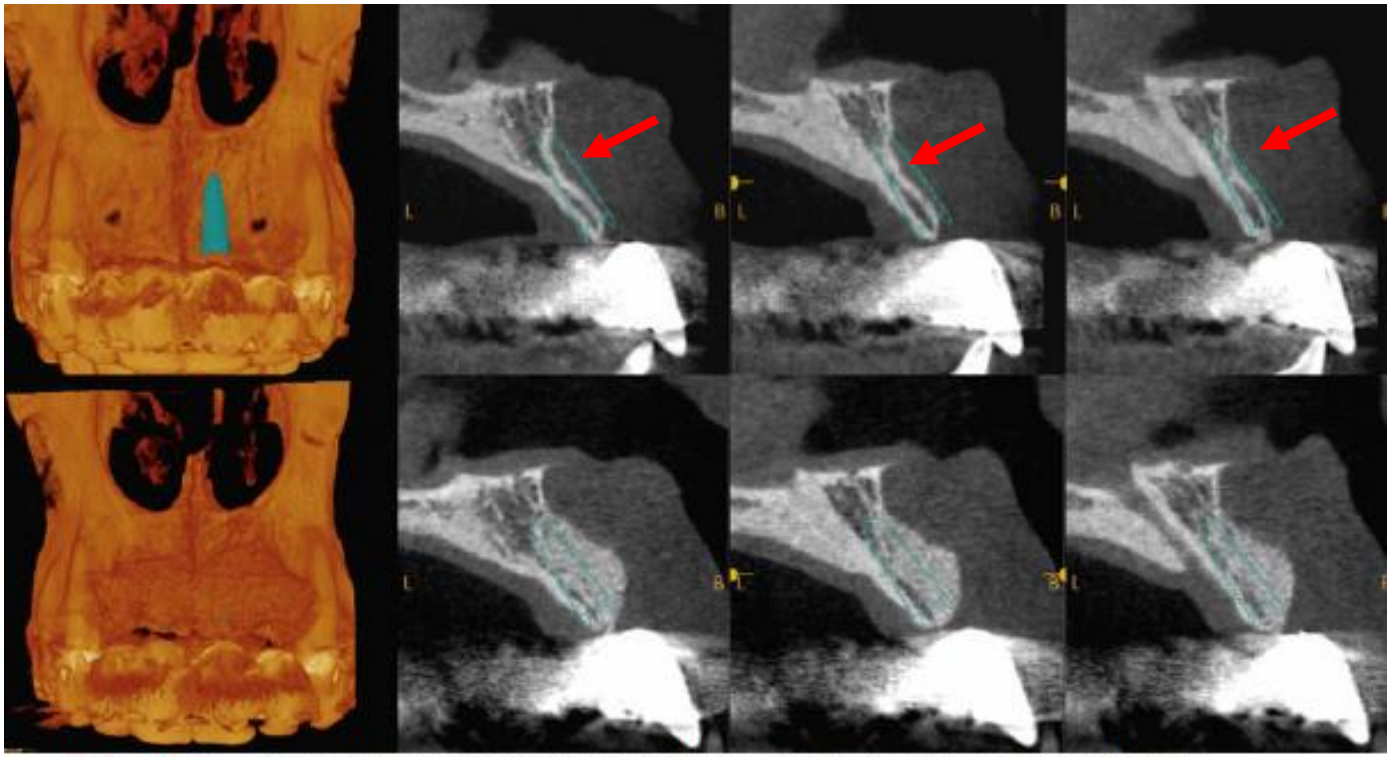


**FIG. 15.5** *Top*: Three-dimensional volume rendering and buccolingual cross-sections of an edentulous maxillary left central incisor site. Note the prominent buccal concavity of the alveolar process, which prevents the desired implant to be placed without significant esthetic compromises. The virtual implant shows extensive buccal thread exposure if placed in the ideal inclination, identifying the need for buccal bone augmentation prior to implant placement. *Bottom*: Cone beam computed tomography sections following buccal bone grafting. Note how the desired implant size is now fully embedded in bone.

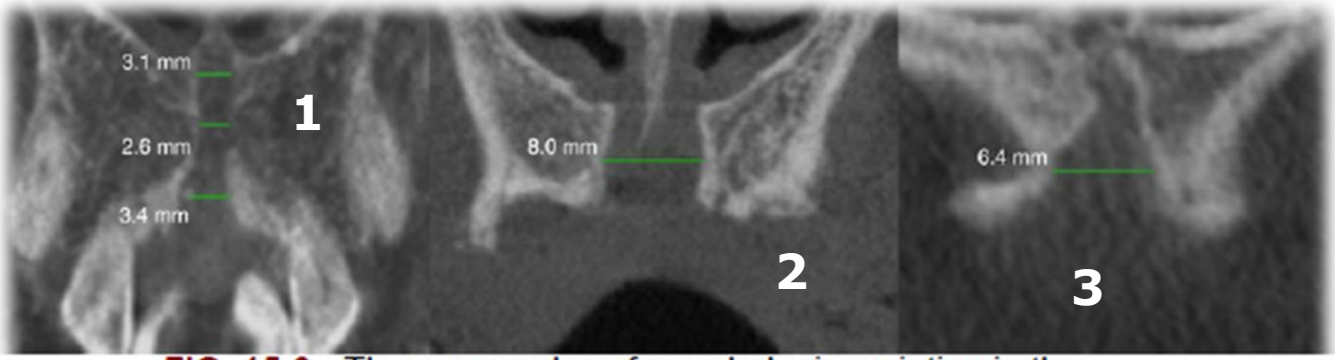
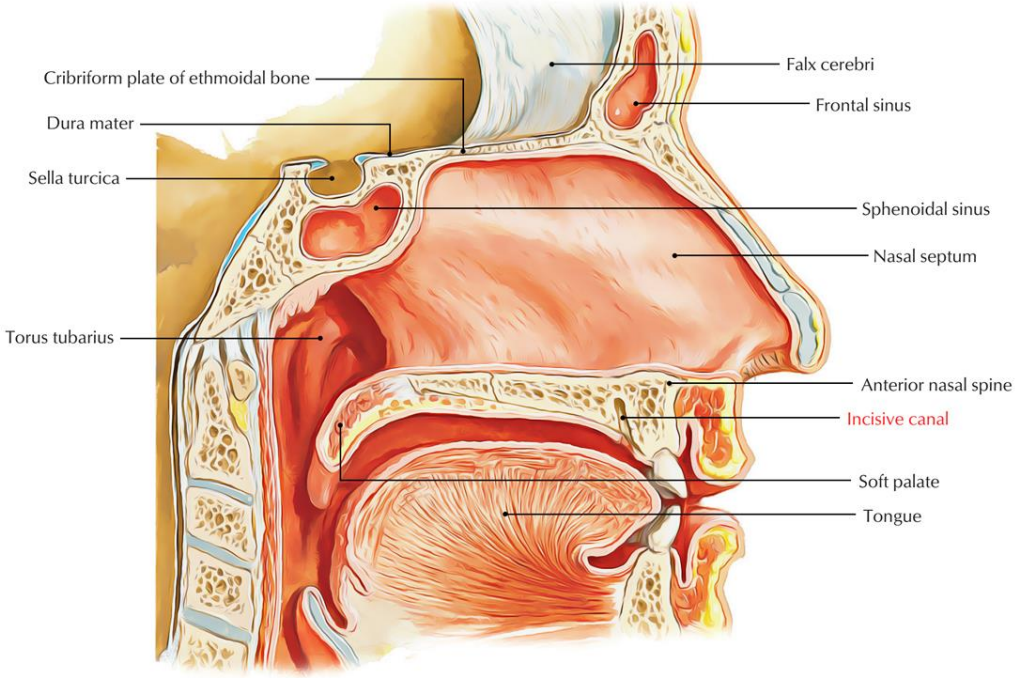




**FIG. 15.6** Three examples of morphologic variation in the nasopalatine canal. Coronal slices depicting a thin, uniform canal *(left)*, two wide, converging canals *(middle)*, and a funnel-shaped canal *(right)*.



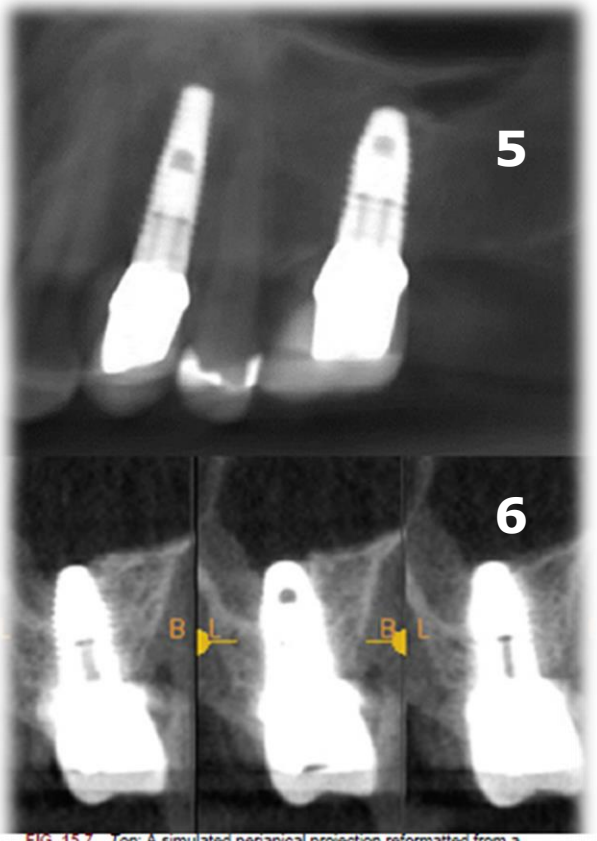
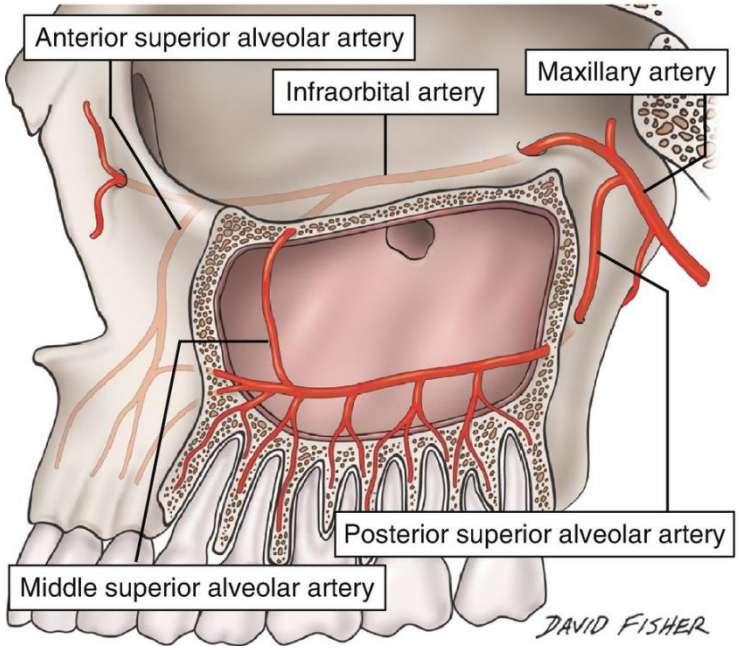




FIG. 15.7 *Top:* A simulated periapical projection reformatted from a cone beam computed tomography study. The position of the maxillary sinus floor relative to the apex of the implant placed at the maxillary left first molar site is difficult to determine due to anatomic superimposition.

- ✓ presence of septa
- ✓ inflammatory disease
- ✓ branches artery



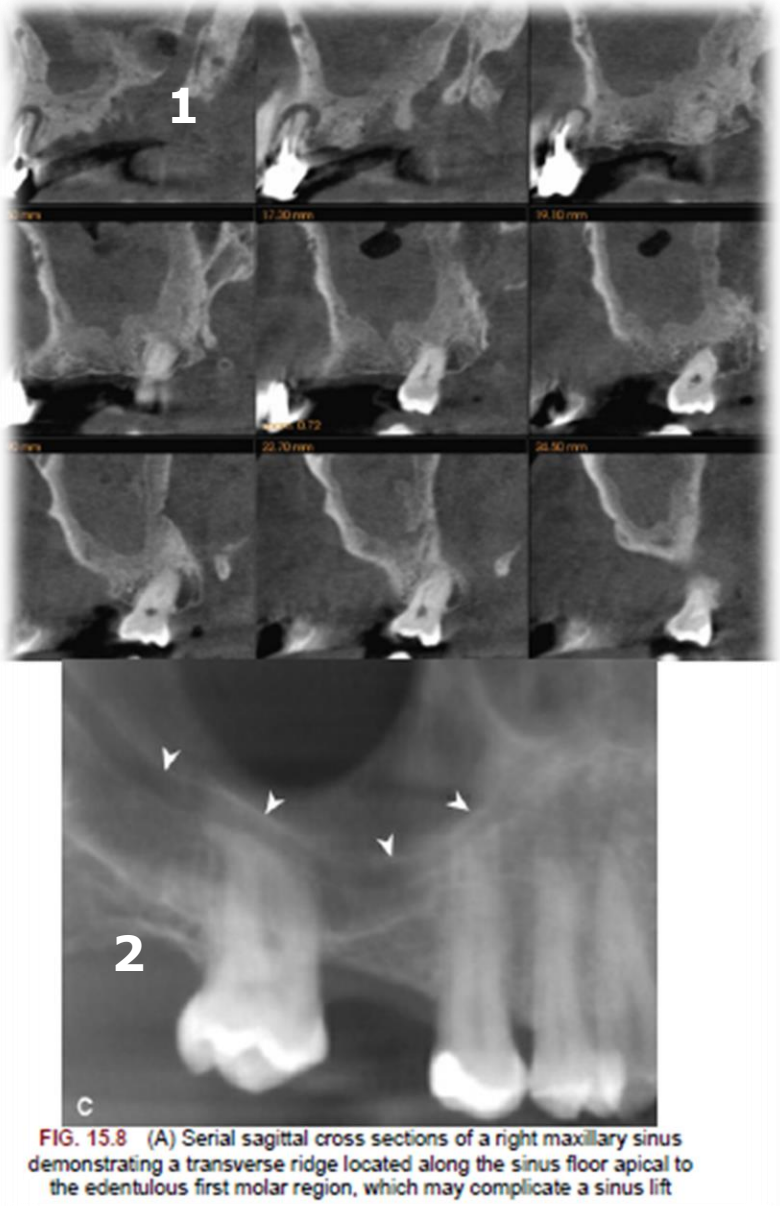
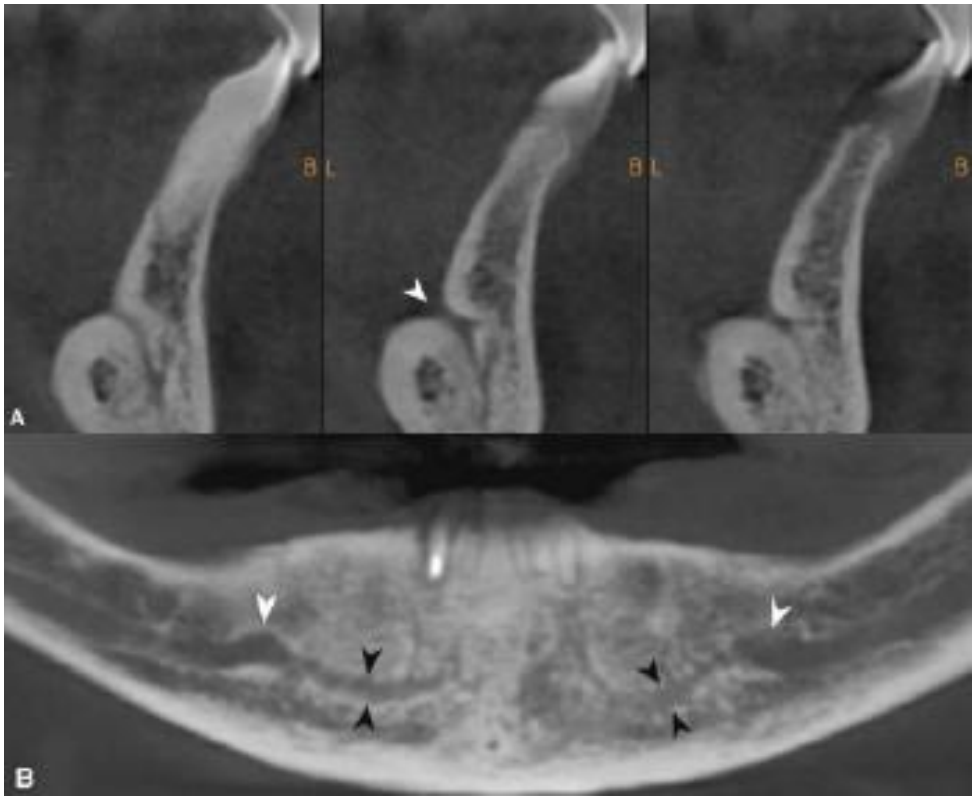
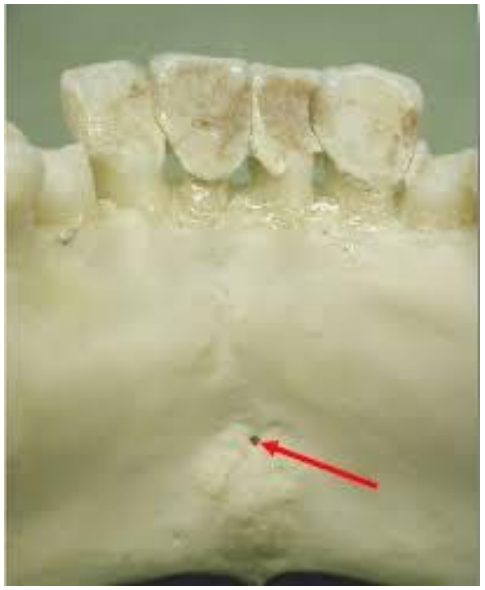
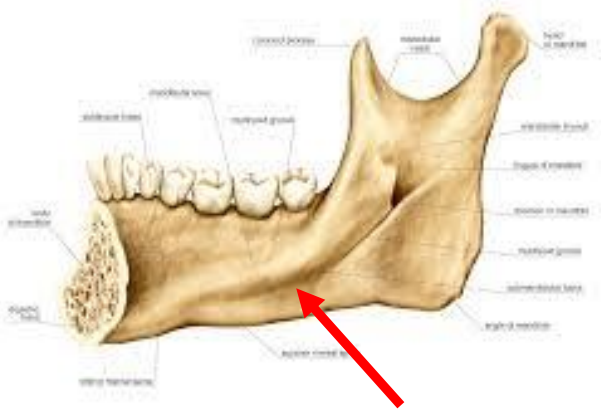
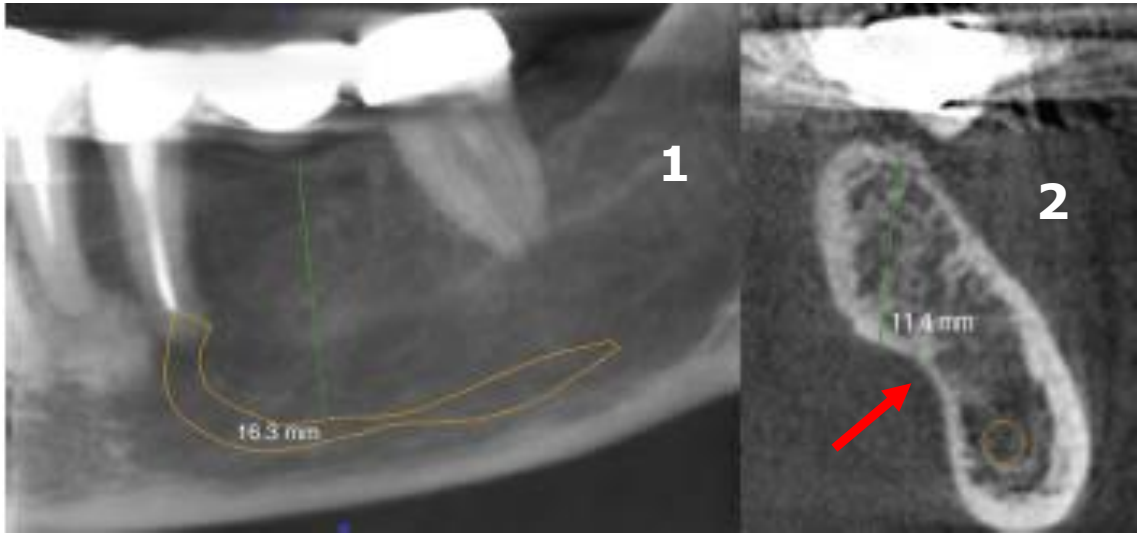



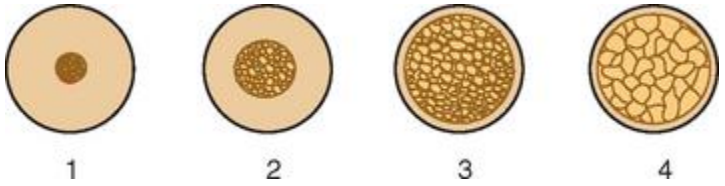

FIG. 15.8 (A) Serial sagittal cross sections of a right maxillary sinus demonstrating a transverse ridge located along the sinus floor apical to the edentulous first molar region, which may complicate a sinus lift

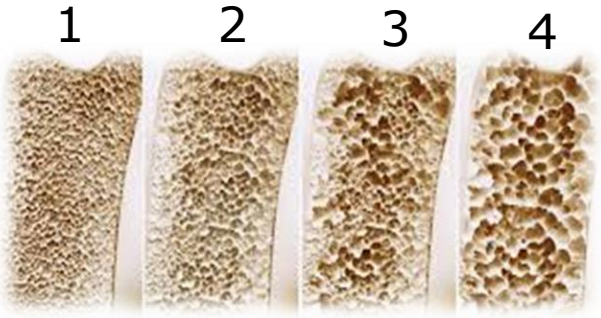

A
B






1
16.3 mm
2
11.4 mm




# Radiologic Assessment of Bone Quality

**TABLE 15.2**

## Misch Classification of Bone Density

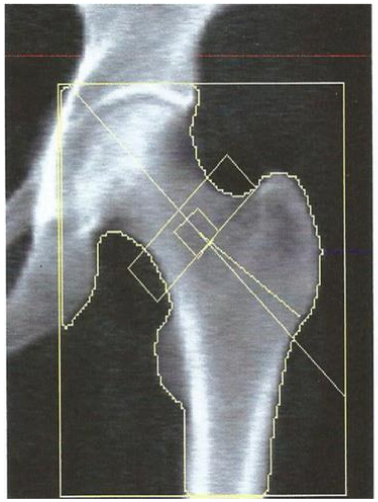
| Classification Type | Radiographic Appearance | Typical Anatomic Location | MDCT Density Range (HU) |
|---|---|---|---|
| D1 | Primarily composed of dense cortical bone<br>Marrow spaces are hardly visible | Occasionally in anterior mandible<br>Rarely in posterior mandible | >1250 |
| D2 | Thick outer layer of porous cortical bone<br>Coarse trabecular bone pattern | Commonly in anterior and posterior mandible<br>Occasionally in anterior maxilla | 850–1250 |
| D3 | Thinner layer of porous cortical bone<br>Fine trabecular bone pattern | Commonly in anterior maxilla, posterior maxilla, and posterior mandible<br>Occasionally in anterior mandible | 350–850 |
| D4 | Faint to imperceptible outline of thin cortical bone<br>Alveolar process is primarily composed of fine trabecular bone | Commonly in posterior maxilla<br>Rarely in anterior maxilla | 150–350 |

- ✓ subjective evaluation (CBCT)
- ✓ mineral mass per unit volume (DEXA)

## bone density:

in the anterior mandible is higher

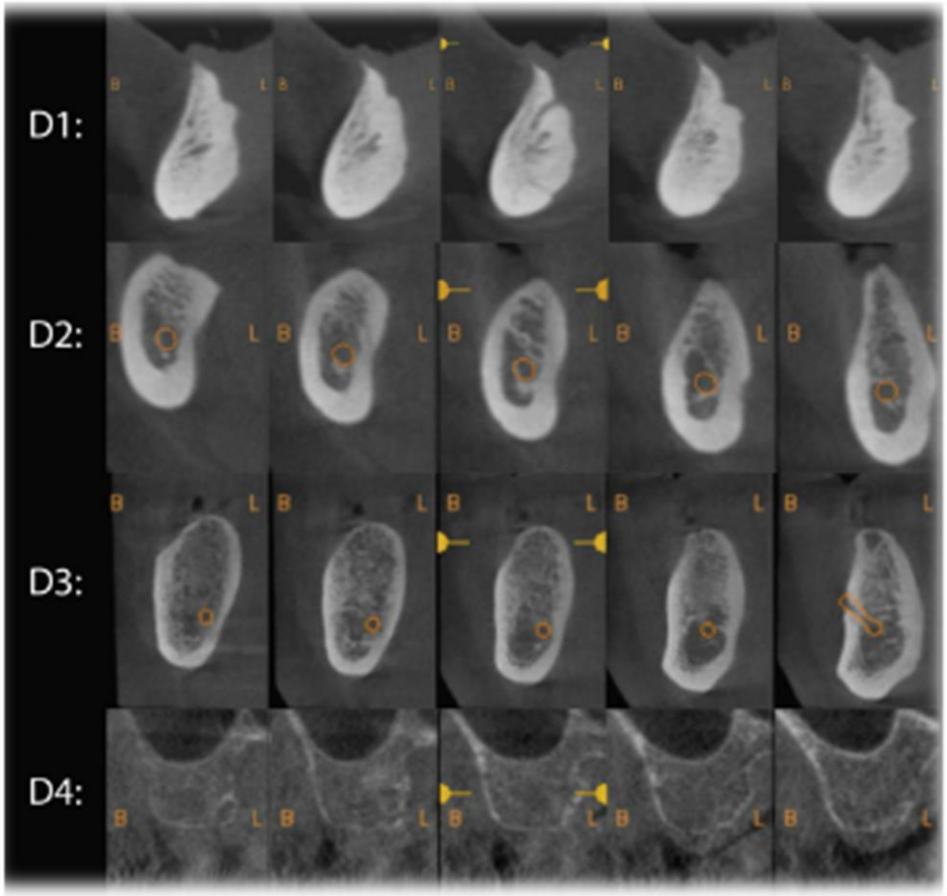
lowest in the posterior maxilla



DXA Results Summary:

| Region | Area ($cm^2$) | BMC (g) | BMD ($g/cm^2$) | T-score | Z-score |
|---|---|---|---|---|---|
| Neck | 4.98 | 4.30 | 0.864 | -0.5 | 0.5 |
| Total | 39.48 | 42.62 | 1.079 | 0.3 | 0.8 |

Total BMD CV 1.0%, ACF = 1.028, BCF = 1.007, TH = 5.496
WHO Classification: Normal
Fracture Risk: Not Increased



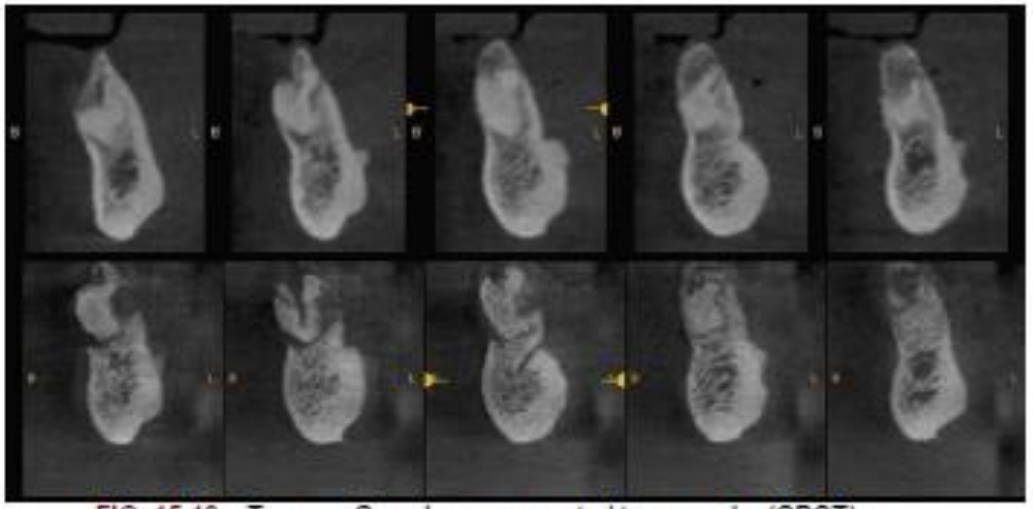
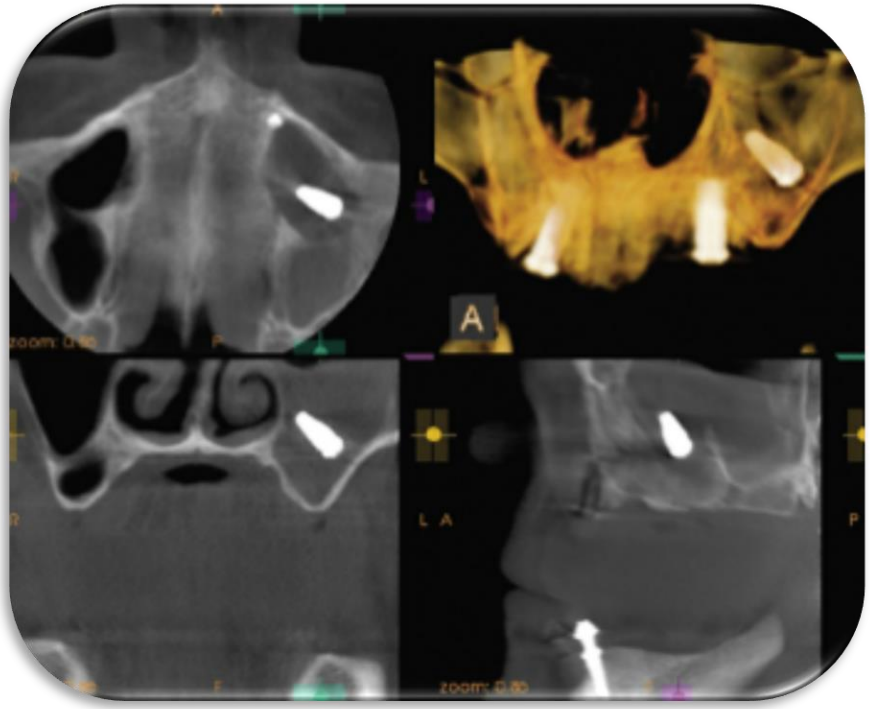


FIG. 15.13 *Top row*: Cone beam computed tomography (CBCT) images of a relatively mature focus of periapical osseous dysplasia in the anterior mandible of a patient evaluated for implant treatment planning. *Bottom row*: Following implant placement, the patient reported pain in the implant area. Two of the implants failed in the immediate postoperative period. Postoperative CBCT sections

- ✓ drill deflection
- ✓ lower vascularity

FIG. 15.12 Cone beam computed tomography section through the posterior left mandible demonstrating a large area of osteosclerosis located in the mesial aspect of an edentulous mandibular left first molar site.

# Intraoperative Imaging



- Periapical imaging
- Panoramic imaging
- CBCT imaging

# Previous diagnostic images

- Where there is clinical evidence of an abnormality that cannot be fully assessed by physical examination alone
- Where there is a high probability of disease that is not clinically evident

# Administrative images

## Box 17.1

# American Dental Association Selection Criteria for Prescribing Dental Radiographs

| Positive Historical Findings | Positive Clinical Signs or Symptoms |
|---|---|
| 1. Previous periodontal or endodontic treatment | 1. Clinical evidence of periodontal disease |
| 2. History of pain or trauma | 2. Large or deep restorations |
| 3. Familial history of dental anomalies | 3. Deep carious lesions |
| 4. Post-operative evaluation of healing | 4. Malposed or clinically impacted teeth |
| 5. Remineralization monitoring | 5. Swelling |
| 6. Presence of implants or evaluation for implant placement | 6. Evidence of dental/facial trauma |
| | 7. Mobility of teeth |
| | 8. Sinus tract ("fistula") |
| | 9. Clinically suspected sinus pathology |
| | 10. Growth abnormalities |
| | 11. Oral involvement in known or suspected systemic disease |
| | 12. Positive neurologic findings in the head and neck |
| | 13. Evidence of foreign objects |
| | 14. Pain and/or dysfunction of the temporomandibular joint |
| | 15. Facial asymmetry |
| | 16. Abutment teeth for fixed or removable partial prosthesis |
| | 17. Unexplained bleeding |
| | 18. Unexplained sensitivity of teeth |
| | 19. Unusual eruption, spacing or migration of teeth |
| | 20. Unusual tooth morphology, calcification or color |
| | 21. Unexplained absence of teeth |
| | 22. Clinical tooth erosion |
| | 23. Peri-implantitis |

## TABLE 17.1

# American Dental Association Guidelines for Prescribing Dental Radiographs

| | PATIENT AGE AND DENTAL DEVELOPMENTAL STAGE | |
|---|---|---|
| Type of Encounter | Child With Primary Dentition (Before Eruption of First Permanent Tooth) | Child With Transitional Dentition (After Eruption of First Permanent Tooth) |
| New patient[a] being evaluated for oral diseases | Individualized radiographic exam consisting of selected periapical/occlusal views and/or posterior bitewings if proximal surfaces cannot be visualized or probed. Patients without evidence of disease and with open proximal contacts may not require a radiographic examination at this time | Individualized radiographic exam consisting of posterior bitewings with panoramic exam or posterior bitewings and selected periapical images |
| Recall patient[a] with clinical caries or at increased risk for caries[b] | Posterior bitewing exam at 6- to 12-month intervals if proximal surfaces cannot be examined visually or with a probe | |
| Recall patient[a] with no clinical caries and not at increased risk of developing caries[b] | Posterior bitewing examination at 12- to 24-month intervals if proximal surfaces cannot be examined visually or with a probe | |
| Recall patient[a] with periodontal disease | Clinical judgment as to the need for and type of radiographic images for the evaluation of periodontal disease. Imaging may consist of but is not limited to selected bitewing and/or periapical images of areas in which periodontal disease (other than nonspecific gingivitis) can be demonstrated clinically | |
| Patient (new and recall) for | Clinical judgment as to need for and type of radiographic | |

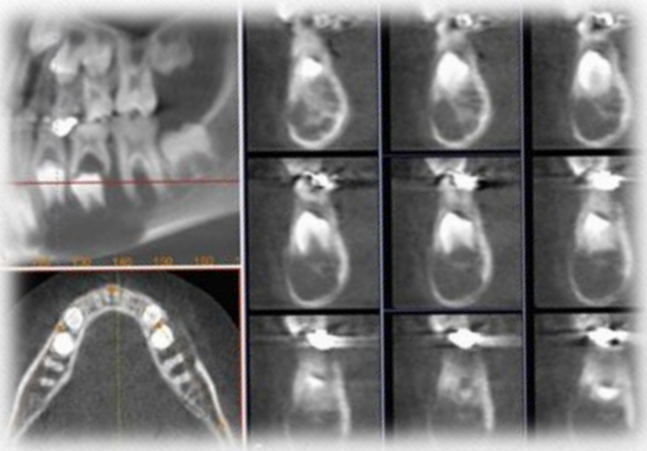
| | | |
|---|---|---|
| monitoring of dentofacial growth and development and/or assessment of dental/skeletal relationships | images for evaluation and/or monitoring of dentofacial growth and development or assessment of dental and skeletal relationships | |
| Patient with other circumstances, including but not limited to proposed or existing implants, other dental and craniofacial pathosis, restorative/endodontic needs, treated periodontal disease, and caries remineralization | Clinical judgment as to need for and type of radiographic images for evaluation and/or monitoring of these conditions | |
| **PATIENT AGE AND DENTAL DEVELOPMENTAL STAGE** | | |
| **Adolescent With Permanent Dentition (Before Eruption of Third Molars)** | **Adult, Dentate or Partially Edentulous** | **Adult, Edentulous** |
| Individualized radiographic exam consisting of posterior bitewings with panoramic exam or posterior bitewings and selected periapical images; full-mouth intraoral radiographic exam is preferred when patient has clinical evidence of generalized dental disease or a history of extensive dental treatment | | Individualized radiographic exam based on clinical signs and symptoms |
| Posterior bitewing exam at 6- to 12-month intervals if proximal surfaces cannot be examined visually or with a probe | Posterior bitewing examination at 6- to 18-month intervals | Not applicable |
| Posterior bitewing exam at 18- to 36-month intervals | Posterior bitewing exam at 24- to 36-month intervals | Not applicable |
| Clinical judgment as to the need for and type of radiographic images for the evaluation of periodontal disease. Imaging may consist of, but is not limited to, selected bitewing and/or periapical images of areas in which periodontal disease (other than nonspecific gingivitis) can be demonstrated clinically | | Not applicable |
| Clinical judgment as to need for and type of radiographic images for evaluation and/or monitoring of dentofacial growth and development or assessment of dental and skeletal relationships. Panoramic or periapical exam to assess developing third molars | Usually not indicated for monitoring of growth and development. Clinical judgment as to the need for and type of radiographic images for evaluation of dental and skeletal relationships | |
| Clinical judgment as to need for and type of radiographic images for evaluation and/or monitoring of these conditions | | |

[a]Refer to Box 17.1.

# Initial Visit

# Recall Visit

## Guidelines for Ordering Cone Beam Computed Tomography Examinations



- Must not be prescribed unless a history and clinical examination have been performed
- Must be justified for each patient to ensure that the benefits outweigh the risks
- Should potentially add new information to aid the patient's management.

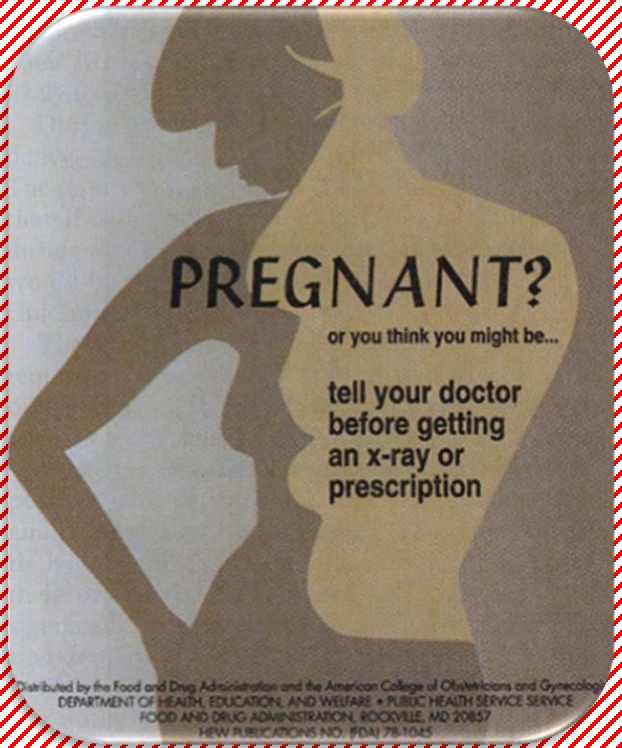
# Imaging Considerations in the Absence of a Positive Finding

Prevalence of an abnormality

Ability of the imaging modality

Detection would influence management?

Radiation doses


PREGNANT?
or you think you might be...
tell your doctor before getting an x-ray or prescription
Distributed by the Food and Drug Administration and the American College of Obstetricians and Gynecologists
DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE • PUBLIC HEALTH SERVICE
FOOD AND DRUG ADMINISTRATION, ROCKVILLE, MD 20857
HEW PUBLICATION NO. (FDA) 78-1045

# Radiation therapy

| Examination | Effective dose (μSv) | Equivalent background e. (days) |
|---|---|---|
| Periapical or bitewing | 5 - 6 | 1 |
| Panoramic & Full mouth | 20 | 1 - 3 |
| Lateral cephalometric | 5 | 0.5 - 1 |