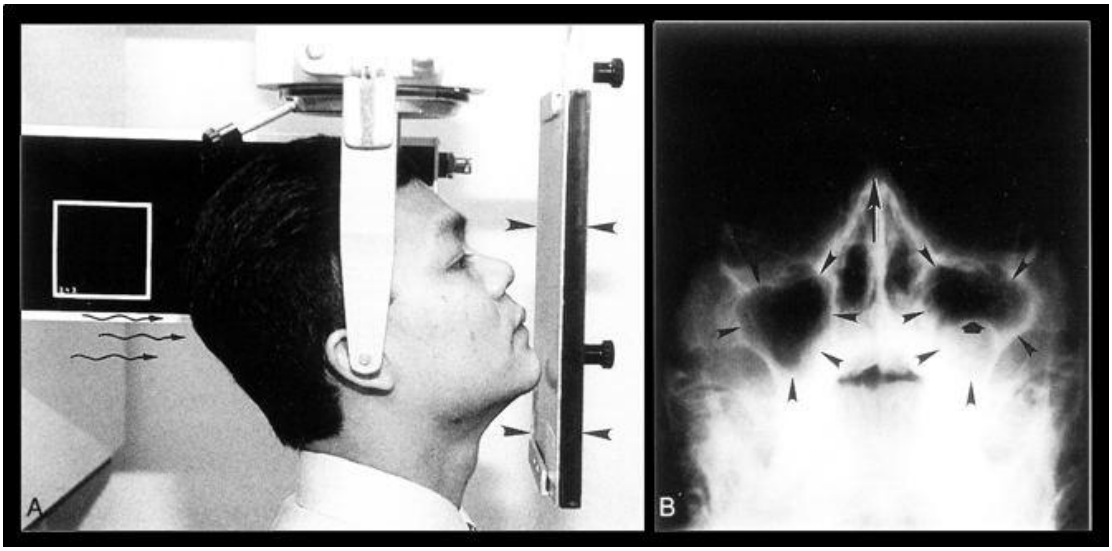
50. All of the following radiographic imaging techniques compose a "Sinus Series." Which one demonstrates a good view of the frontal and ethmoid sinuses, the orbit, the zygomaticofrontal suture, and the nasal cavity.

A. Waters (Occipitomental) Projection
B. Posteroanterior (PA) Projection
C. Lateral Skull Projection
D. Submentovertex Projection

ANSWER: **A.** Waters (Occipitomental) Projection



Evaluation of the sinuses in the skull using plain film radiography requires more than one view or projection. A panoramic radiograph often constitutes the initial exposure because it can provide broad coverage of the sinus anatomy, in particular the maxillary sinuses. A group of radiographic projections, sometimes designated as a *sinus series,* may be made to provide views in several imaging planes. A typical sinus series might include panoramic, Waters, posteroanterior (PA), submentovertex (SMV), and lateral skull radiographs. It is not uncommon for computed tomography (CT) or magnetic resonance (MR) imaging, or both, also to be employed.

Waters (Occipitomental) Projection

In addition to the maxillary sinuses, the Waters view demonstrates the frontal and ethmoid sinuses, the orbit, the zygomaticofrontal suture, and the nasal cavity.

Posteroanterior (PA) Projection

The PA view demonstrates the frontal and ethmoid sinuses, nasal fossae, and orbits.

Lateral Skull Projection

This view is useful to assess the skull and bones of the face for evidence of trauma, local or systemic disease involvement, or growth and development.

Submentovertex Projection

The SMV projection is also known as the basilar view. A submentovertex image demonstrates the base of the skull; the location, general shape, and orientation of the condyles; the sphenoid sinuses; the curvature of the dental arches and portions of the mandible; the lateral wall of the maxillary sinuses; and the zygomatic arches.

Razmus, Thomas F. Current Oral and Maxillofacial Imaging. W.B. Saunders Company, 1996. 8.4.4.

51. Which of the following is the imaging modality of choice when diagnosing nondisplaced condylar fractures?

A. Panoramic film
B. Lateral Ceph
C. CT
D. MRI
E. None of the above

Answer: C. CT

Nondisplaced fractures of the condylar process may be difficult to direct on plain radiographic or panoramic images. CT is the imaging modality of choice because it will enable the clinician to visualize the 3-D relationship of the displaced condylar head to the glenoid fossa and to adjacent anatomical in the skull base and infratemporal fossa.

Salivary stones are sometimes seen on periapical views superimposed over the mandibular posterior apices. The best view for visualizing stones in the distal portion of Wharton's Duct is an occlusal film. Stones in a more posterior location are best visualized on lateral oblique views of the mandible or on a pano. Stones in the parotid duct (Stenson's) are best picked up with a periapical in the buccal vestibule with the exposure time reduced.

Lateral Ceph (Lateral Skull) – used in ortho, midface fracture, Le Forte III fx,
Submentovertex (Base) – zygomatic arch fracture, midface fracture
Posterior-anterior view – mandibular fracture body, midface fracture
Lateral Oblique – mandibular fracture body
Towne's – mandibular fracture body
Panoramic - mandibular fracture body, condylar fracture
Waters – maxillary sinus, midface fracture, orbital rim fractures
CT - **midface fracture**
TMJ – transcranial radiographs, pano, tomograms, TMJ arthrography, CT, MRI

White, Pharoah. Oral Radiology Principles and Interpretation, 6th ed., 2009.
Peterson, Ellis, Hupp and Tucker. Contemporary Oral and Maxillofacial Surgery. 3rd ed., 1998.

TABLE **12-1**
Technical Aspects of Extraoral Radiographic Projections and Resultant Images

	Lateral Ceph	SMV	Waters	PA Ceph	Reverse Towne	Oblique Lateral Body	Oblique Lateral Ramus
Patient placement	Film parallel to midsagittal plane	Canthomeatal line parallel to film	Canthomeatal line at 37° with film	Canthomeatal line at 10° with film	Canthomeatal line at –30° with film	Film in contact with cheek at molar area	Film in contact with cheek at ramus area
Central beam	Beam perpendicular to film	Beam perpendicular to film	Beam perpendicular to film	Beam perpendicular to film	Beam perpendicular to film	Beam aims at the molar-premolar area	Beam aims at the ramus area
Diagram of patient placement							
Illustration of patient placement							
Skull view							
Resultant image							

52. Correct functioning of the sterilizer should be monitored when?

a. When new personnel have recently been trained
b. Weekly with biologic monitor
c. After any change in sterilizer loading procedures
d. After the sterilizer has been repaired
e. All of the above

Answer: E

Correct functioning of sterilization cycles should be verified for each sterilizer at least weekly. In addition to periodic monitoring, the sterilizer should be checked after any of the following:

- Whenever a new type of packaging material or tray is used.
- After training new sterilization personnel.
- After a sterilizer has been repaired.
- After any change in the sterilizer loading procedures.

Guidelines for Infection Control in Dental Health-Care settings-2003. MMWR December 19, 2003; vol. 52 (RR-17)

53. Sharpness (decrease of penumbra) is maximized when:

a. The source-object distance is increased
b. The object-film distance is increased
c. The source object distance is increased and the object film distance is decreased
d. The object-film distance is decreased

ANSWER: C. The source object distance is increased and the object film distance is decreased

In all situations, sharpness is improved when the source-object distance is increased and the object-film distance is decreased. It should be remembered that the longer the object-film distance, the greater the unsharpness. In the dental radiograph, the dental structure farthest from the film will have the greatest unsharpness. Example: The lingual cusp and the lingual root of a tooth will have more sharpness on the radiograph than the buccal cusp and the buccal root or roots on a tooth. The lingual structures are sharper because they are closer to the film.

The factors that influence magnification are the same factors that influence radiographic image or geometric in sharpness; however, the distance factors (source-film distance and object-film distance) have more influence than focal-spot size. It is possible to minimize magnification (equal enlargement) of dental structures by increasing the source-film distance (long cone) and reducing the object-film distances as much as practical

Langland; Langlais; Principles of Dental Imaging; 1997; pgs 57-59

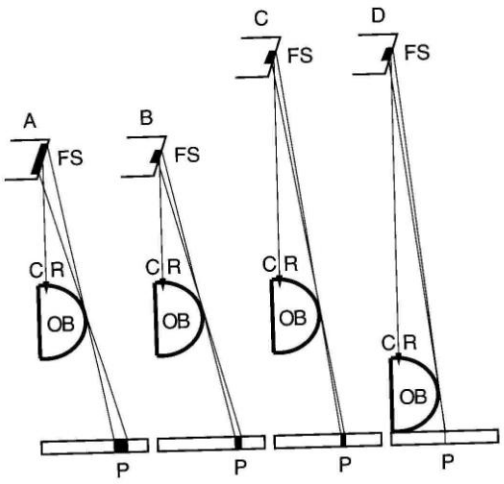
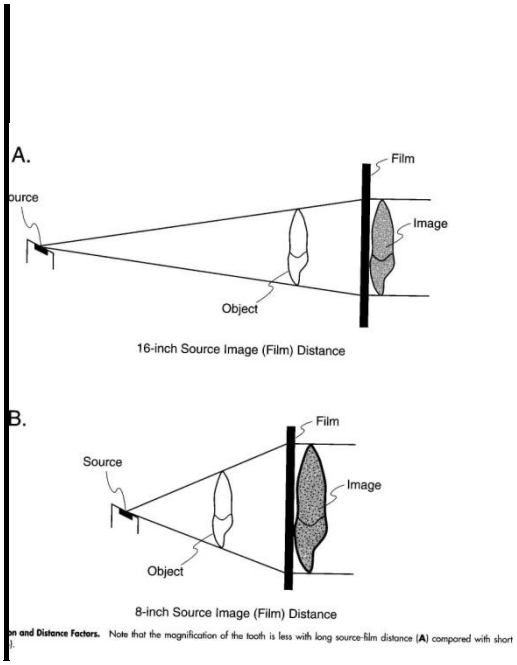


Figure 3.7. Five Rules of Accurate Image Formation. Diagrams illustrating how the accuracy of the radiographic image can be improved by decreasing the size of the penumbra (*P*). The penumbra affects image unsharpness and magnification. Note the changes in size of the penumbra: from *A* to *B* by decreasing the size of a focal spot (*FS*) of the anode; from *B* to *C* by increasing the distance between the focal spot and the film; and from *C* to *D* by decreasing the distance between (*OB*) and the film.



and Distance Factors. Note that the magnification of the tooth is less with long source-film distance (**A**) compared with short

54. With Cone Beam CT, patient radiation dose can be lowered by all of the following except

a. Lowering the chin
b. Collimating the beam
c. Elevating the chin
d. Using thyroid and cervical spine shielding

Answer: a

The effective dose for various CBCT devices ranges from 52 to 1025 μSv depending on the type and model of CBCT equipment and imaging protocol used. These values are approximately equivalent to 4-77 digital panoramic radiographs or 5-103 days equivalent per capita background dose. Patient radiation dose can be lowered by collimating the beam, elevation of the chin, and using thyroid and cervical spine shielding. CBCT provides a range of dose reductions of between 96% and 51% compared with conventional head CT (ranges 1400-2100 μSv).

Reference: Stuart White, Michael Pharoah, "Oral Radiology: principles and interpretation", Sixth edition, 2009.

55. Which of the following is not an advantage of Computed Tomographic (CT) imaging over conventional film radiography and tomography

A. It eliminates the superimposition of images of structures outside the area of interest.
B. Because of the inherent high-contrast resolution of CT, differences between tissues that differ in physical density by less than 1% can be distinguished
C. Data from a single CT imaging procedure can be viewed as images in 3 dimensions, the axial, coronal, or sagittal planes, depending on the diagnostic task.
D. As compared with plain-film radiography, CT involves much higher doses of radiation, resulting in a marked increase in radiation exposure in the population.

Answer D

"CT has several advantages over conventional film radiograph and tomography. First, it eliminates the superimposition of images of structures outside the area of interest. Second, because of the inherent high-contrast resolution of CT difference between tissues that differ in physical density by less than 1% can be distinguished; conventional radiography requires a 10% difference in physical density to distinguish between tissues. Third, data from a single CT imaging procedure, consisting of either multiple contiguous or one helical scan, can be viewed as images in the axial, coronal, or sagittal planes, or in any arbitrary plane, depending on the diagnostic task. This is referred to as multiplanar reformatted imaging. Having the capability of viewing normal anatomy or pathologic processes simultaneously in three orthogonal planes greatly facilitates radiographic interpretation." P. 210

"The widespread use of CT represents probably the single most important advance in diagnostic radiology. However, as compared with plain-film radiography, CT involves much higher doses of radiation, resulting in a marked increase in radiation exposure in the population.

The increase in CT use and in the CT-derived radiation dose in the population is occurring just as our understanding of the carcinogenic potential of low doses of x-ray radiation has improved substantially, particularly for children. This improved confidence in our understanding of the lifetime cancer risks from low doses of ionizing radiation has come about largely because of the length of follow-up of the atomic-bomb survivors — now more than 50 years — and because of the consistency of the risk estimates with those from other large-scale epidemiologic studies. These considerations suggest that the estimated risks associated with CT are not hypothetical — that is, they are not based on models or major extrapolations in dose. Rather, they are based directly on measured excess radiation-related cancer rates among adults and children who in the past were exposed to the same range of organ doses as those delivered during CT studies. communication. Tellingly, a straw poll[35] of pediatric radiologists suggested that perhaps on third

of CT studies could be replaced by alternative approaches or not performed at all."

Computed Tomography — An Increasing Source of Radiation Exposure

Brenner DJ, Hall EJ. Computed Tomography — An Increasing Source of Radiation Exposure
NEJM Vol. 357:2277-2284, Nov 29,2007 Number 22

56. According to the CDC what results from Intermediate level disinfection?

A. Destroys all microorganisms, but not necessarily high numbers of bacterial spores.
B. Destroys all microorganisms, including bacterial spores.
C. Destroys the majority of vegetative bacteria, certain fungi, and viruses. Does not inactivate Mycobacterium bovis.
D. Destroys vegetative bacteria and the majority of fungi and viruses. Inactivates Mycobacterium bovis. Not necessarily capable of killing bacterial spores

ANSWER: **D**. Destroys vegetative bacteria and the majority of fungi and viruses. Inactivates Mycobacterium bovis. Not necessarily capable of killing bacterial spores

Appendix C

Methods for Sterilizing and Disinfecting Patient-Care Items and Environmental Surfaces*

Process	Result	Method	Examples	Health-care application: Type of patient-care item	Health-care application: Environmental surfaces
Sterilization	Destroys all microorganisms, including bacterial spores.	Heat-automated			Not applicable
		High temperature	Steam, dry heat, unsaturated chemical vapor	Heat-tolerant critical and semicritical	
		Low temperature	Ethylene oxide gas, plasma sterilization	Heat-sensitive critical and semicritical	
		Liquid immersion†	**Chemical sterilants.** Glutaraldehyde, glutaraldehydes with phenol, hydrogen peroxide, hydrogen peroxide with peracetic acid, peracetic acid	Heat-sensitive critical and semicritical	
High-level disinfection	Destroys all microorganisms, but not necessarily high numbers of bacterial spores.	Heat-automated	Washer-disinfector	Heat-sensitive semicritical	Not applicable
		Liquid immersion†	**Chemical sterilants/high-level disinfectants.** Glutaraldehyde, glutaraldehyde with phenol, hydrogen peroxide, hydrogen peroxide with peracetic acid, ortho-phthalaldehyde		
Intermediate-level disinfection	Destroys vegetative bacteria and the majority of fungi and viruses. Inactivates *Mycobacterium bovis*.§ Not necessarily capable of killing bacterial spores.	Liquid contact	U.S. Environmental Protection Agency (EPA)-registered hospital disinfectant with label claim of tuberculocidal activity (e.g., chlorine-containing products, quaternary ammonium compounds with alcohol, phenolics, iodophors, EPA-registered chlorine-based product¶)	Noncritical with visible blood	Clinical contact surfaces; blood spills on housekeeping surfaces
Low-level disinfection	Destroys the majority of vegetative bacteria, certain fungi, and viruses. Does not inactivate *Mycobacterium bovis*.§	Liquid contact	EPA-registered hospital disinfectant with no label claim regarding tuberculocidal activity.** The Occupational Safety and Health Administration also requires label claims of human immunodeficiency virus (HIV) and hepatitis B virus (HBV) potency for clinical contact surfaces (e.g., quaternary ammonium compounds, some phenolics, some iodophors)	Noncritical without visible blood	Clinical contact surfaces; housekeeping surfaces

Methods for Sterilizing and Disinfecting Patient-Care Items and Environmental Surfaces; MMWR December 19, 2003, Appendix C

57. Which solution below can be a disinfectant used on semicritical surfaces:

A. Glutaraldehyde
B. Chlorine compounds
C. Stabilized hydrogen peroxide
D. None of the above
E. All of the above

Answer: E. All of the above

Instruments and items for patient care are divided into three (3) categories on the basis of the degree of risk of infection involved in the use of the items. The three categories of items are: critical, semi-critical, and non-critical.

- Critical items are objects that enter sterile tissue or the vascular system. These items present a high risk of infection if the item is contaminated with any microorganism, including bacterial spores. Critical items must be sterile. This category includes surgical instruments, cardiac and urinary catheters, implants, and needles. Items in this category should be purchased as sterile or be sterilized by steam under pressure if possible. If heat labile, the object may be treated with ethylene oxide, or if other methods are unsuitable, a chemical sterilant. The following table lists several germicides categorized as chemical sterilants. Chemical sterilants

can be relied on to produce sterility only if adequate cleaning precedes treatment and if proper guidelines as to organic load, contact time, temperature and pH are met.

- Semi-critical items are those objects which come in contact with mucous membranes or with skin that is not intact. These items must be free of all microorganisms, with the exception of high numbers of bacterial spores. Respiratory therapy and anesthesia equipment, endoscopes, diaphragm--fitting rings and vaginal probes are included in this category. Semi-critical items, generally, require high-level disinfection with the use of wet pasteurization or chemical germicides. Glutaraldehyde (Cidex), stabilized hydrogen peroxide, chlorine and chlorine compounds are dependable high-level disinfectants. Refer to the following table for methods. The exposure time required to achieve high-level disinfection is 20 minutes or more. A sterile water rinse after disinfection is required to prevent contamination with tap water organisms.
- Non-critical items come in contact with intact skin, but, not with mucous membranes. Intact skin acts as an effective barrier to most microorganisms and sterility is not critical. Examples of non-critical items include bedpans, blood pressure cuffs, crutches, bed rails, linens and patient furniture. Low-level disinfectants listed in the following table may be used for cleaning non-critical items.

APIC Guidelines for Infection Control Practice, American Journal of Infection Control; April 1990, Vol 18, 99-113.

Methods of sterilization and disinfection (Table)

	Sterilization		Disinfection		
	Critical items (will enter tissue or vascular system or blood will flow through them)		*High-level (semi-critical items; will come in contact with mucous membrane or non-intact skin)*	*Intermediate-level (some semi-critical items[a] and non-critical items)*	*Low-level (non-critical items; will come in contact with intact skin)*
Object	**Procedure**	**Exposure Time (hr)**	**Procedure (exposure time ≥ 20 min)[b,c]**	**Procedure (exposure time ≤ 10 min)**	**Procedure (exposure time ≤ 10 min)**
Smooth, hard surface[a]	A	MR	C	H	H
	B	MR	D	J	I
	C	MR	E	K	J
	D	6	F[d]		K
	E	6	G		L
Rubber tubing and catheters[c]	A	MR	C		
	B	MR	D		
	C	MR	E		
	D	6	F[d]		
	E	6			
Polyethylene tubing and catheters[c,e]	A	MR	C		
	B	MR	D		
	C	MR	E		
	D	6	F[d]		
	E	6			
Lensed instruments	B	MR	C		
	C	MR	D		
	D	6	E		
	E	6			
Thermometers (oral and rectal)[f]				H[f]	
Hinged instruments	A	MR	C		
	B	MR	D		
	C	MR	E		
	D	6			
	E	6			

Modified from Rutala WA: In Wenzel RP, ed. *Prevention and control of nosocomial infections*, Baltimore, 1987, Williams & Wilkins, pp 257-282. And from Simmons BP: *Am J Infect Control* 11:96-15, 1983.

A. Heat sterilization, including steam or hot air (see manufacturer's recommendations).

B. Ethylene oxide gas (see manufacturer's recommendations).

C. Glutaraldehyde-based formulations (2%). (A glutaraldehyde-phenate formulation at full strength also has been shown to sterilize items that are soaked for 6 ¾ hours. Caution should be exercised with all glutaraldehyde formulations when further in-use is anticipated.)
D. Demand-release chlorine dioxide (will corrode aluminum, copper, brass, series 400 stainless steel, and chrome, with prolonged exposure).
E. Stabilized hydrogen peroxide 6% (will corrode copper, zinc, and brass).
F. Wet pasteurization at 75º C for 30 minutes after detergent cleaning.
G. Sodium hypochlorite (1000 ppm available chlorine; will corrode metal instruments).
H. Ethyl or isopropyl alcohol (70% to 90%).
I. Sodium hypochlorite (100 ppm available chlorine).
J. Phenolic germicidal detergent solution (follow product label for use-dilution).
K. Iodophor germicidal detergent solution (follow product label for use-dilution).
L. Quarternary ammonium germicidal detergent solution (follow product label for use-dilution).
MR Manufacturer's recommendations.
[a] See text for discussion of hydrotherapy.
[b] The longer the exposure to a disinfectant, the more likely it is that all microorganisms will be eliminated. Ten minutes' exposure is not adequate to disinfect many objects, especially those which are difficult to clean, because they have narrow channels or other areas that can harbor organic material and bacteria. Twenty minutes exposure may be he minimum time needed to reliably kill *M. tuberculosis* with glutaraldehyde.
[c] Tubing must be completely filled for disinfection; care must be taken to avoid entrapment of air bubbles during immersion.
[d] Pasteurization (washer disinfectior) of respiratory therapy and anesthesia equipment is a recognized alternative to high-level disinfection. Some data challenge the efficacy of some pasteurization units.
[e] Thermostability should be investigate when indicated.
[f] Limited data suggest that at least 20 minutes exposure time is necessary. Do not mix rectal and oral thermometers at any stage of handling or proccessing.

58. According to current guidelines, the maximum acceptable CFU in the dental chair is:

A. 1,000 CFU
B. 500 CFU
C. 200 CFU
D. It varies depending on the agency

Answer: D

The CDC recommends that dental unit water meet the standard set for drinking water, which is a limit of 500 colony forming units of bacteria per milliliter of water.

The American Dental Association (ADA) has proposed that water used in dental treatment contain a bacterial level of ≤200 CFU/ml.

EPA set the standard for potable water at 500 CFU.

Rice EW, Rich WK, Johnson CH, Lye DJ. The role of flushing dental water lines for the removal of microbial contaminants. Public Health Rep. 2006 May-Jun; 121 (3):270-274.

59. If an object moves mesially from a radiographic reference point while the X-ray tube was angled from the mesial then the object is _____ to the reference point

a. buccal
b. lingual
c. on the same vertical plane
d. requires a 90 degree angled radiograph to determine

ANSWER B. Lingual. **S**ame **L**ingual, **O**pposite **B**uccal

There are 2 methods to determine the location of an object in the jaw or jaws.

The first method is when 2 radiographs are exposed at right angles to one another. This technique will provide a Mesial-Distal and a Superior-Inferior location. For example, if a radiopacity is found near the apex of the first molar on a Periapical radiograph, then an occlusal film (90degrees) will identify the mediolateral position.

The 2nd method is used to identify the spatial position of an object; it is called the tube shift technique, buccal object rule, or Clark's rule. All three names imply the same technique. This is easily remembered by thinking of SLOB. **S**ame **L**ingual, **O**pposite **B**uccal

Below is a description of the SLOB rule.

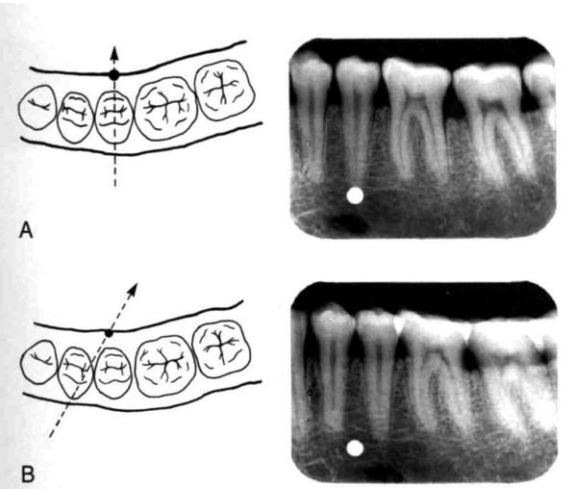


FIG. **4-11** The position of an object may be determined with respect to reference structures with use of the tube shift technique. In **A,** an object on the lingual surface of the mandible may appear apical to the second premolar. When another radiograph is made of this region angulated from the mesial, **B,** the object appears to have moved mesially with respect to the second premolar apex ("same lingual" in the acronym *SLOB*).

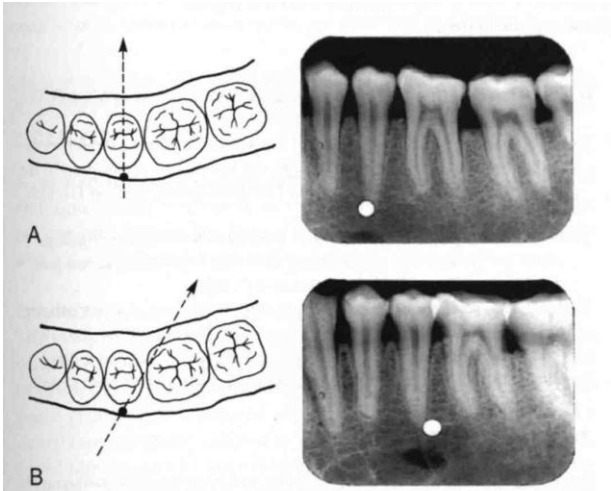


FIG. **4-12** The position of an object can be determined with respect to reference structures with use of the tube shift technique. In **A,** an object on the buccal surface of the mandible may appear apical to the second premolar. When another radiograph is made of this region angulated from the mesial, **B,** the object appears to have moved distally with respect to the second premolar apex ("opposite buccal" in the acronym *SLOB*).

White, Pharoah; Oral Radiology: Principles and Interpretation. 6th edition, 2009, pgs. 50-51

60. In diagnosing condylar neck fractures with suspected medial displacement, panoramic views must be supplemented with a _____.

e. Water's view
f. Towne's view
g. Posterior-Anterior radiograph
h. Lateral Oblique radiograph

Answer: b

The most common difficulty is in determining whether a fracture is indeed present. Panoramic views taken as an initial examination must be supplemented with a Towne's view, especially if there is suspected *medial displacement* of the condylar head.

Reference: Stuart White, Michael Pharoah, "Oral Radiology: principles and interpretation", Sixth edition, 2009.

61. Multiple vertical angulations of the tubehead is suggested to determine the presence of horizontal tooth fractures because.

a. A root fracture is usually oblique (facial to palatal) and one periapical radiograph may easily miss it's presence.
b. It increases the chances of one radiographic beam passing directly through the fracture line to make it visible on the radiograph.
c. A fracture may be missed if the plane of the fracture is not aligned with the direction of the incident x-ray beam on a single-plane image.
d. All of the above
e. None of the above

Answer D.

" Fractures are often erroneously referred to as "lines" in spite of their three-dimentisonal nature. Fractures represent planes of cleavage through a tooth or bone, and these planes extend deep into the tissues. Therefore, a fracture may be missed if the plane of the fracture is not aligned with the direction of the incident x-ray bean on a single-plane image.

The following are general signs that may indicate the presence of a fracture of a tooth or bone.

1. The presence of one or two usually sharply defined radiolucent lines within the anatomic boundaries of a structure. If the line or lines extend beyond the boundaries of the mandible, more than likely they represent an overlapping structure. If a line extends beyond the boundaries of a tooth root, the line may represent a superimposed neurovascular canal.
2. A change in the normal anatomic outline or shape of the structure. A mandible that is noticeably asymmetric between the left and right sides may be fractured. A fracture of the mandible may also be manifest as a change in the contour of the occlusal plane at the location of the fracture site.
3. A loss of continuity of an outer border. This may appear as a gap in the continuity of the otherwise smooth tooth or cortical border. Such a gap may also produce a steptype defect where the two fragment have become displaced relative to one-another.
4. An increase in the radiopacity of a structure. This can be caused by the overlapping of two fragments of tooth or bone such that a particular area appears "doubly" radiopaque.

Reference: Stuart White, Michael Pharoah, "Oral Radiology: principles and interpretation", Sixth edition, 2009.

"Radiographic examination for root fractures is extremely important. Because a root fracture is usually oblique (facial to palatal), one periapical radiograph may easily miss its presence. It is imperative to take at least three angled radiographs (45,90,110 degrees) so that at least at one angulation, the radiograph beam will pass directly through the fracture line to make it visible on the radiograph."

Cohen, Stephen C. Pathways of the Pulp, 9th Edition. C.V. Mosby, 2006. P. 626

62. You just took a radiograph but do not like the contrast. How can you increase contrast and maintain original density?

a. Decrease the original kVp by 15 kVp; Use 2 times the original exposure time.
b. Increase the original kVp by 15 kVp; Use one half the original exposure time.
c. Decrease the original kVp by 15 kVp; Use one half the original exposure time.
d. Increase the original kVp by 15 kVp; Use 2 times the original exposure time.

ANSWER: **A**. Decrease the original kVp by 15 kVp; Use 2 times the original exposure time.

The contrast of a radiographic image can be defined as the number of shades of gray between the extremes of black and white. A higher kVp beam (75 to 90 kVp) will produce an image with more shades of gray between black and white than a lower kVp beam (60 to 75 kVp). More shades of gray between black and white result in a gradual transition from the one extreme to the other, and this is referred to as *low contrast*, or *long-scale contrast.* When there are just a few shades of gray between black and white, this is known as *high contrast,* or *short-scale contrast.* A black and white checkered flag is an example of maximum high contrast or short-scale contrast.

Although kVp exerts its major influence on contrast, density is also affected. A higher energy beam will penetrate the patient more completely and darken the image more than a lower energy beam. When it becomes necessary to alter contrast and maintain the original density of the image, exposure time must be adjusted to compensate for the change in penetrating ability of the beam at the new kVp setting. The following rules can be applied:

To increase contrast and maintain original density:
(1) Decrease the original kVp by 15 kVp
(2) Use 2 times the original exposure time.

To decrease contrast and maintain original density:
(1) Increase the original kVp by 15 kVp
(2) Use one half the original exposure time.

Razmus, Thomas F. Current Oral and Maxillofacial Imaging. W.B. Saunders Company, 1996.

63. What is the approximate amount of image distortion when taking a panorex?

A. No distortion
B. 25%
C. 45%
D. 65%

Answer: B. 25%

The horizontal angulation varies in the horizontal dimension and is affected by the patient's head position. To correct for panorex distortion when measuring anatomical structures, place a round ball of known size in the area of the mental foramen and use the following formula to figure out the discrepancy:

(Ball A/Ball B) x measured bone = actual height of bone,
Where Ball A = actual height of ball and Ball B = radiographic ball measurement

Periapicals have a 1:1 if proper angulation and film position are used.

64. Ghost images on panos have characteristics that help distinguish it and determine where it came from. All of the following characteristics are correct except:

a. Located contralateral to the real image
b. Projected lower on the film than the real image
c. Larger and less defined than real images
d. Blurred in the vertical plane and elongated in the horizontal plane

ANSWER: B. Projected lower on the film than the real image

Ghost images are produced of anatomy and objects located between the center of rotation and the x-ray source. Ghost images are not real; they are a "shadow" of real anatomy and objects and may be distinguished by the following characteristics:

- Located contralateral to the real image.
- Projected higher on the film than the real image.
- Larger and less defined than real images.
- Blurred in the vertical plane and elongated in the horizontal plane.

Examples of anatomy and objects that produce ghost images include earrings, hearing aids, the hard palate, and the "R" and "L" film markers depicting the patient's right and left side. Occasionally, impacted mandibular third molars produce ghost images.

Legg L. Panoramic radiography. Radiographic Technology, Jan-Feb, 2005

65. When the chin is rotated downward, the resulting panorex will demonstrate

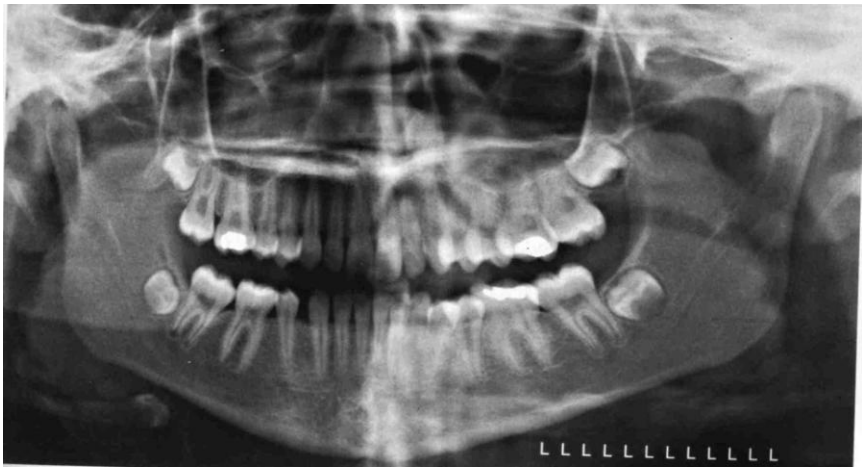
a. absence of the symphyseal region
b. an opaque shadow obscuring roots of the maxillary teeth
c. a “spine-shadow-ghost” radiopaque region in the middle
d. relative magnification of the molar teeth

ANSWER a. See below – **Oral Radiology;** White S, Pharoah M, 6th edition, 2009 pgs 179-183

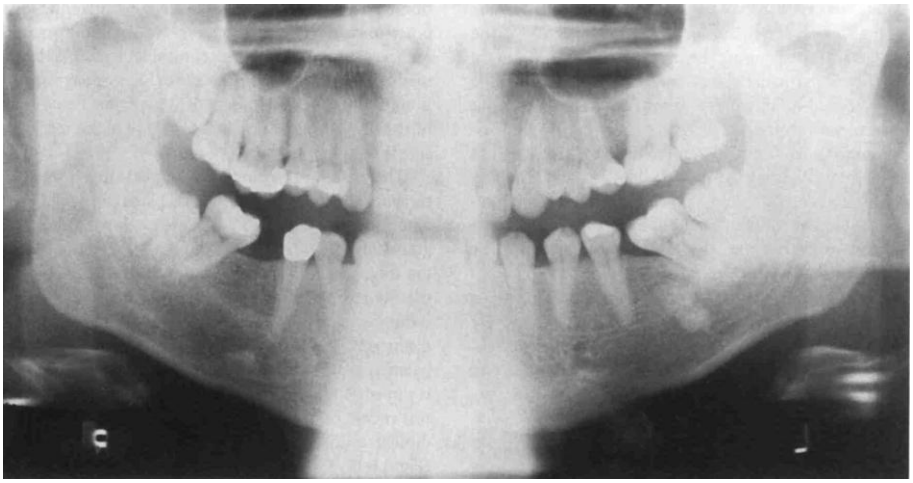
1. The chin and occlusal plane are rotated downward, cutting off the symphyseal region on the radiograph and distorting the anterior teeth

2. The chin and occlusal plane are rotated upward, resulting in overlapping images of the teeth and an opaque shadow (the hard palate) obscuring the roots of the maxillary teeth.

3. head rotation error. Sagittal plane. The patients head was rotated to the left, moving the right side closer to the receptor. Note the magnification of the left molars, ramus, condyle and severe overlap of the posterior teeth.



4. Improper neck extension – allowing the patient to slump their heads and necks forward causes a large opaque artifact in the midline created by superimposition of an increased mass of cervical spine (spine-shadow ghost)



66. A positive HBsAg lab test may be indicative of all of the following except:

a. An acute infection
b. Past infection
c. A chronic infection
d. Transient, up to 18 days after vaccination

Answer: b

Vaccines are available for both HAV and HBV. Twinrix is a combination vaccine for HAV and HBV. There are two HBV vaccines licensed (Engerix-B and Recombivax), which are produced by recombinant DNA technology.

Reference: J. W. Little et al, "Dental management of the medically compromised patient", sixth edition

Interpretation of serologic test results for hepatitis B virus infection

Serologic Marker				***Interpretation***
HBsAg	**Total anti-HBc**	**IgM anti-HBc**	**Anti-Hbs**	
–	–	–	–	Never infected
+	–	–	–	• Early acute infection • Transient (up to 18 days) after vaccination
+	+	+	–	Acute infection
–	+	+	+ / –	Acute resolving infection
–	+	–	+	Recovered from past infection and immune

Serologic Marker				*Interpretation*
HBsAg	**Total anti-HBc**	**IgM anti-HBc**	**Anti-Hbs**	
+	+	–	–	Chronic infection
–	+	–	–	• False + (susceptible) • Past infection

Reference: CDC. MMWR Recommendation Rep. 2006; 55(RR-16):1–25.

67. Which of the following statements is correct regarding Hepatitis?

a. Hepatitis A and E are DNA viruses and also known as "infectious hepatitis"
b. Hepatitis B is a DNA virus and has a long incubation period of 6 weeks to 6 months
c. Hepatits A, E, and F are associated with chronic infections
d. Hepatitis A is an RNA virus and causes a high mortality rate in pregnant women

Answer B

www.cdc.gov/**hepatitis**

ww.nlm.nih.gov/medlineplus/**hepatitis**.html (Viral Hepatitis: A through E and Beyond)

	HAV	**HBV**	**HCV**	**HDV**	**HEV**	**HFV**	**HGV**	**TTV**
Genome	RNA	DNA	RNA	RNA	RNA	RNA	RNA	DNA
Enveloped	no	yes	yes	yes	no	no	yes	no
Route of infection	Fecal/ oral	parenteral	parenteral	parenteral	Fecal/oral	Fecal/oral	parenteral	transfusion
Onset	rapid	slow	slow	rapid	rapid	rapid	?	?
Incubation	28d	6w-6m	14-180d	15-64d	15-60d	?	?	?
Symptoms % patients	Low%	50%	25%	10%	Low%, 50% pregnancy	?	?	?
Chronic infections/ carriers	none	5-10%	60-80%	5%	none	none	?	?
Mortality	0.4%	2%	~4%	1% from co-infections, 10-20%, from super-infection of HBV patients	4%, 20% pregnancy	high	? low	high
Vaccine	Yes	yes	no	yes	no	no	no	no

68. When should Dental Health Care Personnel, who have received the 3 dose Hepatitis B vaccine, be tested to determine their HBsAg titer?

a. 4-6 months
b. 1-2 months
c. 4-6 weeks
d. 1-2 weeks

ANSWER: B. 1-2 months

Prevaccination serological testing for previous infection is not indicated, although it can be cost-effective where prevalence of infection is expected to be high in a group of potential vacinees (e.g., persons who have emigrated from areas with high rates of HBV infection). DHCP should be tested for anti-HBs 1–2 months after completion of the 3-dose vaccination series (17). DHCP who do not develop an adequate antibody response (i.e., anti-HBs <10 mIU/mL) to the primary vaccine series should complete a second 3-dose vaccine series or be evaluated to determine if they are HBsAg-positive (17).

Revaccinated persons should be retested for anti-HBs at the completion of the second vaccine series. Approximately half of nonresponders to the primary series will respond to a second 3-dose series. If no antibody response occurs after the second series, testing for HBsAg should be performed (17). Persons who prove to be HBsAg-positive should be counseled regarding how to prevent HBV transmission to others and regarding the need for medical evaluation. Nonresponders to vaccination who are HBsAg-negative should be considered susceptible to HBV infection and should be counseled regarding precautions to prevent HBV infection and the need to obtain HBIG prophylaxis for any known or probable parenteral exposure to HBsAg-positive blood.

Vaccine-induced antibodies decline gradually over time, and 60% of persons who initially respond to vaccination will lose detectable antibodies over 12 years. Even so, immunity continues to prevent clinical disease or detectable viral infection (17). Booster doses of vaccine and periodic serologic testing to monitor antibody concentrations after completion of the vaccine series are not necessary for vaccine responders (17).

Guidelines for Infection Control on Dental Health Care Settings. 66 MMWR December 19, 2003, (52/RR-17); 11.

69. The following are examples of solid-state detectors used in digital radiography except:

A. Charge-coupled device (CCD)
B. Complementary metal oxide semiconductors (CMOS)
C. Flat panel detectors
D. Photostimulable phosphor plates (PSP plates)
E. All are examples of solid-state detectors

Answer: D. PSP plates

Digital image consists of collection of pixels organized in a matrix of rows & columns. At each pixel of an electronic detector, the absorption of x-rays generates a small voltage. More x-rays generate a higher voltage. At each pixel, the voltage can fluctuate b/w a minimum and maximum value and is therefore an analog signal.

Production of a digital image requires a process called *analog-to-digital conversion* (ADC). ADC consists of 2 steps: sampling & quantization. *Sampling* means that a small range of voltage values are grouped together as a single value. Narrow sampling better mimics the original signal but leads to larger memory requirements for the resulting digital image. Once sampled the image is *quantized*, which means that every sampled signal is assigned a value. The values are stored in the computer & represent the image. For the clinician to see the image, the

computer organizes the pixels in their proper locations and displays a shade of gray that corresponds to the number that was assigned during the quantization step.

Solid-state detectors collect the charge generated by x-rays in a solid semiconducting material. The CCD was the first digital image receptor to be adapted for intraoral imaging. The CCD uses a thin wafer of silicon as the basis for image recording. The silicon crystals are formed in a picture element (pixel) matrix. When exposed to radiation, the covalent bonds between the silicon atoms are broken, producing electron-hole pairs. The number of electron-hole pairs formed is proportional to the amount of exposure that an area receives. Electrons are then attracted toward the most positive potential in the device, where they create "charge packets". Each packet corresponds to one pixel. The charge pattern formed from the individual pixels in the matrix represents the latent image. Image is read by transferring each row of pixel charges from one pixel to the next in a "bucket brigade" fashion. As a charge reaches the end of its row, it is transferred to a readout amplifier and transmitted as a voltage to the analog-to-digital converter located within or connected to the computer. Voltages from each pixel are sampled and assigned a numeric value representing a gray level (ADC). Because CCD detectors are more sensitive to light than to x-rays, most manufacturers use a layer of scintillating material coated directly on the CCD surface or coupled to the surface by fiberoptics. This increases the x-ray absorption efficiency of the detector.

70. Advantages of magnetic resonance imaging versus computed tomography include all of the following except:

a. It is invasive
b. It requires no ionizing radiation for image acquisition
c. It permits a direct visualization of the disk and joint structures
d. Multiplanar imaging is readily obtained and more easily interpretable

ANSWER **A.** It is invasive

MR imagining with surface coils is a proven method for the assessment of internal derangements of the TMJ and is rapidly surpassing orthography and CT as the imaging method of choice. The major advantages of MR in comparison with arthography and CT are: a) it is noninvasive, b) it requires no ionizing radiation for image acquisition, c) it permits a direct visualization of the disk and joint structures, and d) multiplanar imaging is readily obtained and more easily interpretable.

Katzberg RW. Temporomandibular joint imaging. Anesth Prog. 1990 Mar-Jun; 37(2-3): 121-126.

71. What is the imaging technique of choice for ascertaining soft tissues of the TMJ?

a. Conventional CT
b. Cone beam CT
c. MRI
d. Arthrography

ANSWER **C.** MRI – MRI is the image of choice when viewing soft tissues of the TMJ.

Panoramic Projection - provides a means of comparing left and right sides of the mandible and serves as a screening projection. Some panoramic machines have TMJ programs, but these are of limited usefulness because of thick image layers and the oblique, distorted view of the image they provide.

PLAIN FILM Imaging Modalities, combination of transcranial, transpharyngeal, transorbital, and submentovertex (COPS); allows visualization of the TMJs in various planes. Transcranial (open and closed mouth position) and transpharyngeal (mouth open only) projections provide lateral views. Transcranial depicts lateral the lateral view and transpharyngeal depicts the medial view. The transorbital projection is taken from the open or protruded position and depicts the entire medial-lateral aspect of the condyle in the frontal plane and is very useful in detecting condylar neck fractures. A submentovertex projection provides the base of the skull view in the horizontal plane. All of these techniques are gradually being replaced by Cone-beam CT

Conventional CT – Osseous structures and surrounding soft tissue. Soft tissue exposure with Conventional CT is only used in very limited situations and is a high dose in ionizing radiation– typically exposed in the sagittal plane. Provides information in a 3-D view. Conventional CT is being replaced by CBCT as the imaging technique of choice for assessing osseous structures of the TMJ

Arthrography – an indirect image of the disk is obtained by injecting a radioopaue contrast agent into the joint under fluoroscopic guidance. **MRI has replaced arthrography and is now the imaging technique of choice for the soft tissue of the TMJ. MRI can not only display the articular disk but also the surrounding soft tissue structures and also can reveal the presence of joint effusion.** MRI displays the osseous structures of the TMJ but not in comparable detail seen in CT and CBCT. MRI does not use ionizing radiation.

White S.C., Pharoah M.J., Oral Radiology; principles and interpretation; 2009 pgs 473-480