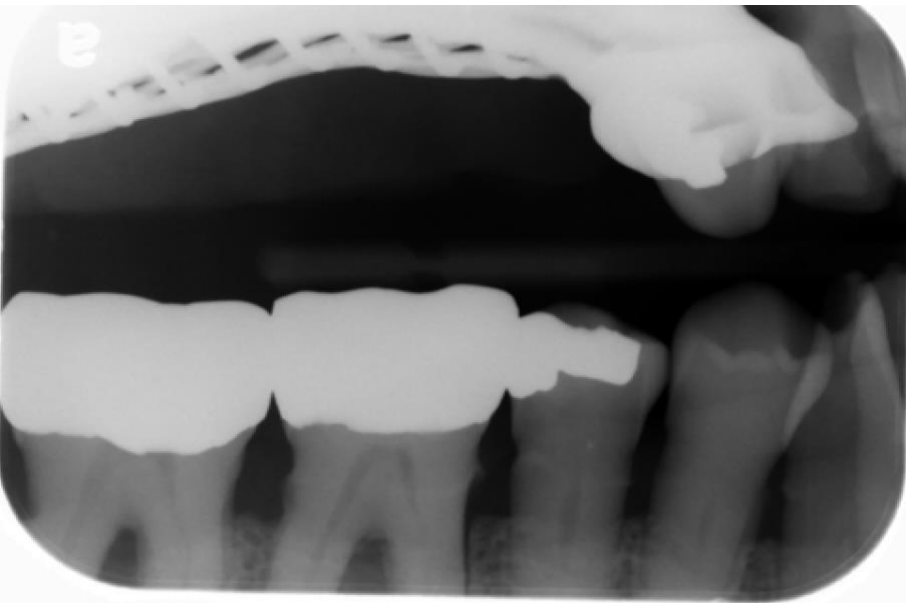


RADIOGRAPHIC ERRORS AND ARTIFACTS



The ideal radiograph is the one which shows:

1. Optimum density
2. Optimum contrast
3. Accurate
4. Covers the area of interest completely

When any of the above conditions are not satisfied it may be termed as the faulty radiographs.

Visual characteristics:

Two visual characteristics of the radiographic image.

1. Density
 2. Contrast
- Directly influence the diagnostic quality of a dental radiograph.

DENSITY

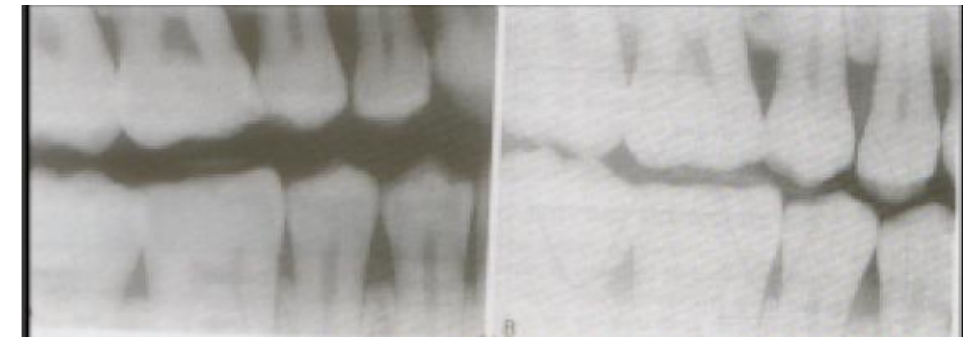
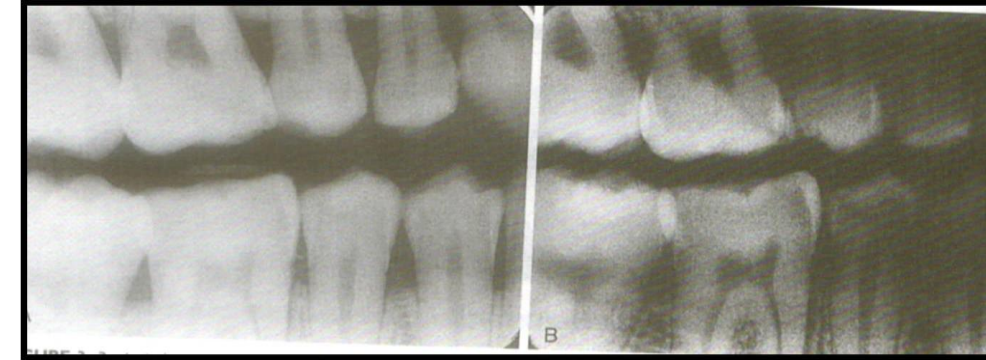
The overall blackness or darkness of a dental radiograph is termed as Density.

Increase in kV-increase in density- film appears dark

Decrease in kV-decrease in density-film appears lighter

Contrast

The difference in the degree of blackness (densities) between adjacent areas on a dental radiograph is termed **Contrast**.



HIGH QUALITY RADIOGRAPH:

Every dental professional would like to achieve the goal of producing consistent, quality intraoral radiographs.

A quality intraoral radiograph will reveal maximum image detail with anatomic accuracy and optimal density and contrast, providing the highest diagnostic yield.

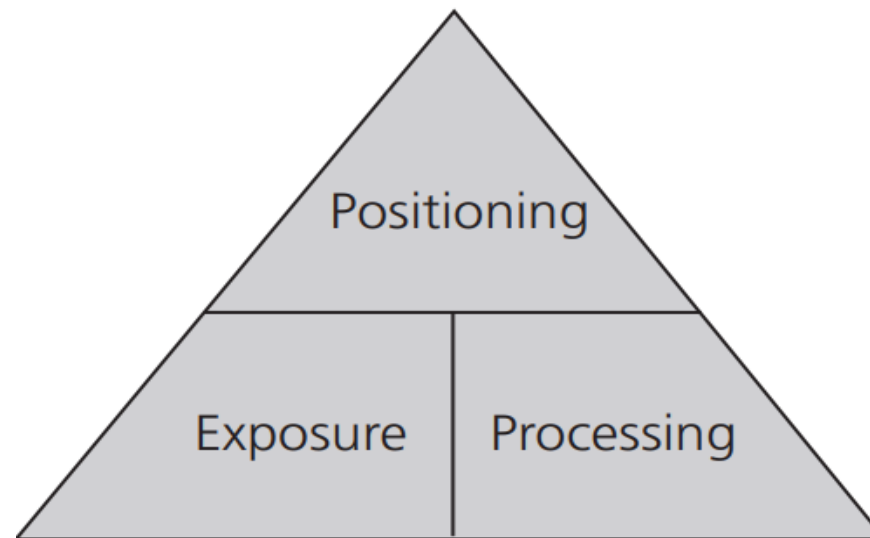
The goal of all radiography should be to produce a high quality radiograph. Such a radiograph will exhibit maximum detail to resolve fine objects.

It will show the teeth and anatomic structures accurately without distortion or magnification. It will have the optimal density and contrast (visual characteristics) to maximize its use for the detection of dental disease.

To create such a film, the dental staff must pay attention to all three steps in the production of the radiograph including:

positioning, exposure and **processing.**

Three steps In producing a quality radiograph



Quality Evaluation Criteria

1-All radiographs must have acceptable images (details, definition, density & contrast).

2-All crowns and roots including apices are fully depicted together with interproximal alveolar crests, tooth contact areas, and surrounding apical bone regions.

3-Images of all teeth and other structures are shown in proper relative size and contour with minimal distortion and without overlapping images, where anatomically possible.

4-The radiograph is free from film handling and processing errors.

5-Retake will lead to:

A-Expose the patient to unnecessary radiation.

B-Waste film & time (money).

C-Interfere with accurate interpretation and diagnosis.

Proper patient preparation is one of the important factors in the production of good-quality film .

Patients should be removed of metal, partials or complete dentures, or any metal or plastic objects in the Orofacial region

Causes of faulty radiograph:

The majority of the errors produced can be categorized into three groups:

I-Technique & Projection errors. II- Exposure errors. III-Processing errors.

I. Technique & Projection errors:

A-Patient preparation errors:•Radiopaque artifact •Blurred image •Pressure mark

B-Film placement errors: • Dot artifact, •Crown not shown, •Area of interest not shown •Distortion •Apices cut off ,•Dropped film corner,•Black line

A-Patient Preparation Errors:

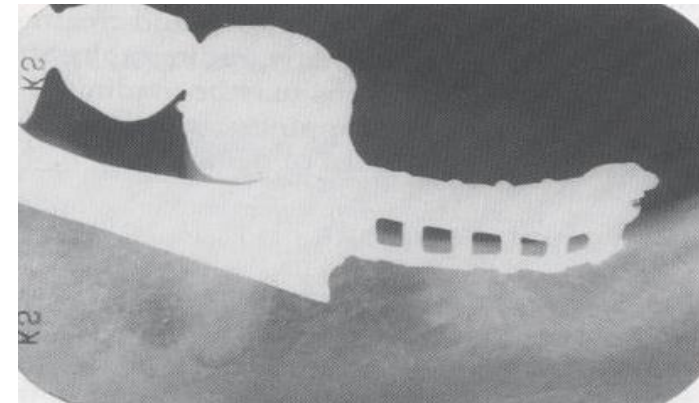
1.Radiopaque artifact

Appearance: as radiopaque artifact superimposed over the dental image.

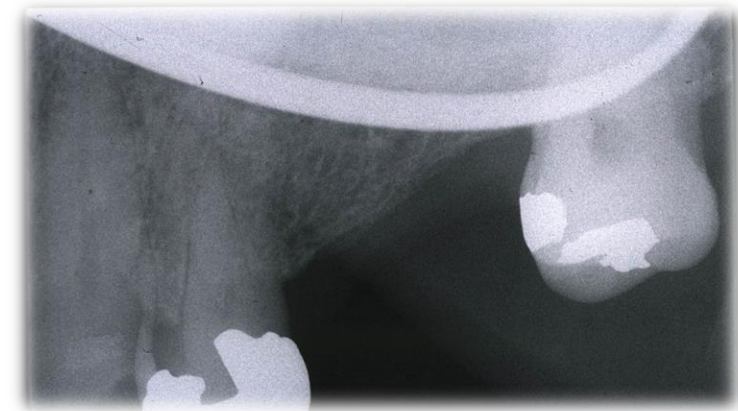
Cause : Dental appliances left in the mouth during exposure, jewelry & eye glasses.

Correction : all this items should be removed before placing of the film.

metal partial denture



denture left in the mouth



eye glasses



Technique & Projection errors

A. Patient preparation error :

Blurred image

Cause: Movement of the film, patient or X-ray tube head during exposure will result in a blurred image.

Correction: the operator should explain to the patient & remind him/her to remain motionless during radiological exposure.

Pressure mark : Pressure from the incisal edge & cusps of the teeth (mostly in the pediatric occlusal radiograph). May appear black or white. **Correction:** ask the patient to bite gently.

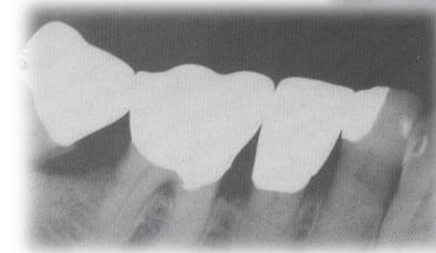
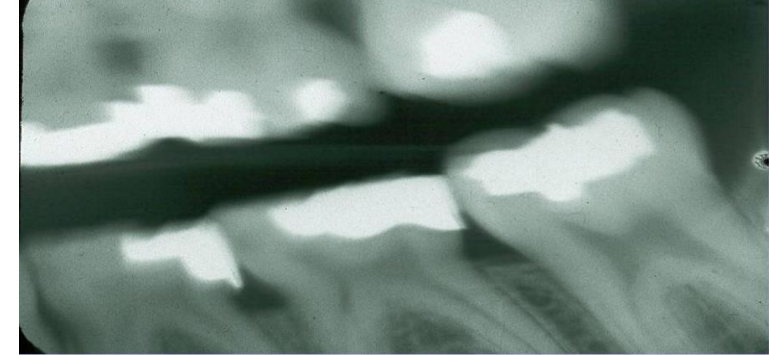
B. Film Placement Error.

1. Apices Cut-off.

Appearance: Absence of apical structures & no apices appear on the film.

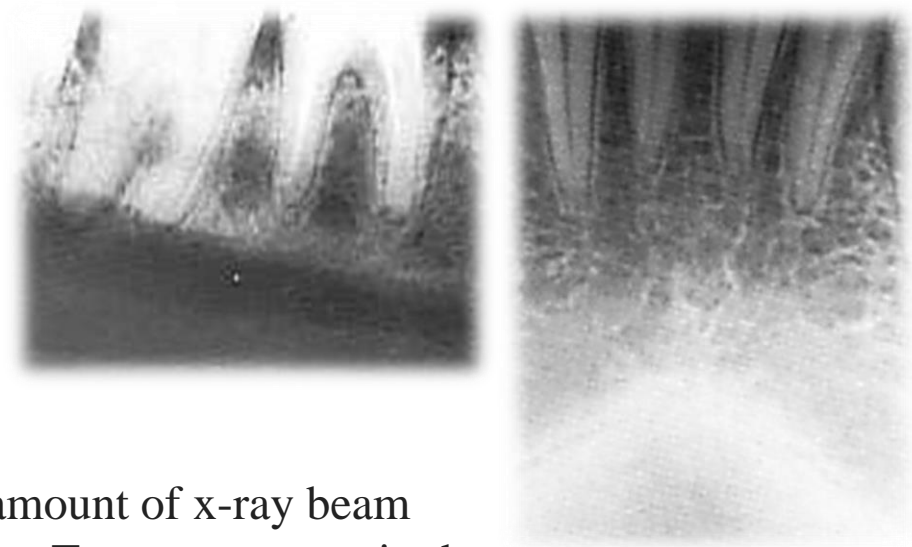
Cause: Insufficient vertical angulation. The film is not positioned in the patients mouth to cover the apical regions of the teeth.

Correction: make sure that no more than 1/8 inch of the film edge extend beyond the incisal -occlusal surfaces of the teeth such film placement ensure adequate coverage of the tooth apices.



2. The crowns of teeth not shown

There is not enough film extending occlusally.



3. Reversed film

Reversed film refers to a film exposed from opposite side. It is the decrease in the amount of x-ray beam exposing the film. This results in light images with herringbone or Tyre track or car – Tyre appearance in the radiograph. This pattern is due to the embossed pattern in lead foil at which the x-ray beam is exposed.

Cause: If the Film is placed in the mouth reversed and then exposed, the x-ray beam gets attenuated by the lead foil backing in the film pack

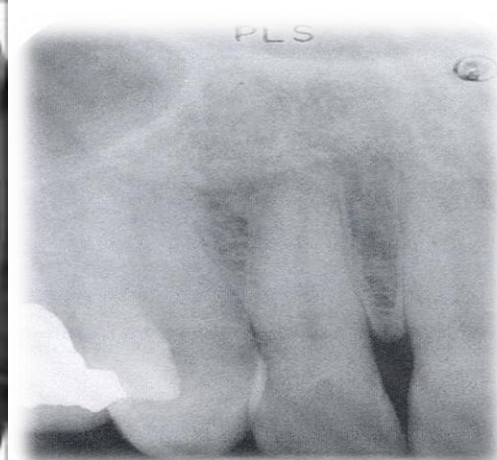
Correction: always place the white side of the film adjacent to the teeth.



Techniques Artifacts

4. Dot Artifact.

Dot produce a circular radiolucent artifact on the final radiograph

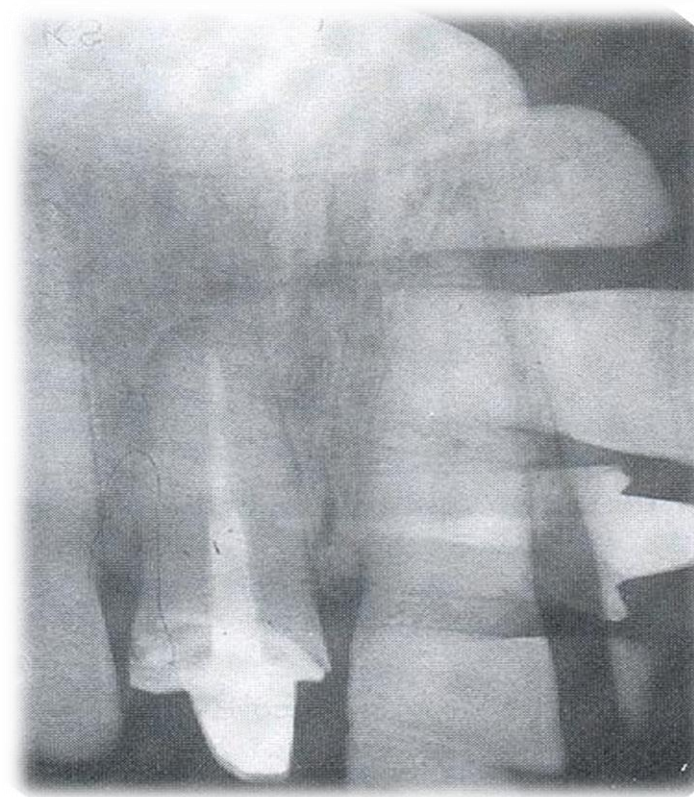


Double Image

Appearance: a double image appear on the film.

Cause: the film is exposed twice.

Correction: separate exposed and unexposed films.



Techniques Artifacts

Tongue or Finger Artifact.

Cause: Phalangioma occurs when the patient holds the film in the mouth in an incorrect way which results in exposing the image of **fingers** on the film.



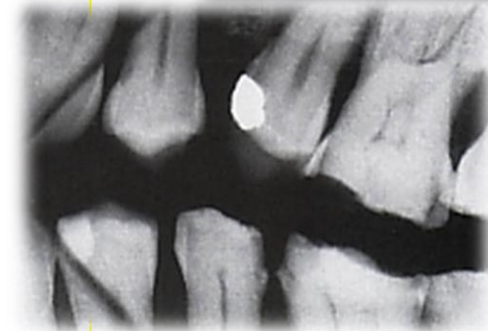
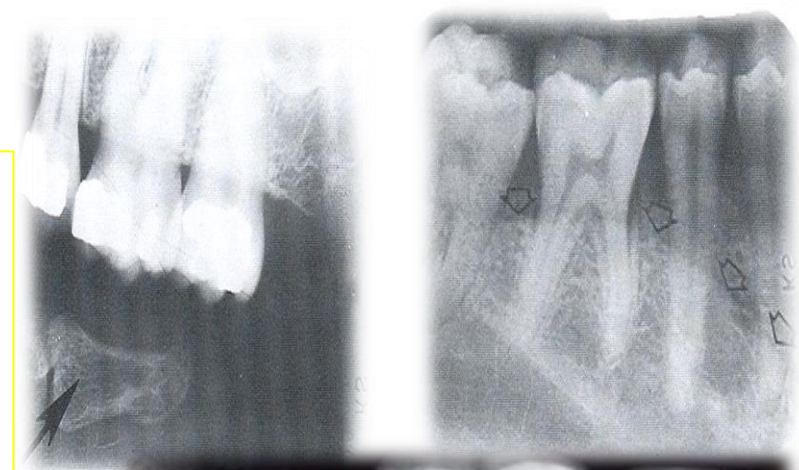
Dropped film corner

The film edge is not placed parallel to the occlusal surface of the teeth.

Area of interest not shown

This is the result of not placing the film to cover all the teeth in the area of interest and not centralizing the film over the area of interest. Black line

Due to excessive bending of the film prior to its placement inside the patient's mouth (pressure causes ionization of silver halide upon processing will be darker).



Techniques Artifacts

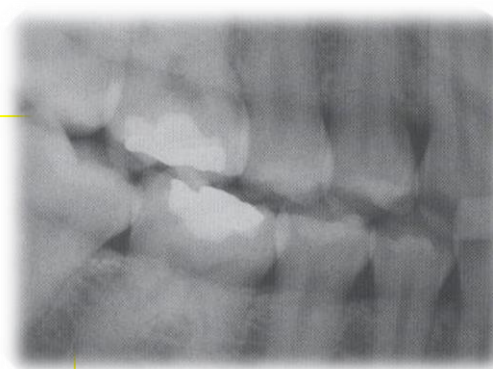
Overlapping Errors.

Incorrect horizontal angulation

Appearance: overlapped contacts appear on the film.

Cause: the central ray is not directed through the interproximal spaces. As a result the proximal surfaces of adjacent teeth appear overlapped in the periapical film and this prevent the examination of interproximal areas this error occurs with both the paralleling and bisecting techniques.

Correction: direct the x-ray beam through the inter proximal regions.



Shape Distortion Errors. Shortening

Appearance: short teeth with blunted roots appear on the film.

Cause: The vertical angulation is excessive. This error occurs with the bisecting techniques

Correction: prevent excessive vertical angulation with the

Elongation

Appearance: long distorted teeth appear on the film.

Cause: the vertical angulation is insufficient (decrease) therefore the image appears longer than the actual teeth. This error occurs with the bisecting technique

Correction: use adequate vertical angulation with the bisecting technique.

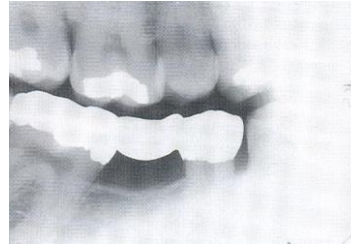


Film bending

Appearance: images appear stretched and distorted.

Cause: the film is bended excessively owing to the curvature of the hard palate or heavy finger pressure on the film.

Correction: check the film placement before exposure, instruct the patient to stabilize the film gently, in case of curvature of hard palate cotton rolls can be used also film holding device is helpful in preventing film bending .



Cone-cut

Appearance: as a clear area with curved outline .

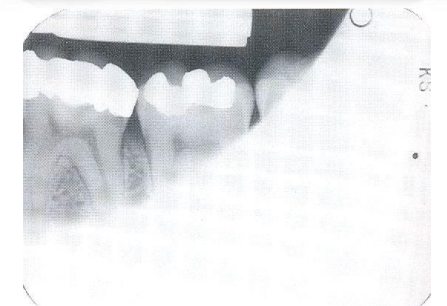
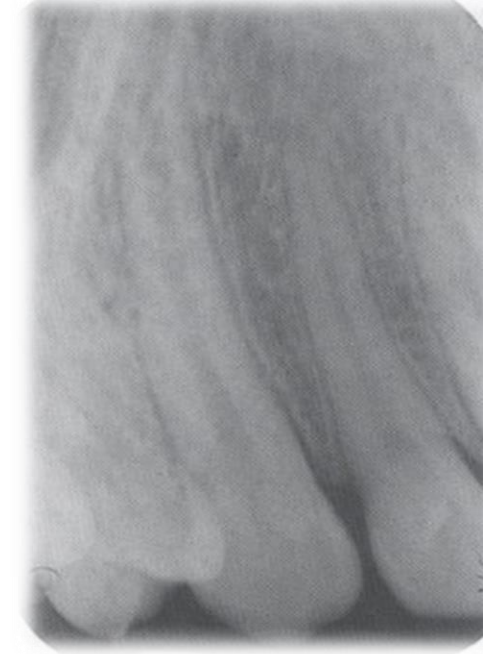
Cause: If the PID (Positioning-Indicating Device)is misaligned and the x-ray is not centered over the film, a partial image is seen on the resultant radiograph, this partial image is called **cone-cut**

Exposure Artifacts

A. Film exposure Errors

1.Blank Image: a film that has receive no radiation will have no image & will appear clear film, due to:

- The x-ray machine is not turned on.
- The operator had completely failed to align the x-ray PID with the film.
- The operator may not press the timer button properly to activate the exposure.
- The film not exposed at all, while another is used twice & produce double image.



Exposure Artifacts

2.Film Exposed to Light

Appearance: the film appears black.

Cause: the film accidentally exposed to white light.

Correction: -Do not unwrap the film in a room with white light .

-Check the dark room for possible light leaks .

-Use safe light only during processing.



B.Time and Exposure Factor Problems

1.Over exposed film

Appearance: the film appears dark.

Cause: excessive exposure time ,KvP ,mA ,or a combination of these factors

Correction: check the exposure time ,KvP, mA ,settings on the x-ray machine before exposing the film.

2.Under exposed film

Appearance: the film appears light.

Cause: inadequate exposure time ,KvP, mA ,or a combination of these factors.

Correction: check the exposure time, KvP, mA, settings on the x-ray machine before exposing the film.

Processing Artifacts

- Processing Artifacts
- Time and temperature errors.
- Chemical contamination errors.
- Film handling errors.

Lighting errors.

A. Time and temperature

1. Under developed film

Appearance: the film appears light (faint).

Cause:

- Inadequate developing time.
- Inaccurate timer.
- Low developer temperature.
- Inaccurate thermometer.
- Depleted or contaminated developer solution.



Processing Artifacts

2.Over developed film

Appearance: the film appears dark.

Cause:

- Excess developing time.
- Inaccurate timer.
- High developer temperature.
- Inaccurate thermometer.

Concentrated developer solution.

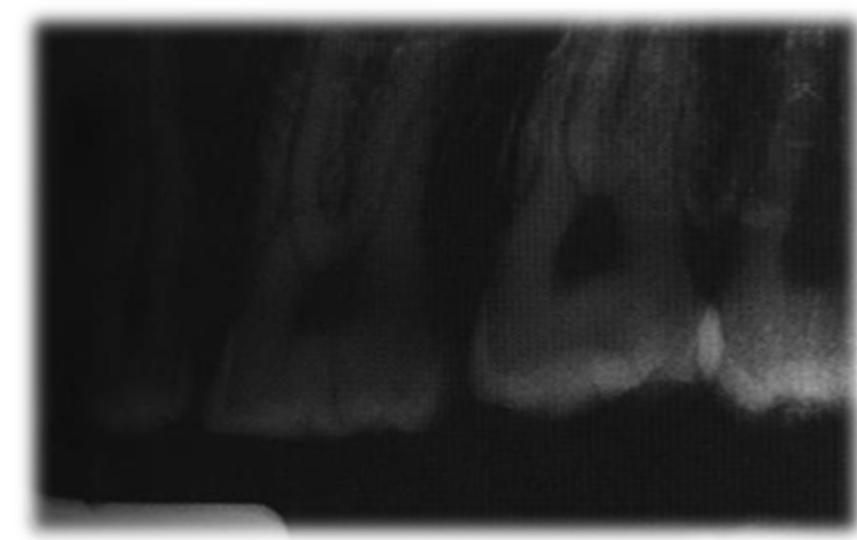
3.Reticulation of emulsion

Appearance: the film appears cracked.

Cause: the film is subjected to a sudden temperature change between the developer and water bath.

Correction: check the temperature of the processing solutions and water .bath

Avoid drastic temperature differences between the developer and water bath.



B. Chemical contamination

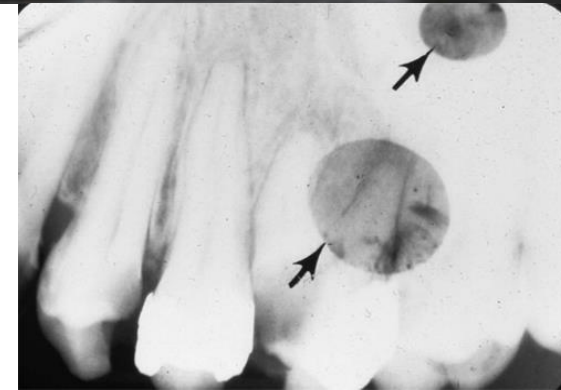
1. Developer spots

Appearance: dark spots appear on the film.

Cause: developer solution comes in contact with the film before processing.

Correction: use clean work area in the dark room.

To ensure clean working surface ,place a paper towel on the work area before unwrapping films



2. Yellow-brown stains

Appearance: the film appear yellowish-brown.

Cause: 1.exhausted developer or fixer.

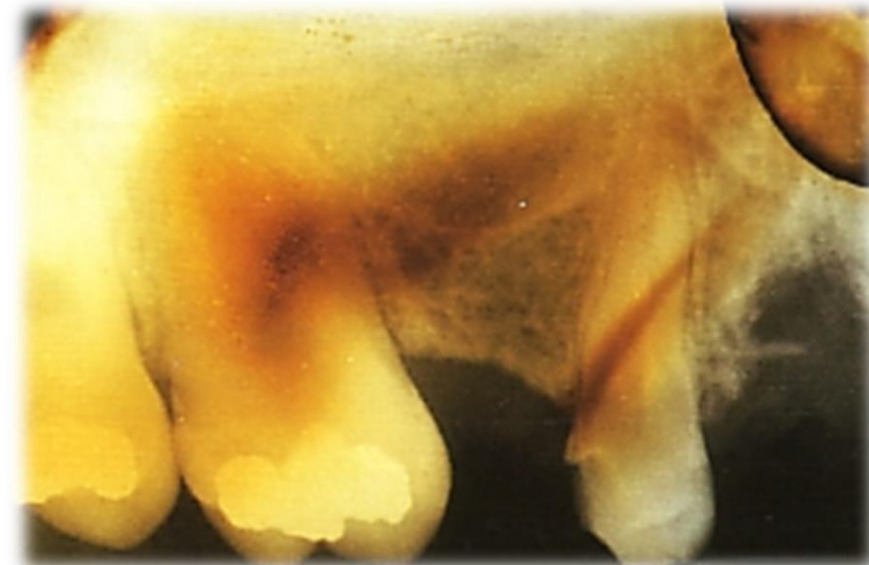
2.Insufficient fixation time.

3.Insufficient rinsing.

Correction: replace depleted developer and fixer solutions with fresh one.

Make sure that the film have adequate fixation and rinsing time.

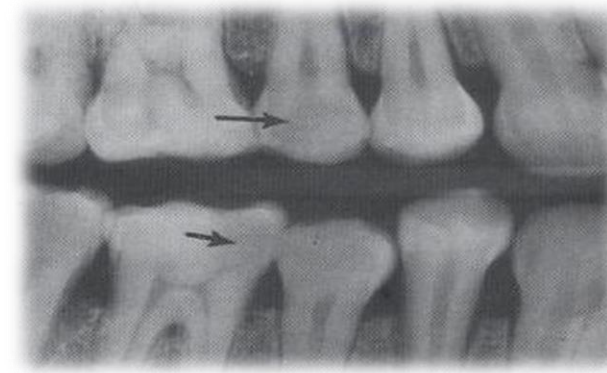
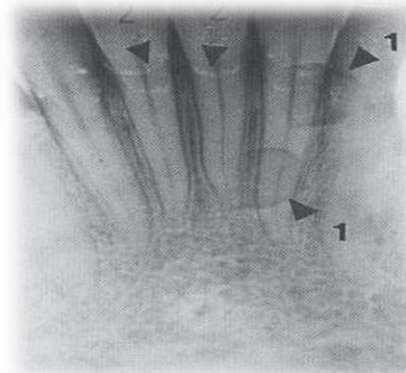
Rinse processed film for 20 m in circulating cold water.



Processing Artifacts

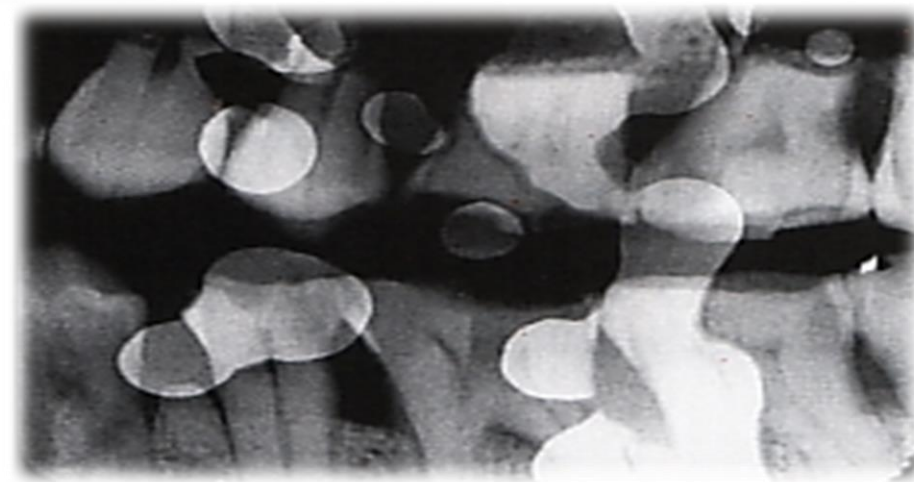
3. Deposits on the film:

Chemical precipitants that adhere to the film due to contamination, improperly prepared, or exhausted solutions, unclean film hanger clips.



4. Fixer spots

- Appearance: white spots appear on the film.
- Cause: fixer solution come in contact with the film before processing.
- Correction: use clean work area in the dark room.
- Place a paper towel on the work area before unwrapping films.



Film Handling Artifacts

A. Pressure Marks

1-Finger print impression

1.Fingerprint artifact

Appearance: black fingerprint appears on the film.

Cause: the film is touched by fingers contaminated with developer.

Correction: wash and dry hands before processing films.

Work in a clean area.

Handle the film by the edges only.

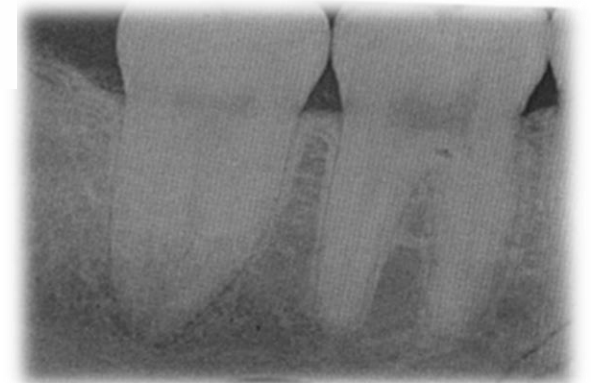
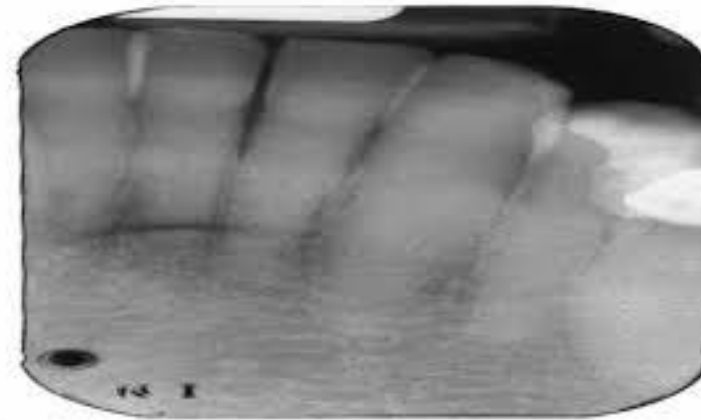
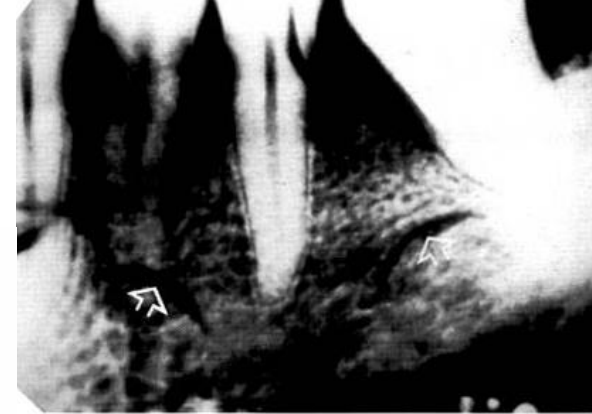
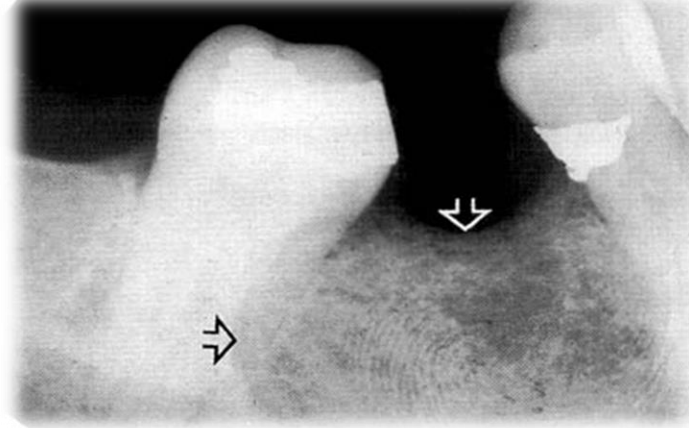
2.Finger nail marks

2.Fingernail artifact

Appearance: black crescent-shaped marks appear on the film.

Cause:the film emulsion is damaged by the operators finger nail during rough handling of the film.

Correction: gently handle the film by the edges only.



•3.Bend Marks. (black line marks)

- Film creasing

- Appearance: a thin radiolucent line appears on the film.

- Cause: the film is creased and the film emulsion cracked .

- Correction: do not bend or crease the film excessively instead gently soften the corners of the film before placing in the patients mouth.



4.Static electricity

- Appearance: thin, black branching lines appear on the film.

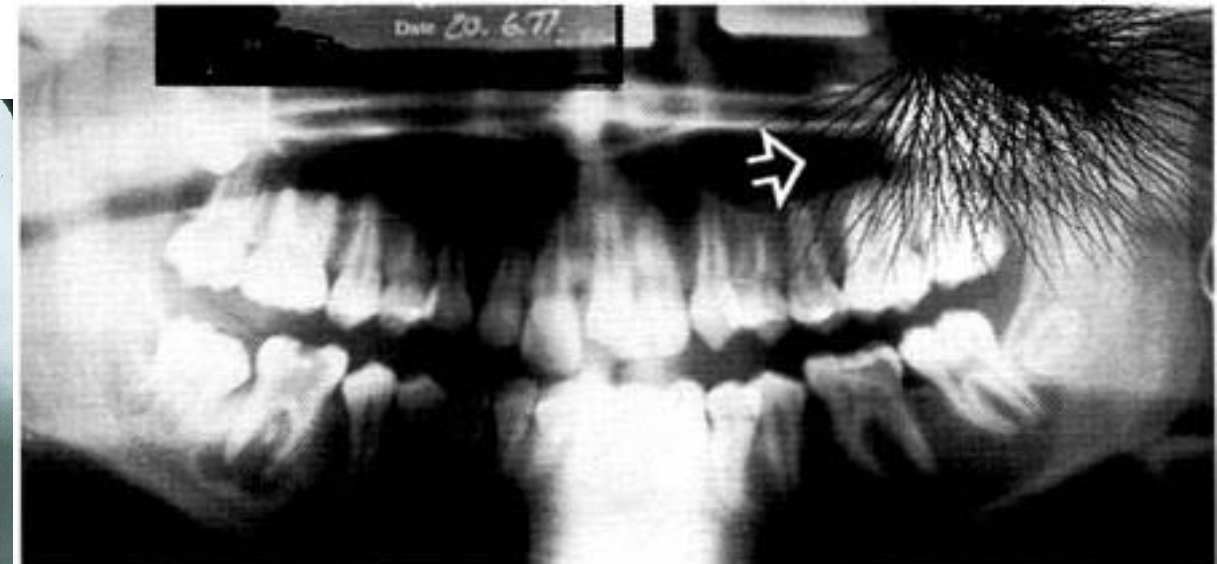
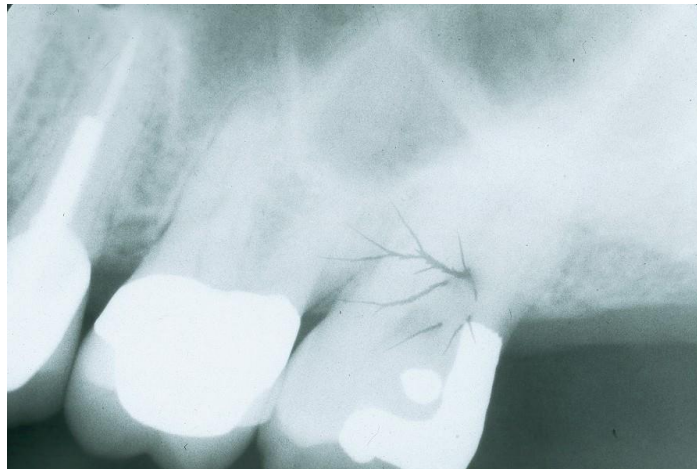
- Cause: opening a film packet quickly.

- Opening a film packet before touching another object such as the film processor.

- It occurs most frequently during period of low humidity.

- Correction: open film packets slowly.

- Touch a conductive object before unwrapping films.



5. Film Fog:

Appears as a dull-gray low contrast image due to:

- Use of out dated film.
- Improper film storage.
- Radiation before & after exposure.
- Improper safelight condition.
- Higher developing solution temperature.

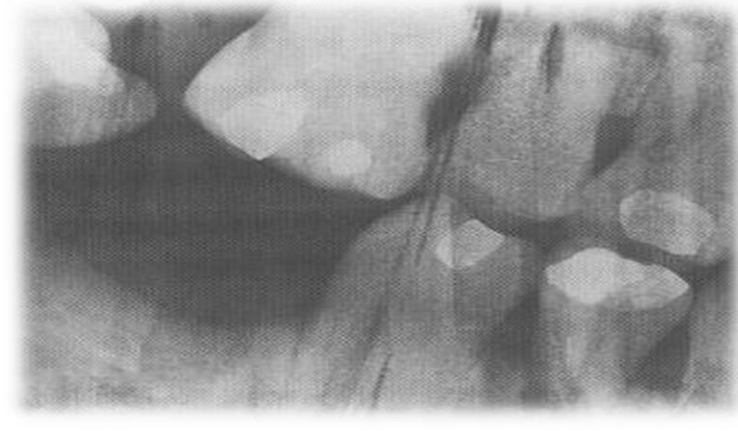
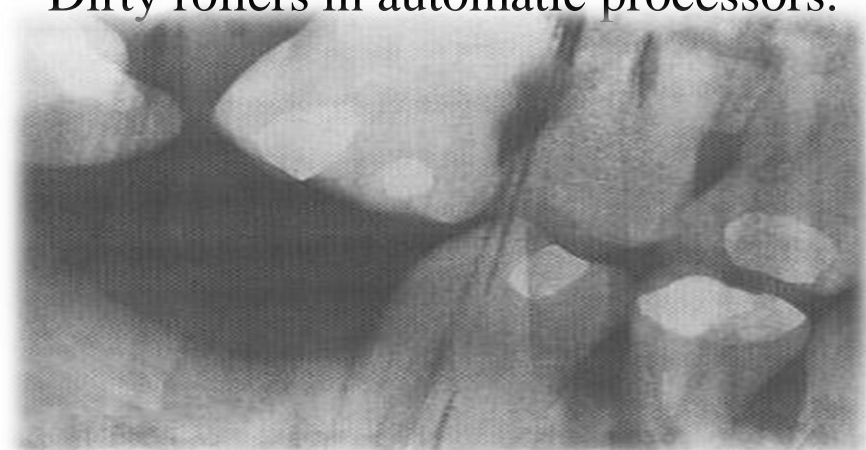
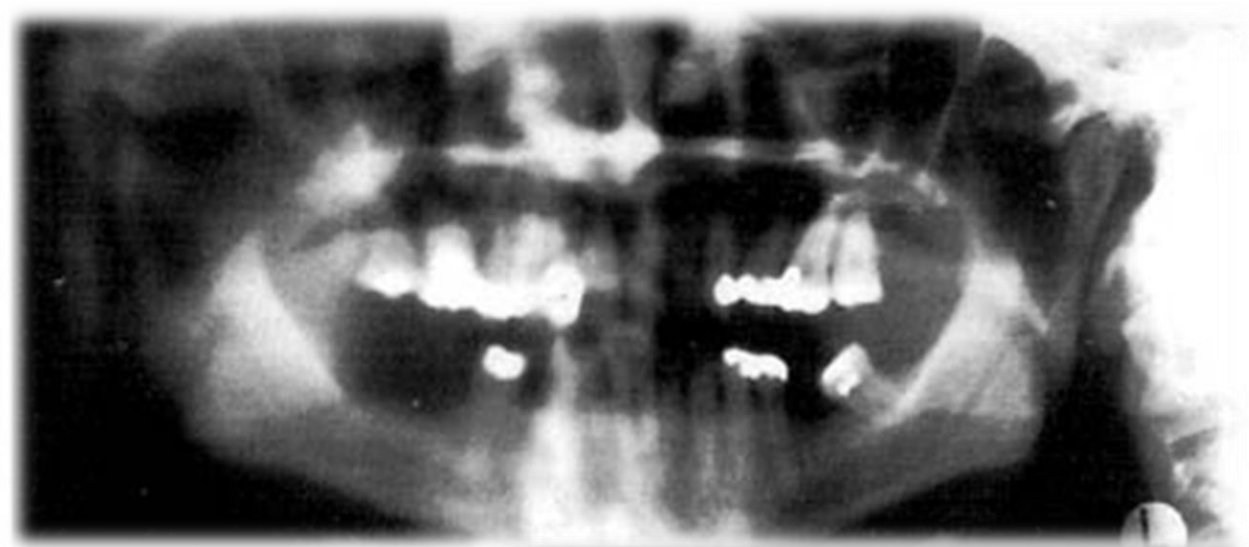
White light leaks in the dark room.

Correction: check the filter and bulb wattage of the safe light.

Check the dark room for light leaks.

6. Black Streaks:

- Fixer contaminated hanger clips.
- Insufficient fixing solution or improper rinsing.
- Dirty rollers in automatic processors.

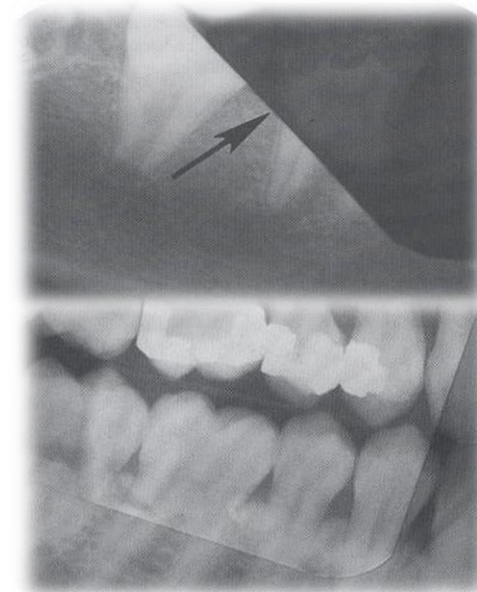


7. Overlapped films

Appearance: white or dark areas appear on films where overlap has occurred.

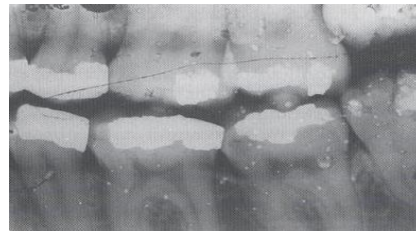
Cause: when two films come into contact with each other during manual or automatic processing techniques. Films that overlap in developer are white, while that overlap in fixer are black.

Correction: make sure that the films were not come into contact with each other during processing.



8. Air bubbles

Appearance: white spots appear on the film.



Cause: air is trapped on the film surface after the film is placed in the processing solution. Air bubbles prevent the chemicals from affecting the emulsion in the area.

Correction: gently agitate and stir film racks after placing them in the processing solution.

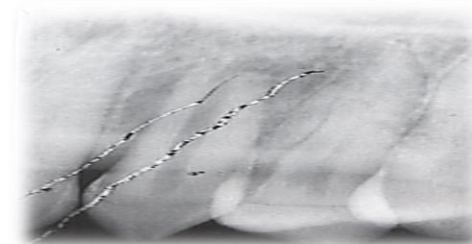
9. Scratched film

Appearance: white lines appear on the film.

Cause: the soft film emulsion is removed from the film base by a sharp object such as film clip or film hangers.

Correction: use care when placing a film rack in the processing solutions.

Avoid contact with other film hangers.



10. Developer cut off:

Appearance: a straight white border appears on the film

Cause: low level of developer solution that represents an under developed portion of the film.

Correction: check the developer level before processing films.

Make sure that all the film parts are completely immersed in the developer solution.

11. Fixer cut off

Appearance: a straight black border appears on the film.

Cause: low level of fixer solution that represents an unfixed portion of the film.

Correction: check the fixer level before processing films .

Make sure that all the film parts are completely immersed in the fixer solution.

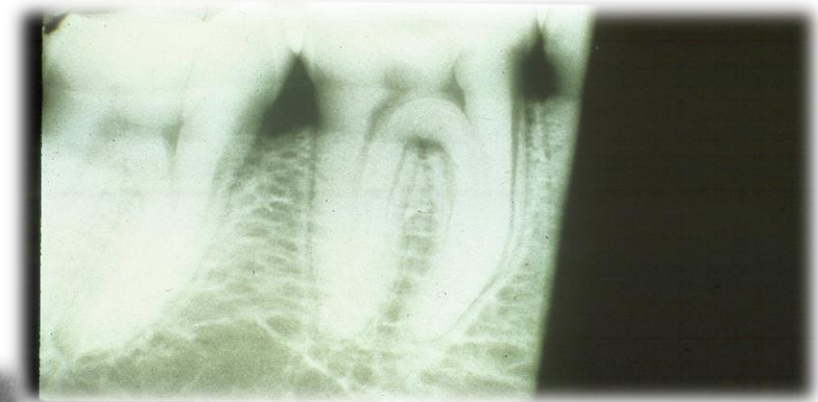
Lighting errors-Light leak

Appearance: the exposed area appears black.

Cause: accidental exposure of the film to white light.

Torn film packets that expose a portion of the film to light.

Correction: examine film packets for minute tears or defects before use. Never unwrap films in the presence of white light.



ERRORS AND CAUSES

Film too dark

Possible causes

- Overexposure owing to:
 - Faulty X-ray equipment, e.g. timer
 - Incorrect exposure time setting by the operator
- Overdevelopment owing to:
 - Excessive time in the developer solution
 - Developer solution too hot
 - Developer solution too concentrated
- Fogging owing to: — **Poor storage conditions:*** Allowing exposure to stray radiation
- Too warm
 - Old film stock i.e. films used after expiry date
 - Faulty cassettes allowing ingress of stray light
 - **Faulty darkroom processing unit:**
 - Allowing leakage of stray light * Faulty safe-light OR Thin patient tissues.

Film too pale

Possible causes

- Underexposure owing to:
 - Faulty X-ray equipment, e.g. timer
 - Incorrect exposure time setting by the operator
 - Failure to keep timer switch depressed throughout the exposure

PANORAMIC IMAGING ERRORS

Incorrect Exposure

Errors visible on a panoramic radiograph can result from the improper preparation and positioning of a patient. Patient preparation errors can result in radiolucent and radiopaque artifacts.

The most common machine variable error occurs with selection of the incorrect exposure setting – usually kVp.

Kilovoltage settings that are too high produce dark images while low kVp settings result in light images. Correction of this type of error usually involves a retake at a kVp that is either 5% above, in the case of an underexposed radiograph, or 5% below, in the case of an overexposed radiograph, the initial setting. In the case of digital radiography, only overexposures can be corrected with use of image software. **A severely underexposed image does not contain all of the information in the first place and density manipulation will not improve the image quality. The two examples here show the effect of overexposure and underexposure on the panoramic image.**

Incomplete exposure

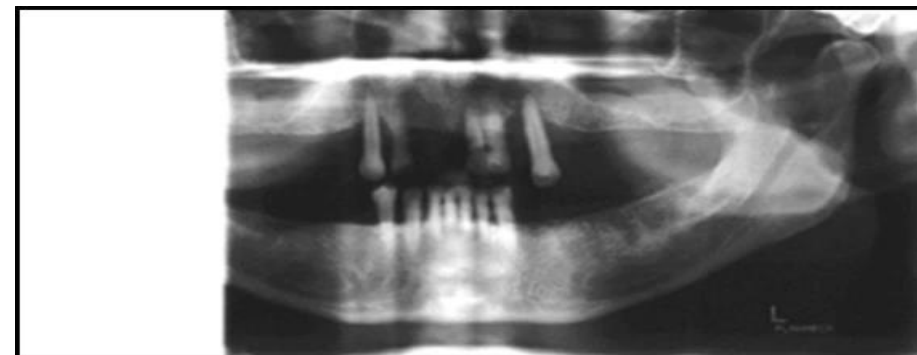
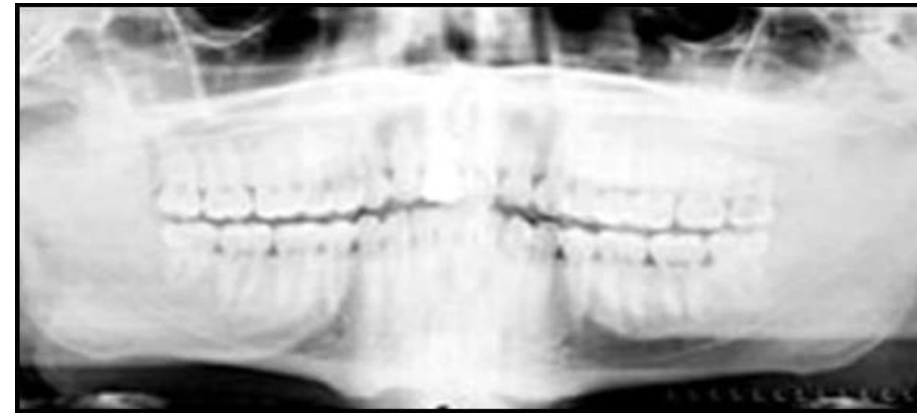
Another error occurs principally with panoramic units that use a flexible cassette attached to a rotating drum. If the drum is not re-aligned at the correct start position after attachment of the cassette, only a partial image will be obtained. In addition, a partial image can be produced if the operator lets go of the exposure button prior to completion of the entire exposure cycle or if shoulder contact stops machine rotation

Incomplete Exposure



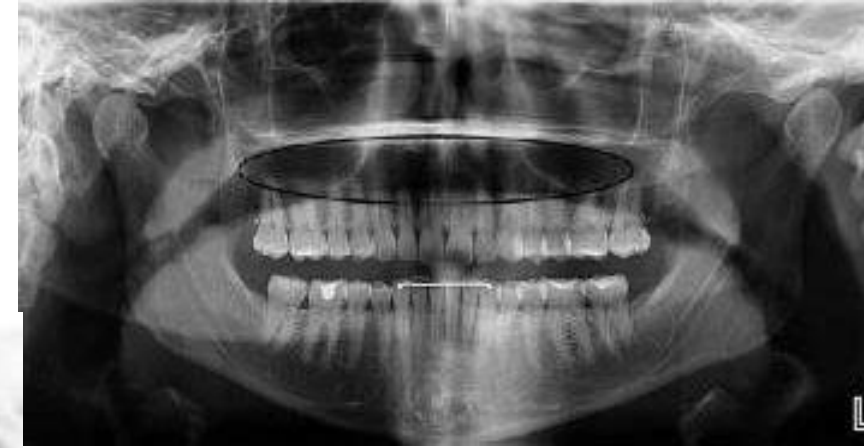
High Density Image

Low Density Image. The two examples here show the effect of overexposure (top) and underexposure (bottom) on the panoramic image



A patient who does not fully place his or her tongue to the roof of the mouth will cause a radiolucent band to be superimposed of the apices of the maxillary teeth.

A radiolucent artifact will superimpose over the anterior teeth if the patient's lips are not closed around the bite block



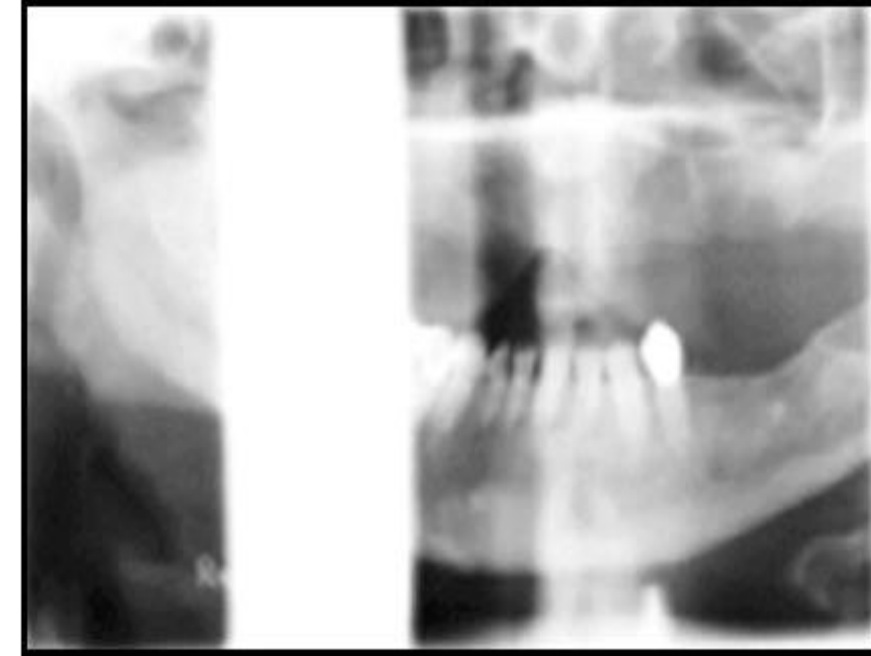
Panoramic radiograph with radiolucent artifact superimposed over the maxillary apices. The patient's tongue is not placed against the hard palate

Failure to remove metal objects from the patient's head and neck region will cause a ghost image to appear on the radiograph. The image shows the real image of an earring on the left side of the radiograph with the ghost image superimposed over the right maxillary sinus region



Incorrect program selection – An error that may occur principally with panoramic units that allow various program options, is failure to change the program after the previous patient. This results in exposure of the patient using the previous program choice

The two examples above show the effect of incorrect program selection. The image on the left image resulted from using a child exposure program, limiting the field of exposure posteriorly. The image on the right is due to the use of an orthogonal program segmenting the anterior and posterior dentition without coverage of the ramus and TMJ



Patient Positioning

The second component of technique error analysis is the determination of patient positioning errors. This is of critical importance because even small patient positioning errors can produce effects that can obscure areas of the image and result in the loss of diagnostic information.

Technique errors can be easily recognized by careful analysis of the position, relationship of structures, unsharpness and distortion in a panoramic radiograph. The visual effects of incorrect patient positioning on the image may be described according to whether they affect anatomic representation or features of the dentition

Incorrect Head Orientation

There are three planes in which the patient's head may be positioned incorrectly:

1) **Horizontal**, 2) **Vertical** and 3) **Anteroposterior**.

Incorrect positioning in each plane produces characteristic effects. Of course, there is the possibility of multiple errors in more than one plane – this will produce multiple and sometimes compounding effects and, in this instance, have are referred to as “compound” errors. The analysis of positioning errors therefore involves stepwise recognition of the radiographic features associated with each planar discrepancy.

Horizontal plane discrepancies – Alter the position of the teeth and jaws on one side relative to the path of the effective rotation center and x-ray beam projection.

The two feasible options are that the patient is

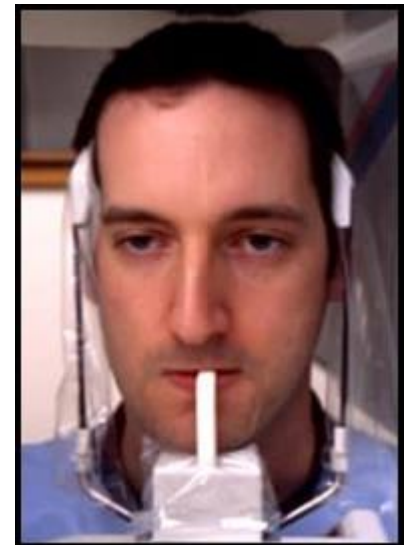
A. twisted (rotated) with respect to the machine, or

B. that their head is tilted. Both results are because the midsagittal plane of the patient is not correctly aligned at the time of exposure.

- This can occur if the patient “follows” the receptor during exposure and move off-center

This error can be prevented by ensuring the midsagittal reference line of the panoramic unit coincides with the patient's midline and that this line is perpendicular to the floor. Prevention of patient movement can be facilitated by adjustment of the lateral head supports to stabilize the patient to prevent movement during exposure.

- The principal effect of malpositioning the patient is to offset more lateral and posterior structures, like the posterior dentition and ramus, with respect to the focal trough and x-ray beam projection



Twisting

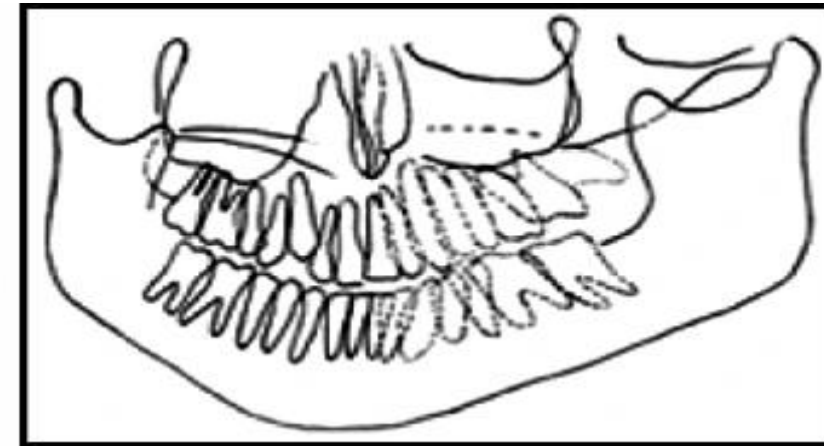
The most obvious image effects from the patient head “**twisting**” within the machine are anatomic.

Most noticeably:

1. The width of the ramus on one the side reduces (closer to the receptor) and becomes closer to the spine
2. The width of the ramus on other side increases (farther away from the receptor) and is further away from the spine – and may also projected be off the image.
3. The nasal conchae on the side opposite the twisting are more pronounced.
4. The maxillary sinus and nasal fossa of the same side as the twisting become more noticeable.

While the anterior teeth remain normal, there are two secondary effects on the dentition:

1. The first is that tooth size increases posteriorly on the side opposite to the direction of head tilt and,
2. Secondly, there appears to be increased overlapping of contacts on the opposite side of the tilt.



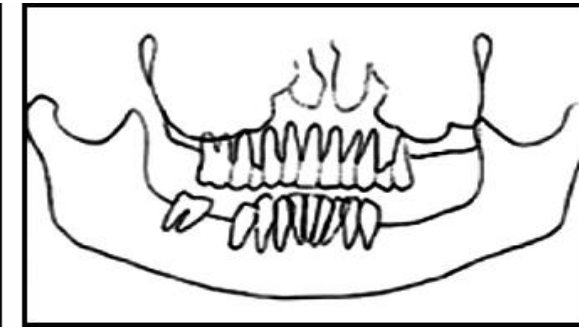
Panoramic radiograph (schematic on right) demonstrating the effects of twisting – Elongation of left mandible, reduction in size of teeth on opposite side, occlusal plane canting and pronounced tooth overlap on the same side.

Tilting – The principal effect of tilting the patient is to create artifacts in the dentition and ramus superoinferiorly. The most obvious image effects are also anatomic. Most noticeably:

1. The lower border of the mandible slopes markedly on the side to which the head is tilted.
2. The mandible also appears elongated and tilted up.

The effects of tilting on the dentition include:

1. A reduction in the size of the teeth on the tilted side.
2. A greater overlap of the teeth on the opposite side.
3. Canting (sloping) of the occlusal plane towards the tilted side.

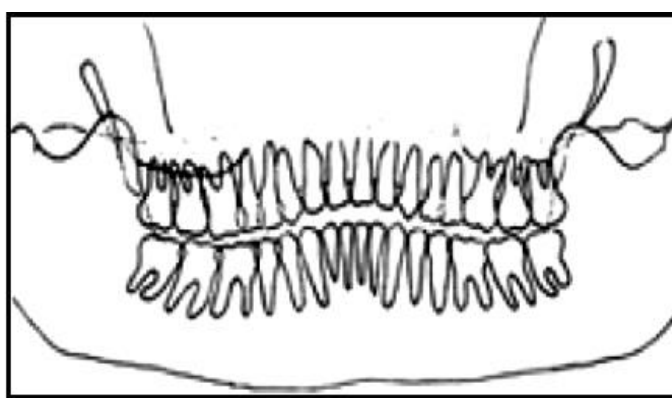


Panoramic radiograph (schematic on right) demonstrating the effects of tilting.

Vertical plane discrepancies - Alter the relative position of the occlusal plane of the teeth and the condyles of the mandible. The viable options are that the patient's chin is positioned too far up, or too far down or that it is not positioned on the chin rest (when this is used to position the patient). Vertical errors occur when the patient's head is incorrectly positioned superiorly or inferiorly in the machine. **The instructions in the manufacturer's manual may vary in which plane is used to adjust the patient's head up or down.** Prevention of this error can be accomplished by ensuring that the patient's horizontal reference line is parallel to the floor or the lateral reference markers.



Head/Chin Up.



Panoramic radiograph (schematic on right) demonstrating the effects of positioning the head too far up.



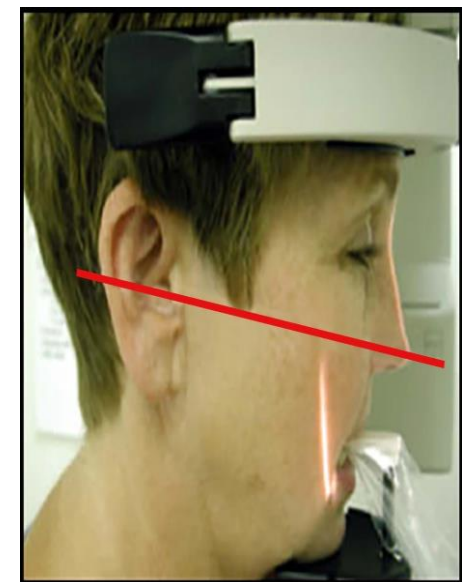
Head/chin tilted too high

The first possibility is that the patient's head is positioned too high or tilted up. Most noticeably, this produces a frown configuration of the occlusal plane.

1. The hard palate is superimposed over the maxillary teeth apices.
2. The TMJs are pushed posteriorly and in many cases are projected off the sides of the image.
3. The nasal cavity and other superior structures are blurred and out of focus.
4. The maxillary anterior teeth may appear elongated and fuzzy.

Head/chin tilted too low – The second possibility is that the patient's head is positioned tilted too far down. The principal effect of tilting the chin down is to position more of the maxillae into the focal trough, align the maxillary teeth and to bring less of the lower anterior mandibular area into the focal trough. The anatomic effects of positioning the head too far down can be severe and may necessitate retaking the radiograph

- 1- Most noticeably, this produces a grin or "Jack-O-Lantern" configuration of the occlusal plane.
- 2- The TMJs are positioned higher and in many cases are projected off the top of the image.

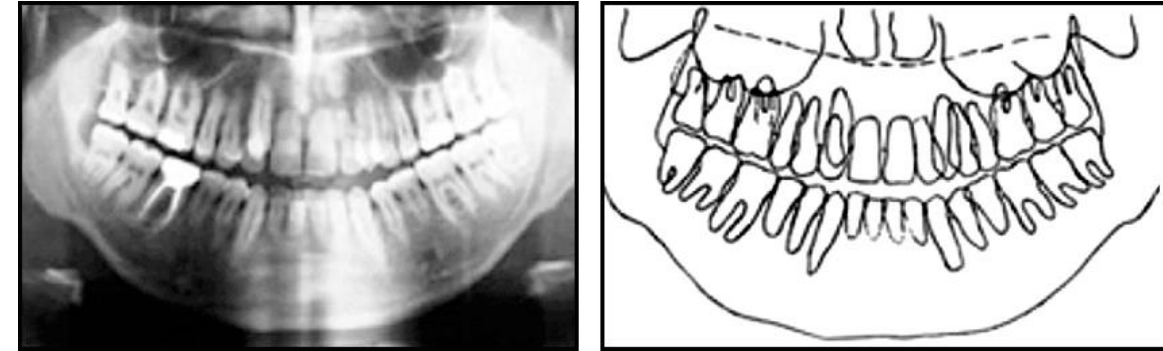


3-The hyoid bone comes into the doubling diamond and forms a single widened line. The hyoid may superimpose over the lower border of the mandible.

4-The anterior mandible is usually widened and out of focus.

5-The mandibular anterior teeth may display pronounced foreshortening and appear out of focus.

Panoramic radiograph (schematic on right) demonstrating the effects of positioning the head too far down

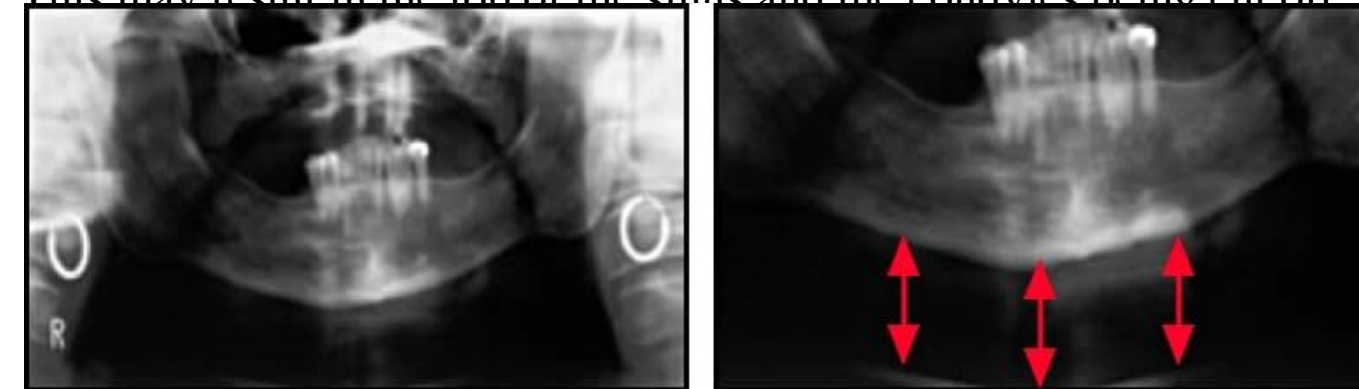


Chin not on chin rest :

The third possibility is that the patient's chin is lifted from the chin rest. This is usually because the initial height of the machine is lower than the height required for the patient. Often a patient will stoop to enter a panoramic machine but once they are positioned and immediately before exposure will straighten themselves up.

The main visual effect of the chin being lifted from the chin rest is to create an image with a shift of anatomic structures superiorly.

This may result in the top of the sinus and the condyles being cut off



Anterioroposterior plane discrepancies – Alter the position of the teeth, especially the anterior teeth in the focal trough. The two practical options are that the patient is positioned either too far forward or too far backward.

Too far forward – Anterior positioning of the patient too far forward occurs either due to patient slipping forward, **sucking the bite block**, or **not using a bite block**.

Prevention of this error first necessitates that a bite block is used; secondly it requires that the patient's anterior teeth be placed in an end-to-end position in the bite block.

Prevention of subsequent patient movement can be aided by adjustment of the forehead support, when available, to prevent the patient from sliding forward.

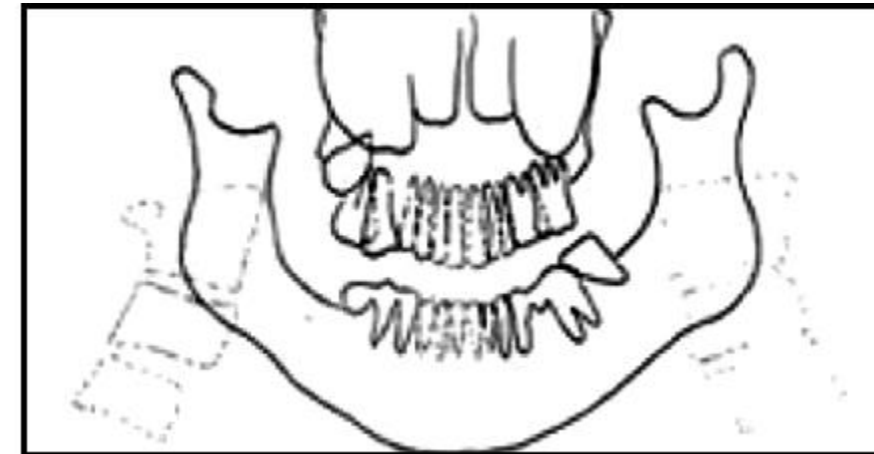
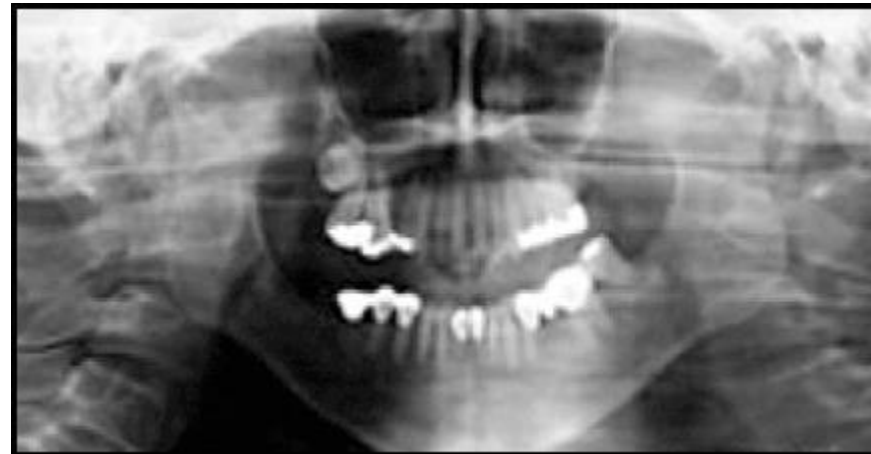
The effect of positioning the patient too far forward is to position structures that are normally within the focal trough, like the anterior dentition, further anteriorly and out of focus and to bring more posterior structures, like the spine, nasal fossa, and maxillary sinus into the focal trough.

Most noticeably, spine is superimposed over the ramus bilaterally.

The anterior teeth are narrowed in width on both arches and out of focus.

Severe overlapping of the teeth, particularly the premolars.

Panoramic radiograph (schematic on right) demonstrating visual effects on image with patient's head positioned too far forward during exposure: Spine superimposed over the ramus area, nasal fossa and maxillary sinus become clearly evident. Effects on the dentition however are the most noticeable with narrowing and blurring of the anterior teeth.



If the midsagittal plane is not perpendicular to the floor, the resulting image will appear magnified on one side. **The picture demonstrates magnification of the left side because the patient's head is tilted to the right. If the Frankfort plane is not parallel to the floor**, the patient's chin will be too high or too low and will cause one dental arch to be positioned outside of the focal trough. If the chin is too high, the patient's maxillary arch is positioned in the focal trough but the mandibular arch is outside the focal trough.



Panoramic radiograph caused by patient's midsagittal plane not positioned perpendicular to the floor. The left side of the radiograph is magnified due to the patient's head being tilted to the right

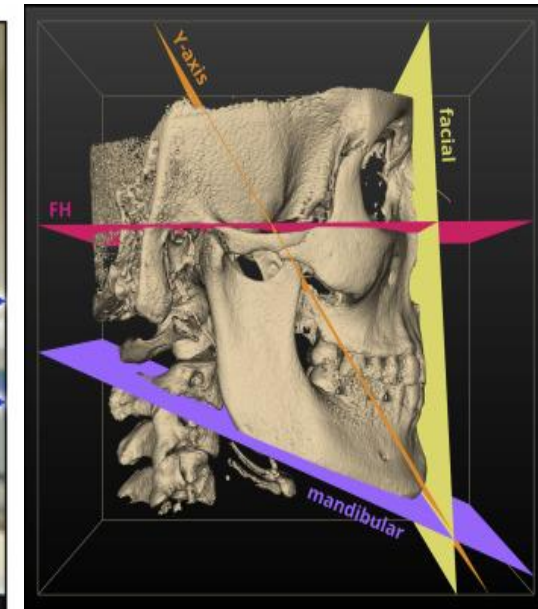
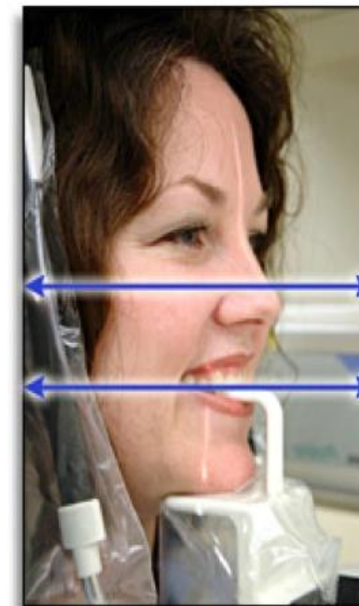
Midsagittal Plane



The Frankfort plane (superior border of the external auditory meatus to the infraorbital rim) or **plane of occlusion** (vertical/up-down plane) is positioned parallel to the floor in panoramic imaging.

The Tragal-canthus plane (tab in ear to outer corner of the eye), and the Ala-tragus (corner of nose to tab in the ear) plane are used to align the vertical position of the head as well. Some machines provide a horizontal alignment light to help assess the proper vertical position of the head.

The patient's forehead and chin should be in the same vertical plane



Frankfort and Occlusal Plane

Prevention of this error, as with anterior positioning errors, **firstly necessitates that a bite block is used; secondly it requires that the patient's anterior teeth be placed in an end-to-end position in the bite block.**

Instances such as trismus or when a patient's jaws are wired together, the clinician can use the bitepiece to measure the approximate distance **to position the patient on the chin rest.**

The principal effect of positioning the patient too far back is to position structures that are normally within the focal trough, like the **anterior dentition, further posteriorly and out of focus.**

1-Most noticeably, **severe ghosting of the ramus and mandible.**

2-The anterior teeth are widened on both arches and out of focus.

3-Blurring of the turbinates (nasal conchae) across the sinus.

4-Widening of the entire image, cutting off posterior structures.



Head Projected

Head Straightened

Tissue Projection Errors

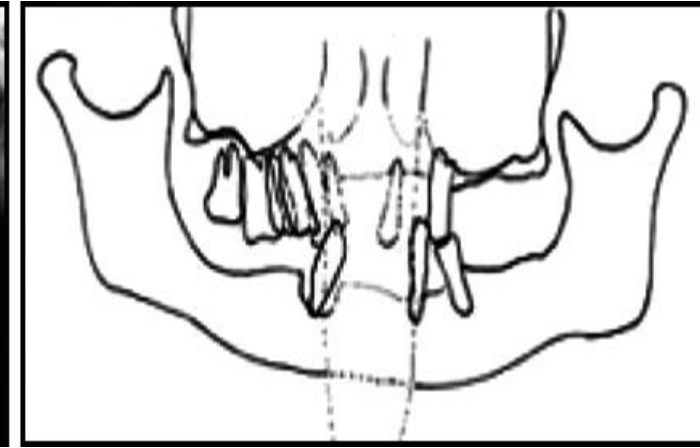
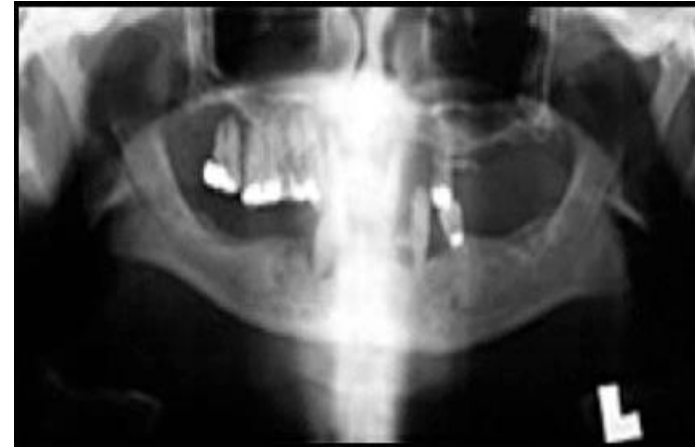
The second category of technical errors in panoramic radiography are tissue projection errors or those due to tissue superimposition. There are two errors possible:

Hard Tissue Projection Errors:

1. Spine – The first hard tissue error can occur when the patient assumes the “head extended” position. One of the final instructions to patients before panoramic exposure is that they should move their feet slightly forward into the machine – a sort of “panoramic shuffle.” This has the effect of straightening the cervical spine of the patient. If the patient is not instructed to do this, they will often assume a head projected position. This is because of the natural tendency of patient's is to put their head forward into the panoramic head holding apparatus rather than physically moving their head and their body. The positioning effect of this is that the spine assumes a more oblique position with respect to the x-ray beam and attenuates (absorbs) more x-rays.

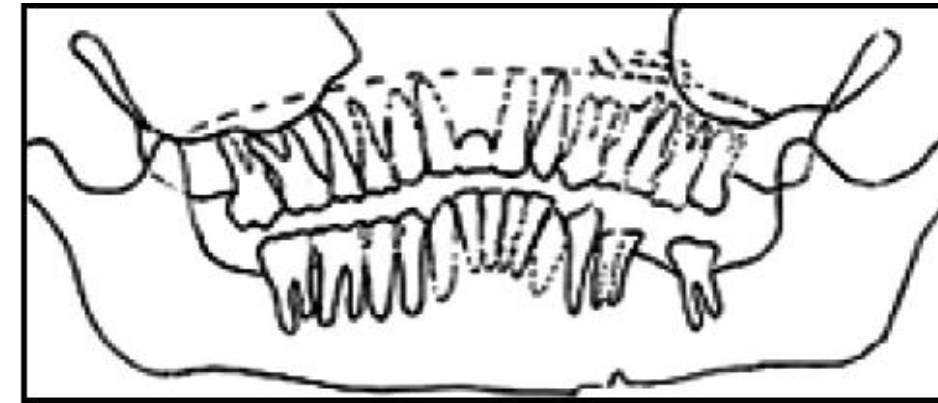
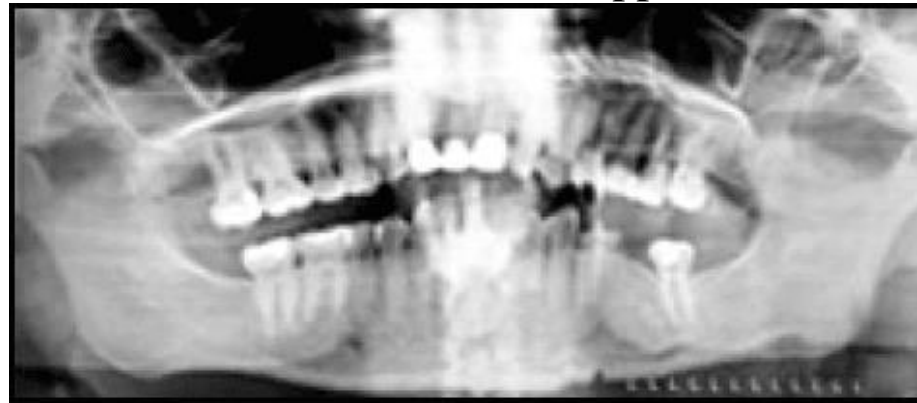
The most obvious anatomic feature of head projection is the superimposition of the spine on the ramus of the mandible and the production of a more ghost images. The most characteristic ghost image is of the spine, and it appears as a central midline radiopacity that broadens inferiorly. In addition, because of poor contrast, the dentition may be difficult to visualize because of this superimposed ghost image radiopacity.

Panoramic radiograph (schematic on right) showing the effect of the spine on the anterior of the image with slumping of the patient



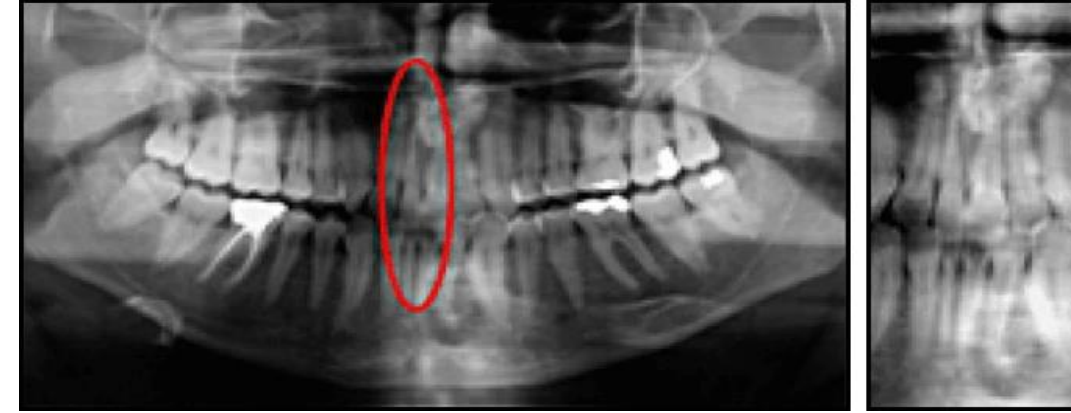
2. Patient Movement – The second hard tissue error can occur when the patient moves during an exposure. Because the panoramic exposure is of the order of between 16 to 20 seconds, the possibility exists that a patient may move during the exposure. Prevention of this error can be aided by continuing to inform the patient, throughout the exposure, of the progress of the unit around their head while instructing the patient to remain still. Movement produces characteristic anatomic effects by stretching or breaking the image in the zone of movement. This may lead to the appearance of a **“false”** fracture. Appreciation of this artifact is important in the assessment of patients reporting with maxillofacial injury. Additional presentations may result from double imaging or loss of segments. Another characteristic effect is the appearance of a dent in the lower border of the mandible.

Panoramic radiograph (schematic on right) showing the effect patient movement on the image. Note the discontinuity of the left lower border of the mandible and distortion of dentition and palate immediately superiorly.



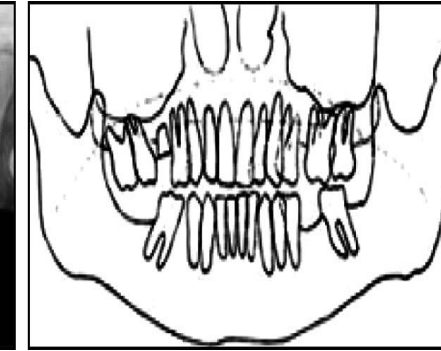
The effect of patient movement on the dentition can be subtle – and contribute to what could be called “**motion microdontia.**”

In this image (cropped and zoomed on right) notice that in the midline anterior region, tooth # 8 in the maxilla is extremely narrow and suggests that the patient may have a central incisor that is a microdont. On further examination it can be seen that tooth # 26 in the mandibular arc, directly below # 8 is also a microdont. Further clues to this appearance being due to a motion artifact are revealed by comparing the anatomy above and below the teeth with the opposite side. This is especially apparent in the relative width of the ala or soft tissue shadow of the nose



Soft Tissue Projection Errors

1. **Tongue Drop** – The second tissue projection error can result from soft tissue artifacts associated with either the tongue not being placed on the palate during the exposure, or the lips not being closed. These errors occur when the patient is not instructed to place their tongue on the roof of their mouth during the entire exposure and to keep their lips together. The principal effect of this is to produce areas of relative radiolucency associated with the **oro and naso pharyngeal airspaces**, which can obscure visualization. This occurs because panoramic x-ray beam exposure is designed to be **sufficient to transmit through both the hard and soft tissues of the maxillofacial region**. This is particularly evident with underexposed radiographs where the features of the maxilla in particular are obscured by the radiolucency created by the incorrect position of the tongue and radiopacity of the palatal hard and soft tissue.



Panoramic radiograph (schematic on right) showing the effect of not placing the tongue on the roof of the mouth on the image.

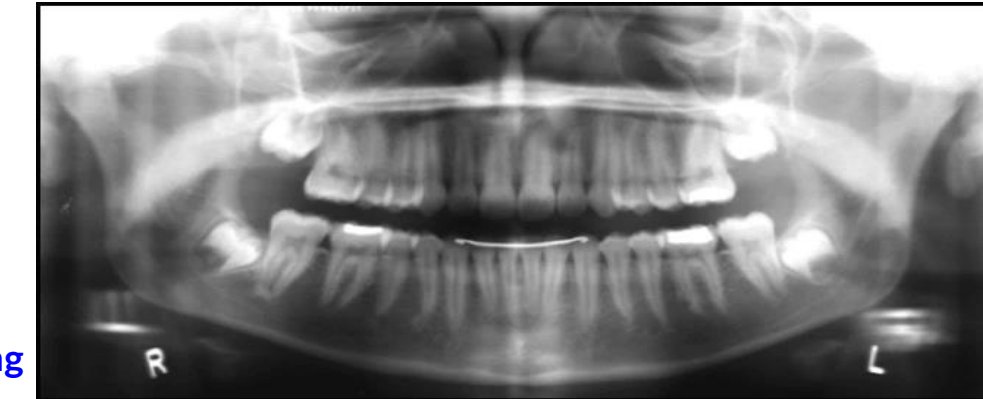
Prevention of this error can be aided by continuing to instruct the patient, throughout the entire exposure, to keep their tongue on the roof of their mouth. Failure to place the tongue on the roof of the palate throughout the exposure does not produce any anatomic effects but does have some consequences to the visibility of the dentition.

While failure to position the tongue on the roof of the mouth is one of the most common **technique errors**, it is rarely the cause for a re-take. However, the effect can be accentuated in two situations when the patient is edentulous and when the patient is positioned too far forward. **Failure to place the tongue on the roof of the mouth may also create apparent “apical pathology.”**



This image demonstrates the effect that a relaxation in tongue position during panoramic exposure can produce. Notice that in the maxillary midline there appears to be a radiolucent, cyst-like radiolucency that has expanded inferiorly below the alveolar bone. Closer examination reveals that the uppermost part of this lesion is shaped in a gradual curve – this curve represents the top of the palate and is the tell tail sign that this "lesion" has been created because the patient's tongue dropped during the exposure

2. Lips not closed – The second soft tissue error results from the lips not being closed throughout the exposure. While there are no anatomic effects of this error, it can also contribute to “burnt out” of the crowns of the anterior teeth or be responsible for increased radiolucency over the maxillary anterior region that could be interpreted as apparent anterior bone loss.

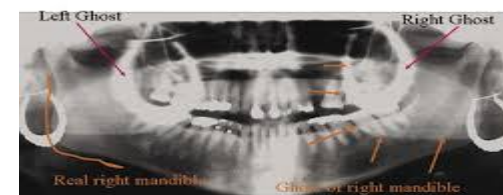


Panoramic radiograph demonstrating the effect that occurs when the lips are not closed during exposure resulting in an area of increased radiodensity in anterior crown regions.

Additional radiopaque artifacts can occur with the **improper** use of **lead aprons**. Using a lead apron with a thyroid collar will produce a radiopaque artifact along the lower edge of the image with a triangular opacity projecting upward towards the maxillary arch



Panoramic “Ghost Image”



Ghost Images: Objects outside the image layer that are not entirely excluded from the panoramic radiograph

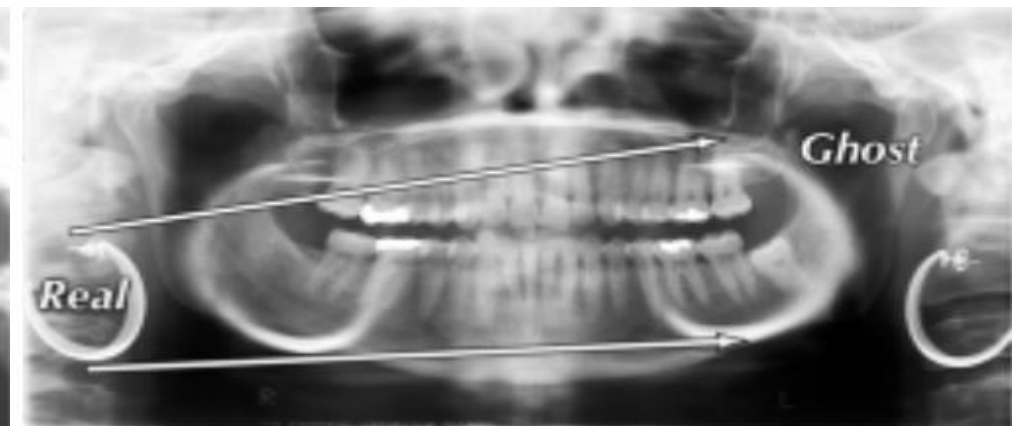
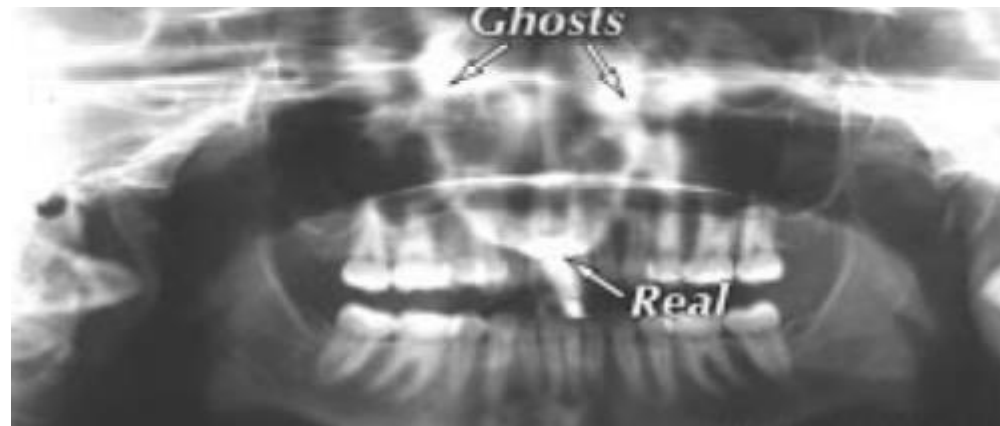
Anatomic Ghosts

All panoramic radiographs include ghost images even though these are minimized following more than 50 years of trial and error by the various manufacturers of panoramic dental systems. Many ghost images are actually from normal anatomic structures. For example, in the edentulous patient having relatively thin soft tissues, it is not uncommon for the ghost image of the mandibular ramus to be clearly demonstrated in magnified form over the contralateral mandibular body .

The presence of such a **ghost shadow of normal anatomic structures is not an error in technique**, but rather a normal finding when using panoramic radiology on some patients. While ghost images of some anatomic structures cannot be avoided, most ghost images can be excluded or reduced. A very common unwanted image is that of the cervical spine reflected over the mandibular incisor teeth

This is best prevented by having the patient stand, or sit, upright with their neck straight and extended, rather than slouched during panoramic exposures. If the patient's neck is slouched, the X-ray beam traverses several cervical vertebrae on the way to exposing the incisor view causing an opaque shadow of the spine to obscure details of the incisor teeth. Jewelry Ghosts Jewelry, such as earrings, is usually constructed of materials with high atomic density, and is generally

Tongue rings have become evermore frequent



This Yellow Faced sun
Orchid is amazing

SUBHANA ALLAH

THANK YOU

