

L.13

Panoramic Radiography

Panoramic Technique Errors:

By

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Causes and Appearance of Errors in Technique:

A considerable number of radiographs exposed in dentistry are of marginal or nondiagnostic quality. The value of a panoramic radiograph is reduced when it is of poor diagnostic quality, due to various positioning and processing errors. Among the various types of image quality evaluations, clinical imaging evaluation is the most important inspection that enables actual and comprehensive evaluation since it reflects the entire quality-assurance process and it must be performed continuously.

Low-quality radiographs can lead to repetition of radiographs and misinterpretation, which in turn may result in incorrect diagnosis and treatment planning. The repetition of panoramic radiography carries an associated risk of inducing cancer which has been estimated as 0.21 or 1.9 cases/million examinations.

Inaccuracies in patient positioning lead to discrepancies between horizontal and vertical magnification, with consequent distortion of the image. Since a principal objective of the quality assessment program is to ensure the production of good diagnostic quality radiographs, it is vital to monitor image quality on a regular basis. It is recommended that a simple, subjective image quality rating system should be used for dental radiographs.

The diagnostic value of panoramic films is increased considerably if clinicians are aware of their limitations and apply a systematic approach to their interpretation. "The hardest thing to see is what is in front of your eyes." The value of panoramic radiograph is reduced when they are of poor diagnostic quality. This poor quality usually is not a result of an inherent limitation with the equipment, but rather is a result of errors made by the operators during patient positioning and processing.

It is important for the clinician to be able to understand errors when they occur and how to correct them. The following table lists various errors that can occur with

panoramic imaging. It also addresses the radiographic appearance of the errors and solutions for correcting the problem.

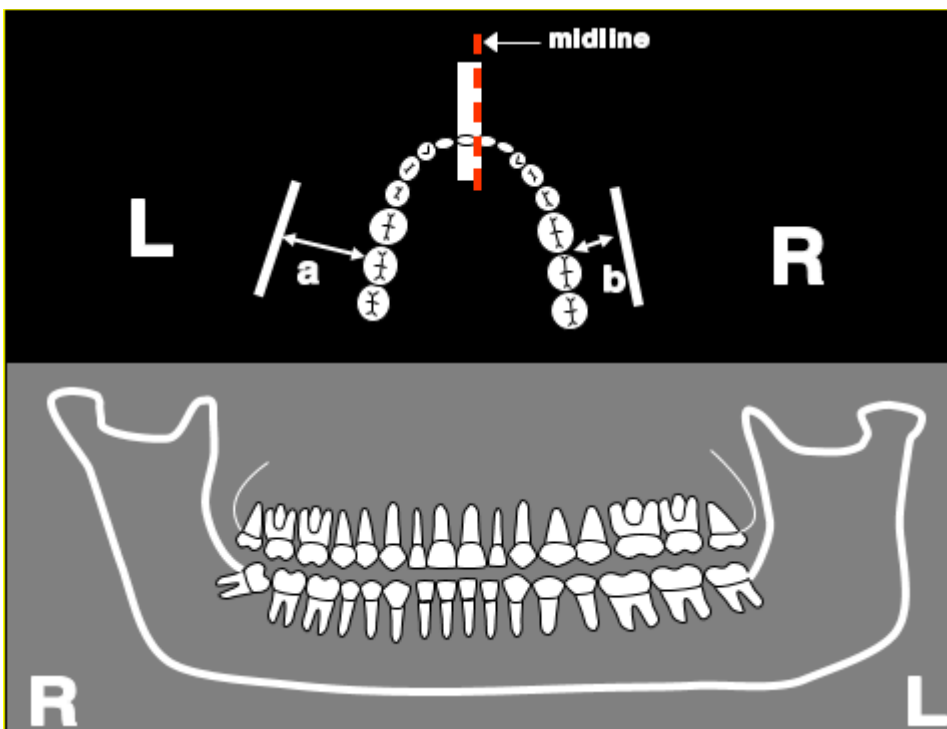
Patient Positioning Errors.

1	Ghost images.	Ghost image resembles real image Projected on opposite side of film and is higher.	Have patient remove all radiodense objects before exposure.
2	Lead apron artifact.	Radiopaque, cone-shaped artifact in center of image.	Use lead apron without thyroid collar.
3	Patient lips not closed.	Dark radiolucent shadow around anterior teeth.	Remind patient to close lips around bite block.
4	Patient chin too high.	Condyles may not be visible Maxillary incisors appear blurred and magnified Reverse smile line (frown).	Keep Frankfort plane parallel with floor.
5	Patient chin too low.	Exaggerated smile line (Joker). Condyles higher on image. Mandibular incisors appear blurred; roots appear short.	Keep Frankfort plane parallel with floor.
6	Patient too far forward (anterior to focal trough).	Anterior teeth are narrowed. Spine is visible on film.	Make sure patient's teeth are in bite block notches.
7	Patient too far back (posterior to focal trough).	Anterior teeth appear magnified. Ramus isn't entirely visible.	Make sure patient's teeth are in bite block notches.

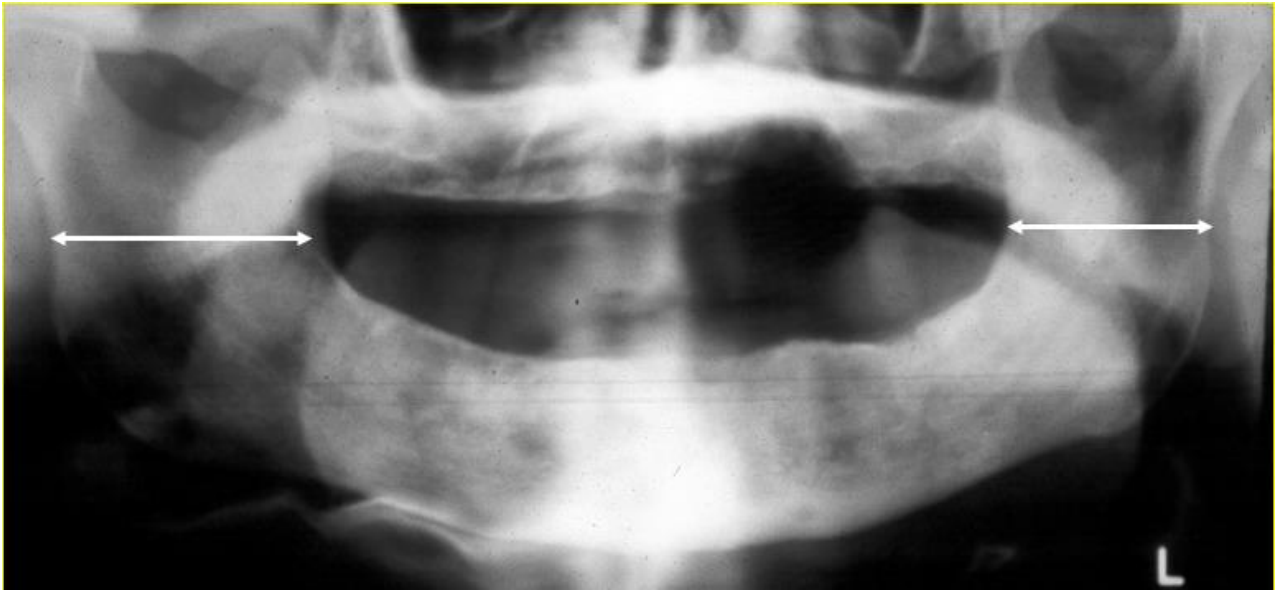
8	Patient head not centered	Ramus and posterior teeth appear unequally magnified. Side farthest from receptor appears magnified. Side closest to receptor appears smaller. Example: Patient turned to right will produce image with magnification on left side and overlapping of contacts.	Keep midsagittal plane perpendicular to floor & ensure indicating light is located at center of patient's nose
9	Patient spine isn't straight	Cervical spine appears as radiopacity in center of image	Have patient stand as tall as possible. Seat patient if necessary.

The most common errors seen when taking panoramic radiographs:

Head Turned:



Turning the head moves the teeth closer to the film on one side (b, above) and farther from the film on the other side (a, above). This results in an enlargement of the images of the teeth and ramus on one side and a reduction in the size of the images on the other side.



Head turned to the left. The ramus is wider on the right side.



Head turned to the right, moving the teeth closer to the film on that side. The teeth on the left side, being farther from the film, will be magnified more and appear larger.

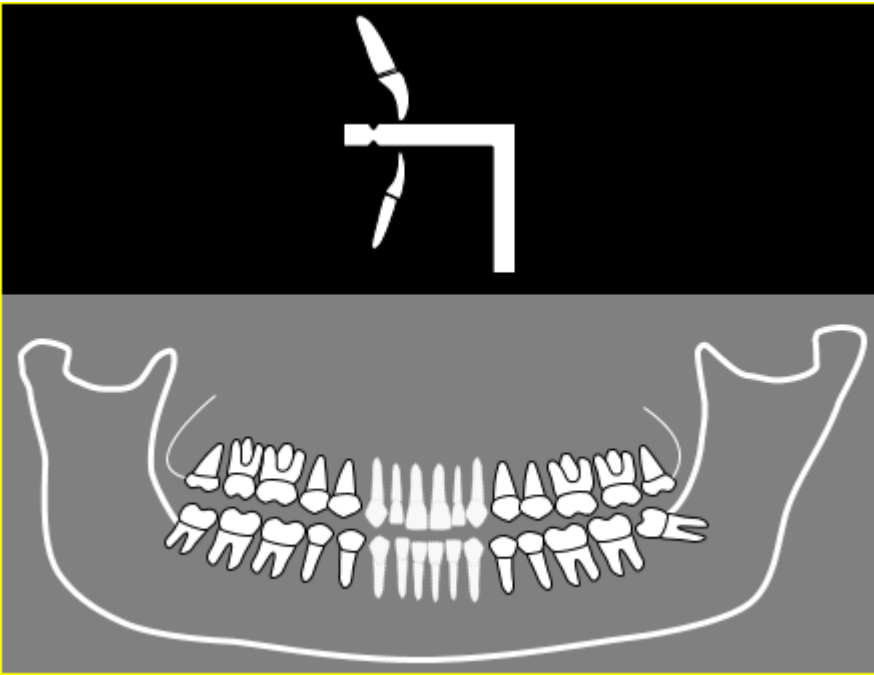


The head is turned to one side, causing an asymmetry of the condyles, and wider teeth and ramus on one side than the other.



The head is tilted to one side, causing one condyle to appear higher than the other and the inferior border of the mandible is slanting.

Teeth too anterior:

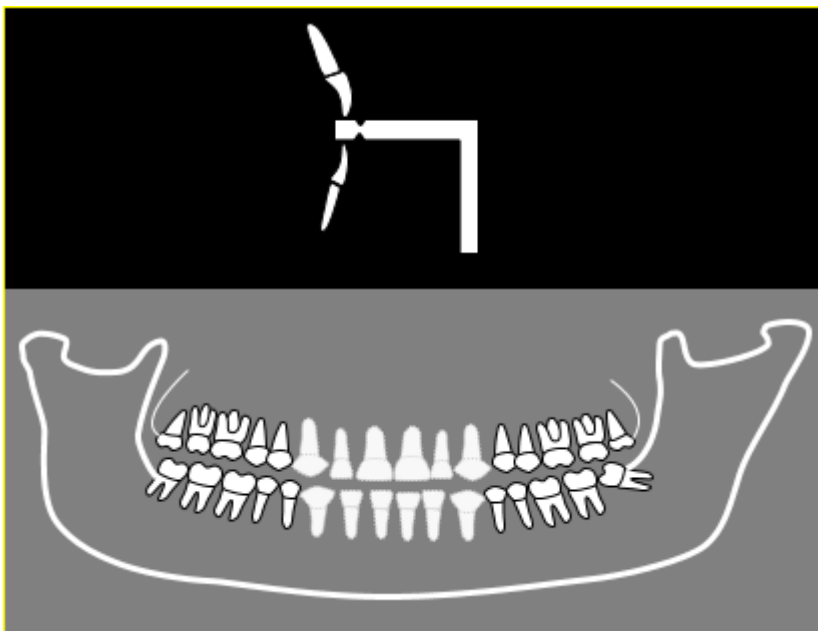


If the incisors are positioned anterior to the notch in the bitestick, they will end up closer to the film, which passes in front of the patient. This results in a reduction in the width of the images of the front teeth (less magnification) and, since they are now slightly outside the focal trough, the images of the teeth will be blurred.



The central incisors are in front of the bite groove, causing them to appear thin and fuzzy. The cervical spine is in the focal zone, causing it to be superimposed on the mandible.

Teeth too posterior:



If the incisors are positioned posterior to the notch in the bitestick, they will end up farther from the film, which passes in front of the patient. This results in an increase in

the width of the images of the front teeth (more magnification) and, since they are now slightly outside the focal trough, the images of the teeth will be blurred.

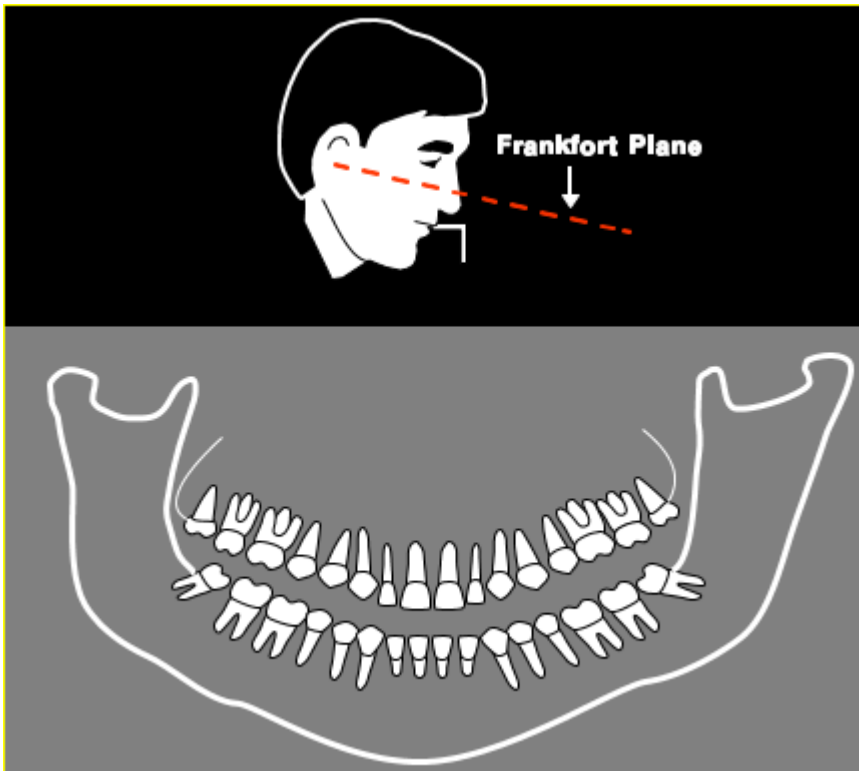


Incisors positioned posterior to notch in bite stick. Incisors wider than normal and blurred.



The anterior teeth are positioned behind the bite groove, causing them to appear wider than normal.

Head tipped down:



If the head is tipped down too much, so that the Frankfort Plane is angled downward, the resulting film will show a V-shaped mandible and shortening of the mandibular incisors.



Chin tipped down too much. Roots of mandibular incisors shortened. V-shaped mandible.

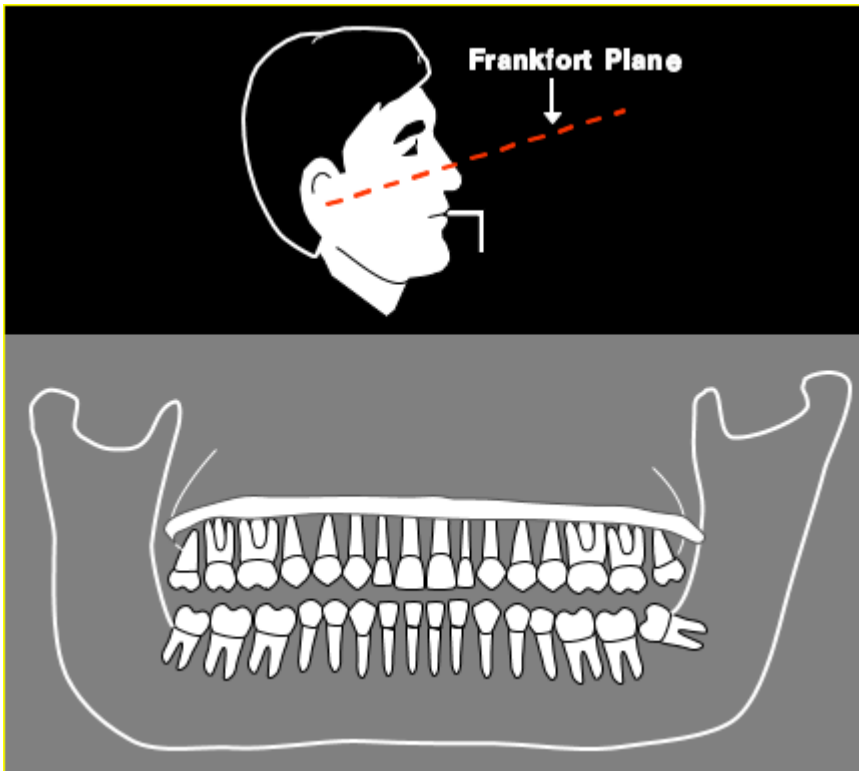


Patient's chin is tilted downward leading to appearance of a “Cheshire cat grin” due to the accentuated Curve of Spee.

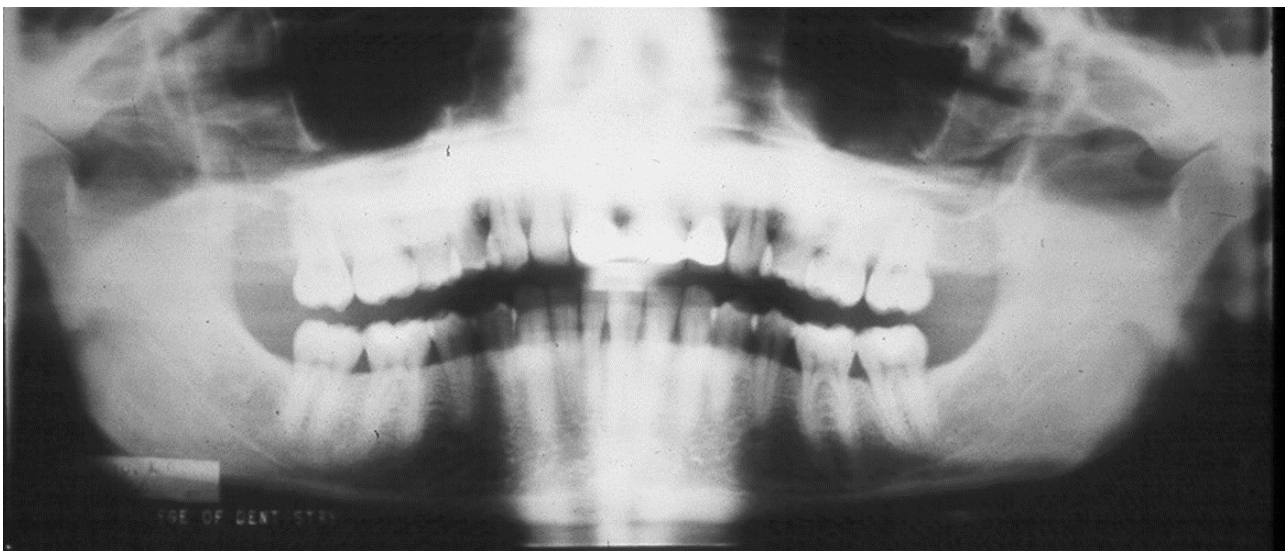


The patient's chin is too low. The occlusal plane is “smiling” and the apices of the mandibular incisors are fuzzy.

Head tipped up:



If the head is tipped up too much, so that the Frankfort Plane is angled upward, the resulting film will show a squared-off mandible and the hard palate will be superimposed over the roots of the maxillary teeth. A “reverse smile” may be seen.



Chin tipped up too much. Hard palate superimposed over roots of maxillary teeth. Squared-off mandible. “Reverse Smile”.

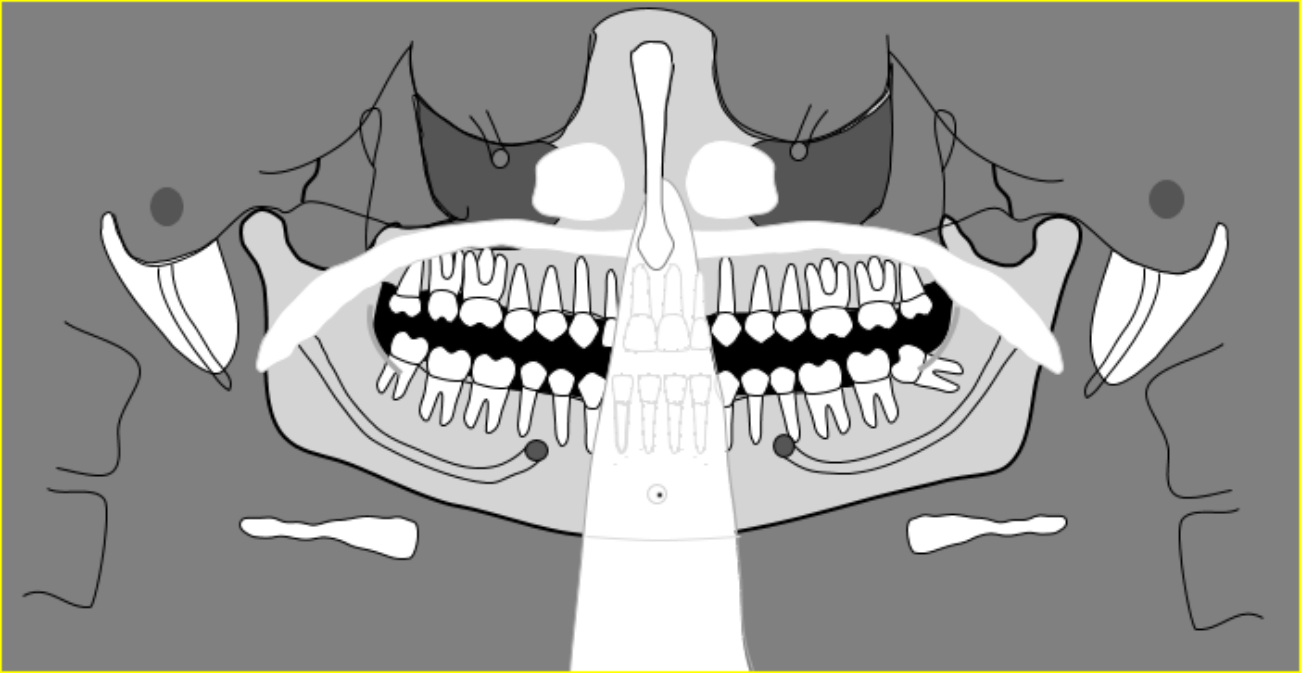


Patient's chin is tilted upward leading to appearance as that of a wide “grimace” due to a flattened Curve of Spee.



The patient's chin is too high, causing a flat occlusal plane, splayed condyles, and loss of sharpness of the maxillary incisors.

Vertebral (spinal) shadow:



White area in the center of the film represents the shadow of the vertebral column due to patient slouching. Although faint, you will usually be able to see outlines of the teeth and bone in the area.

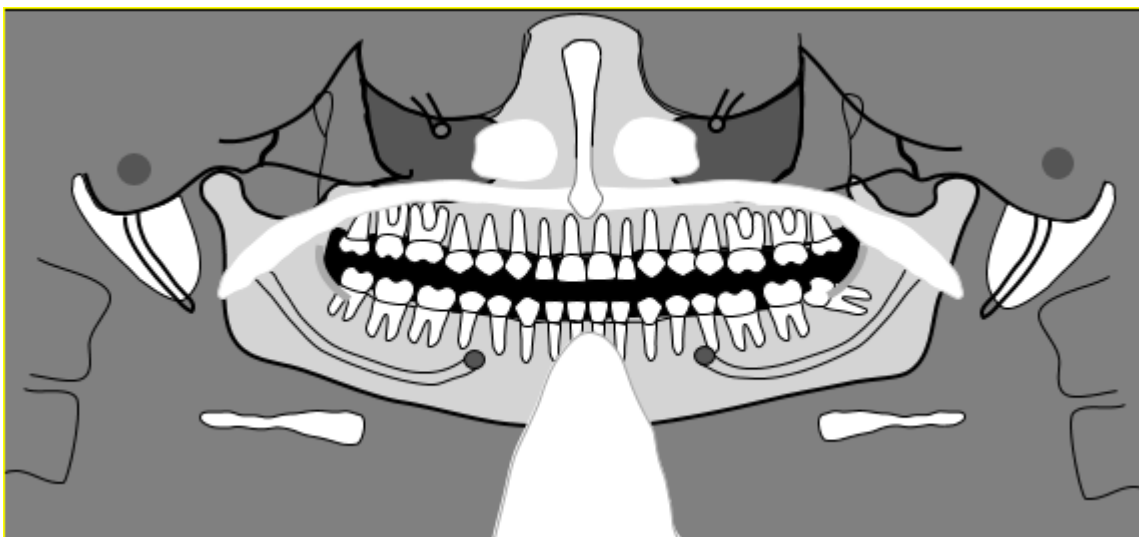


Shadow of the vertebral column due to patient slouching.



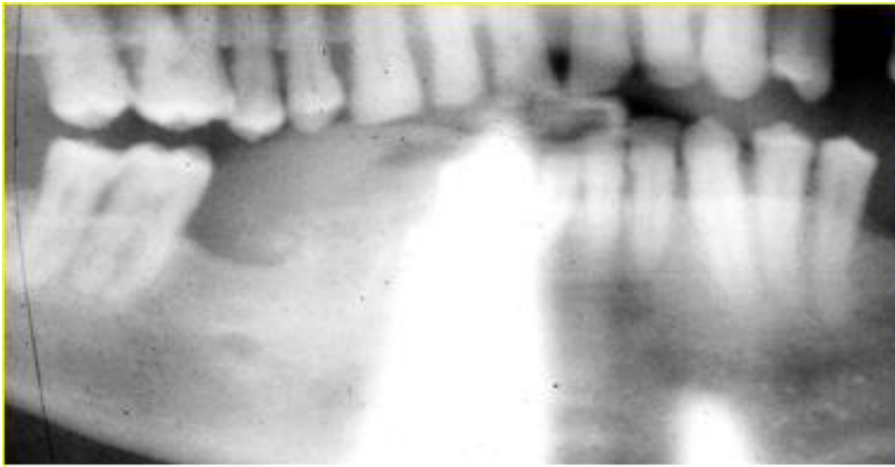
The cervical spine is slumped, appearing as a pyramid-shaped opacity, centered at the lower half of the film.

Lead Apron shadow:



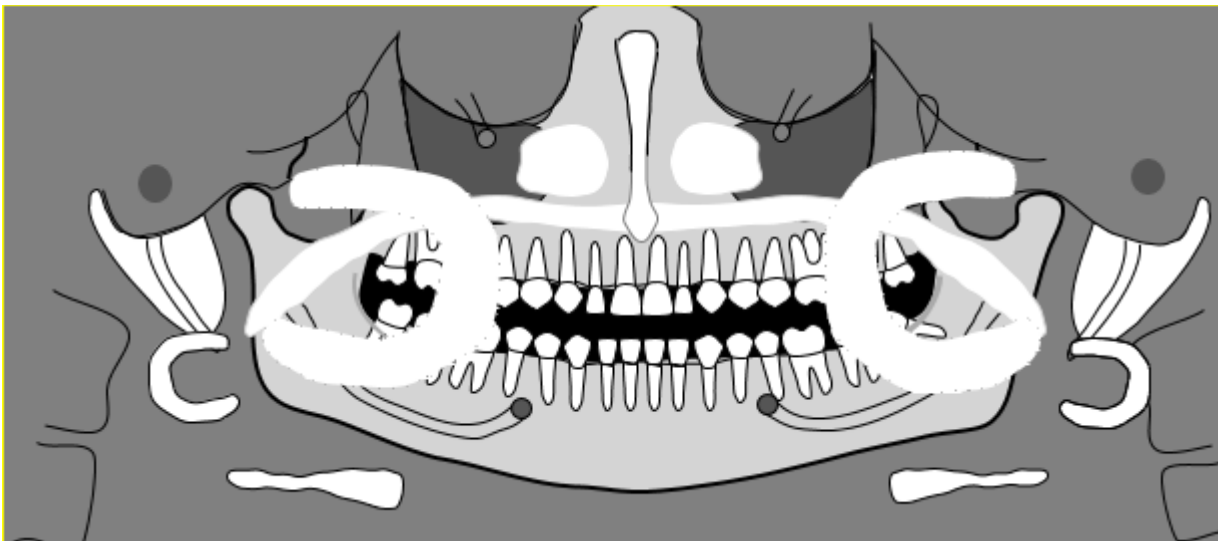
The lead apron should be placed low on the back of the patient's neck so that it does not block off the x-ray beam as the tubehead passes behind the patient. (A thyroid collar is never used for panoramic films). If the apron blocks the beam, a completely

radiopaque shadow is produced on the film overlying a portion of the mandible; no evidence of teeth or bone is seen in this area.

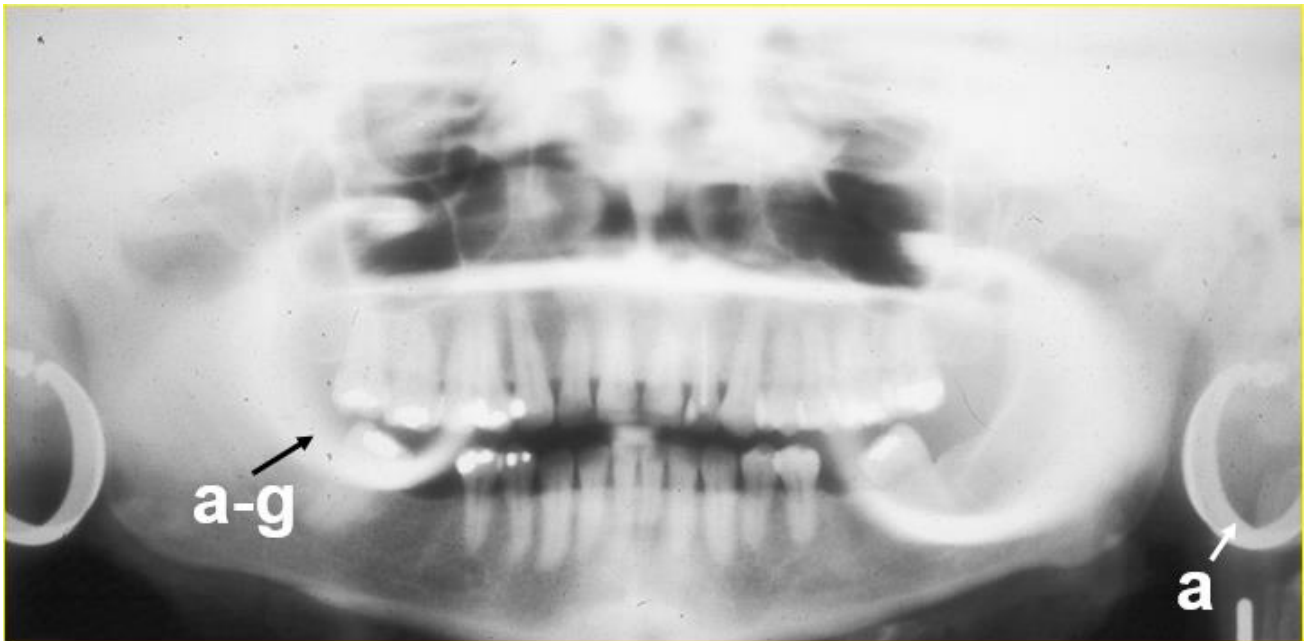


White areas on film represent lead apron being placed too high on back of neck.

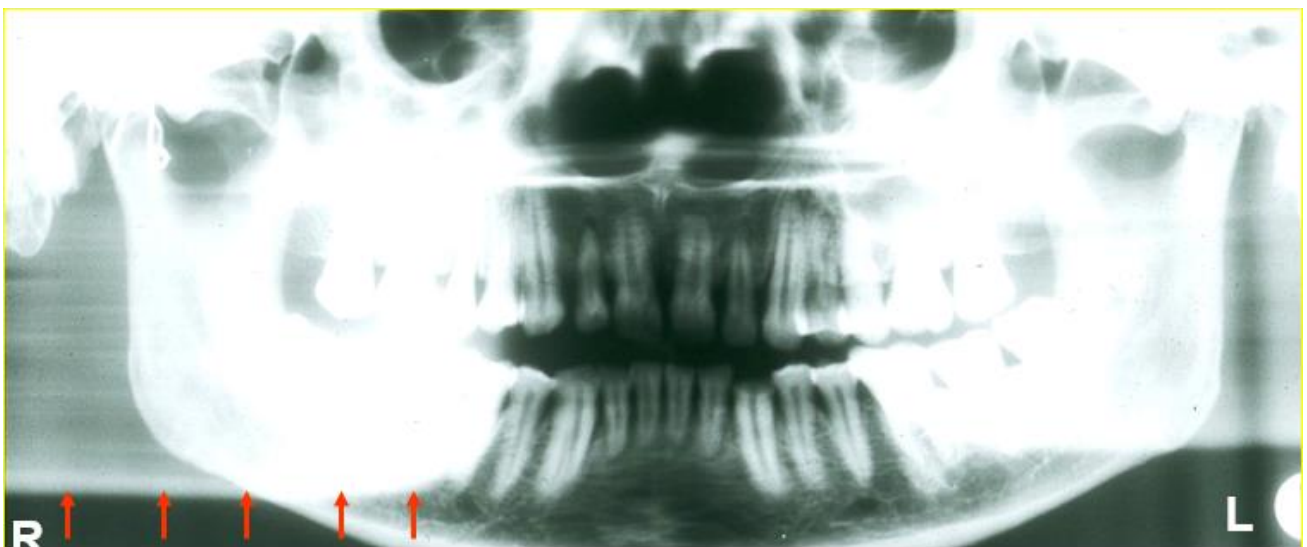
Ghost Images:



As the x-ray beam passes around the patient, objects such as jewelry or dense bone will produce a real image on the side where the object is located and a “ghost” image on the opposite side. This ghost image will have the same shape and orientation as the real image, but it will be larger and projected higher on the film and will be very blurred.

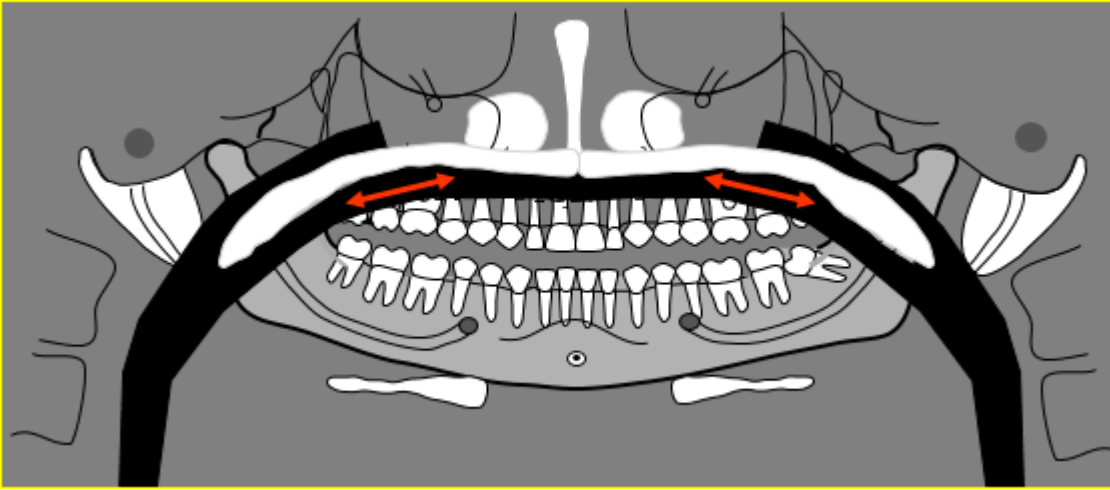


Ghost images of earrings. The ghost image (see “a-g” above) has the same shape and orientation, but is higher, larger and on the opposite side when compared to the image of the actual object (see “a” above).



The red arrows above point to the ghost image of the left side of the patient’s mandible.

Palatoglossal Air Space:

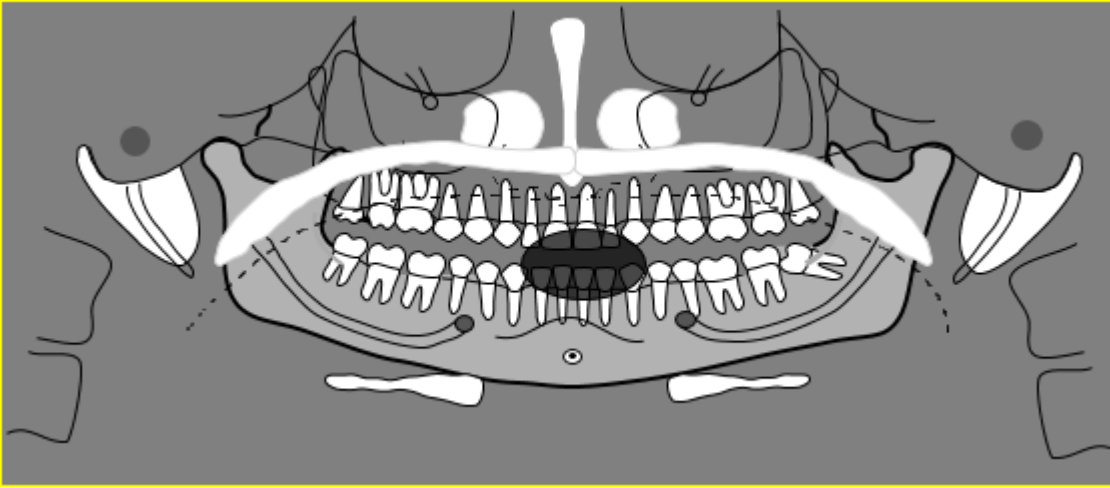


Right before exposing the film, the patient is asked to swallow (to feel the tongue elevate to contact the palate) and to keep the tongue against the palate during the entire exposure. This will help to eliminate the palatoglossal air space (see red arrows above). If this radiolucent band appears on the film, it may mask periapical radiolucencies that might be present.

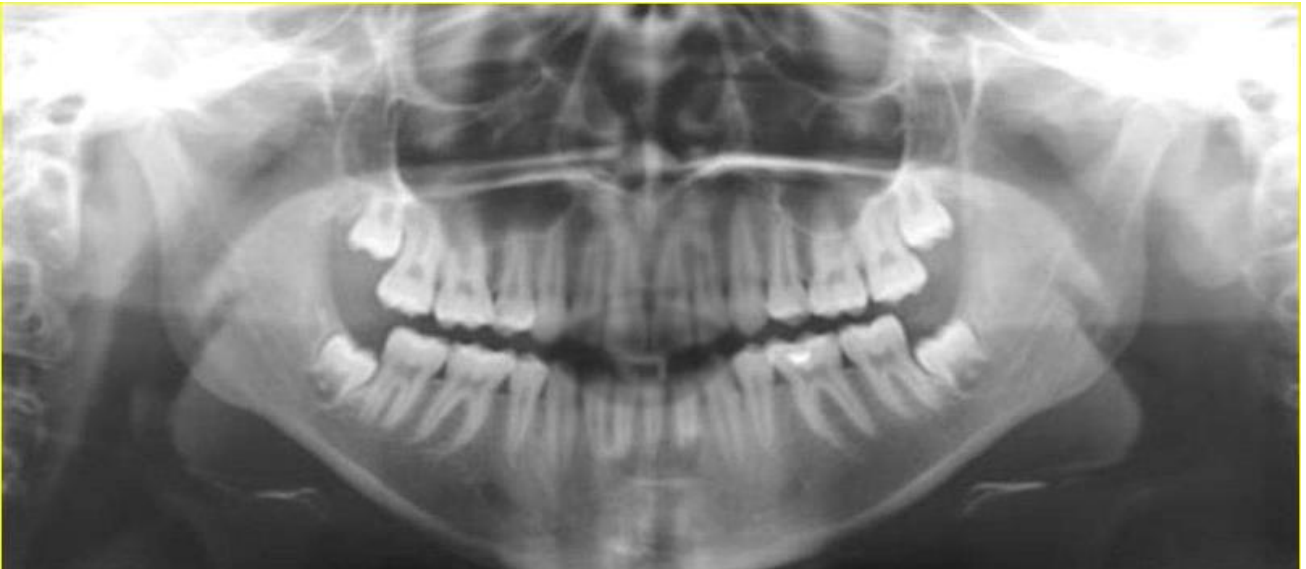


The palatoglossal air space (radiolucent band above roots of maxillary teeth) results from failure to place and maintain the tongue against the palate during exposure.

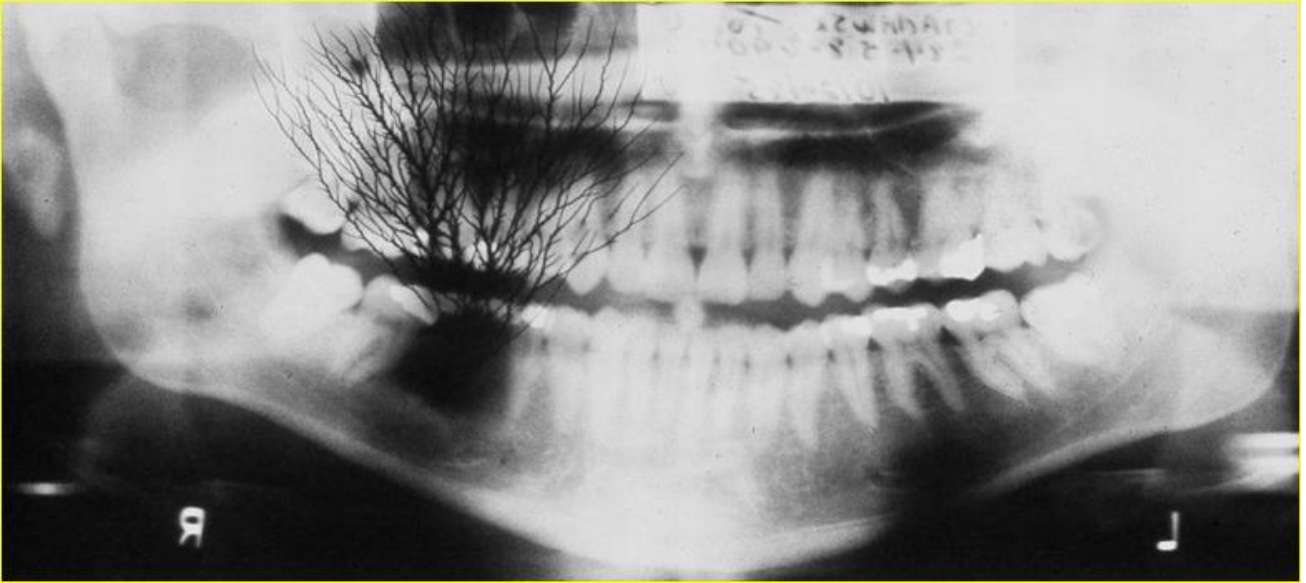
Lip Space:



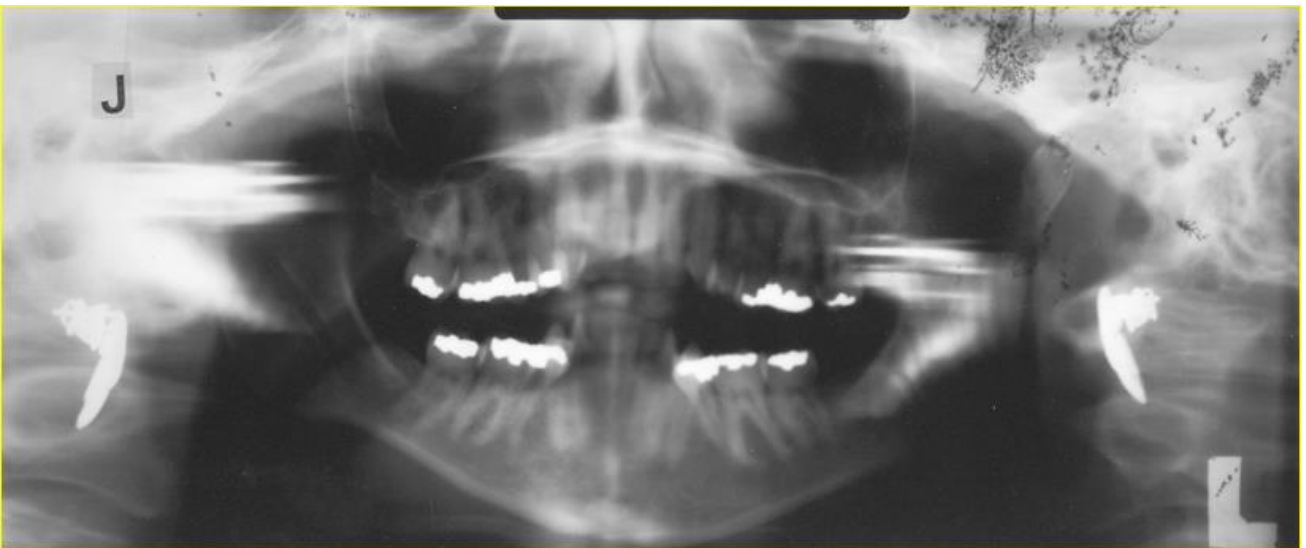
Right before exposing the film, the patient is asked to close his lips on the bite block. This will help to eliminate the lip space. If this radiolucent shadow appears on the film, it masks the crowns of anterior teeth.



Lip space



Static electricity caused by friction when removing film from box or cassette too rapidly.



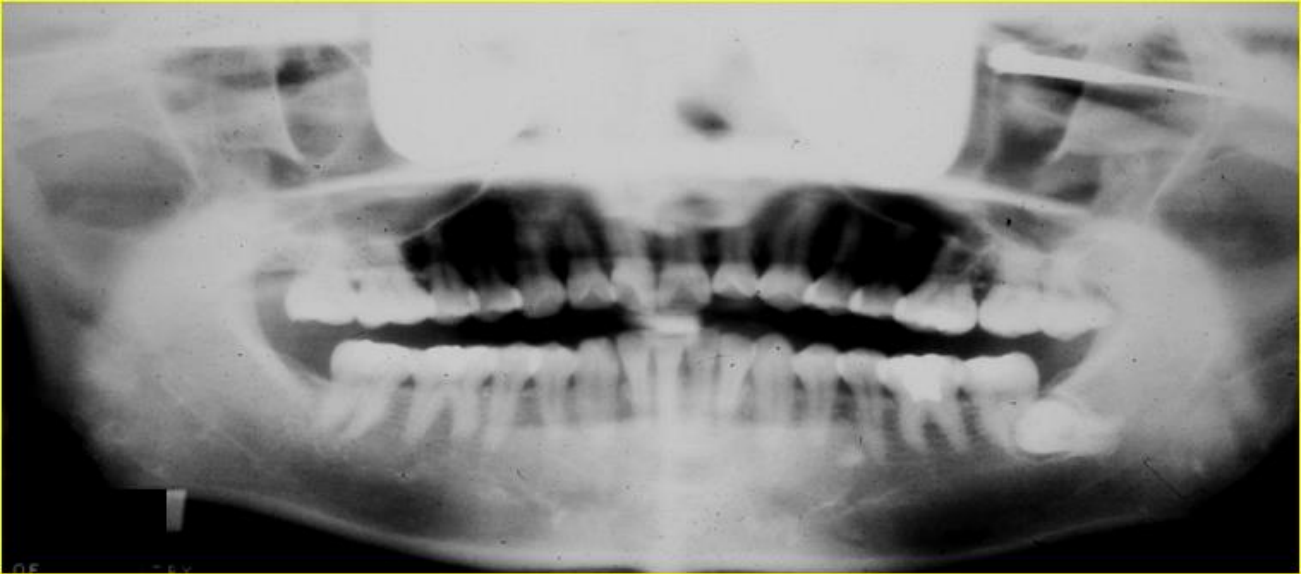
Static electricity caused by friction when removing film from box or cassette too rapidly.



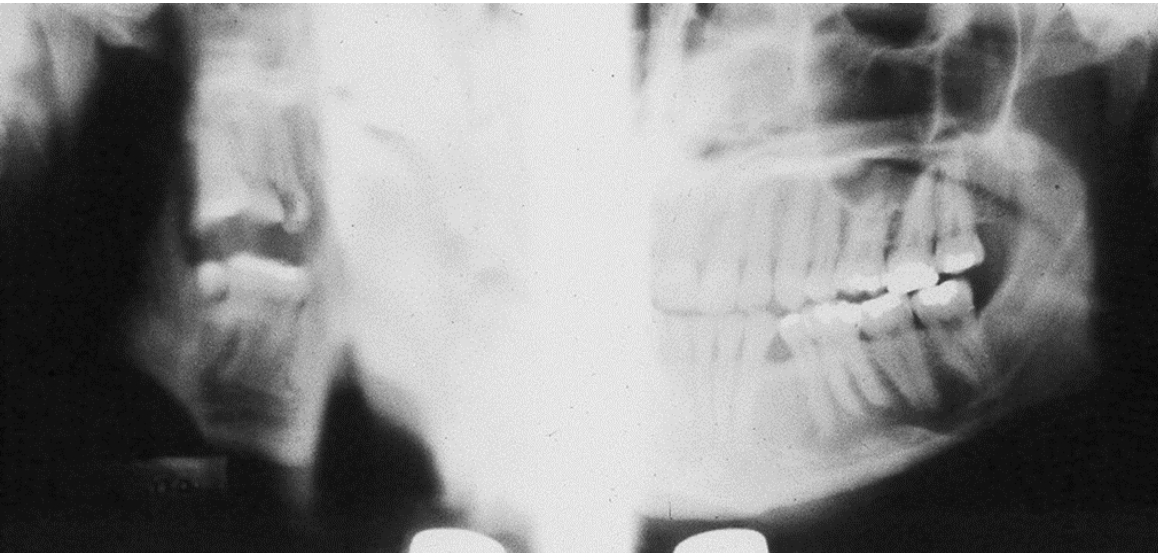
Failure to remove complete upper denture before exposure. This is usually not a problem since the denture acrylic is not dense enough to block the image of the maxillary bone.



Leaving partial dentures in the mouth for a panoramic film will usually obscure important diagnostic information as seen in the above film. Note the hearing aid in the left ear (green arrow) and its ghost image overlying the right orbit (red arrows).



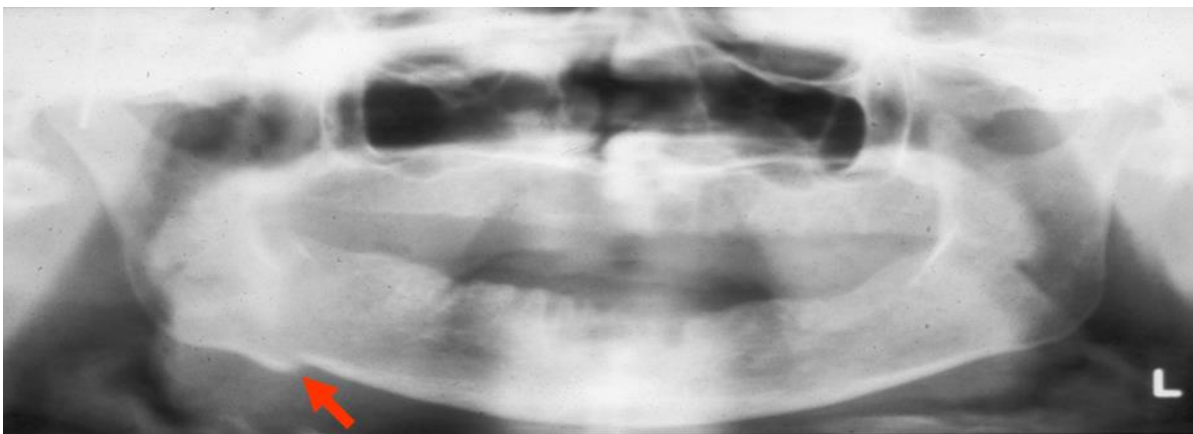
Failure to remove glasses. Also note squared-off mandible and reverse “smile”, indicating chin tipped up too much.



Patient movement.
Patient movement



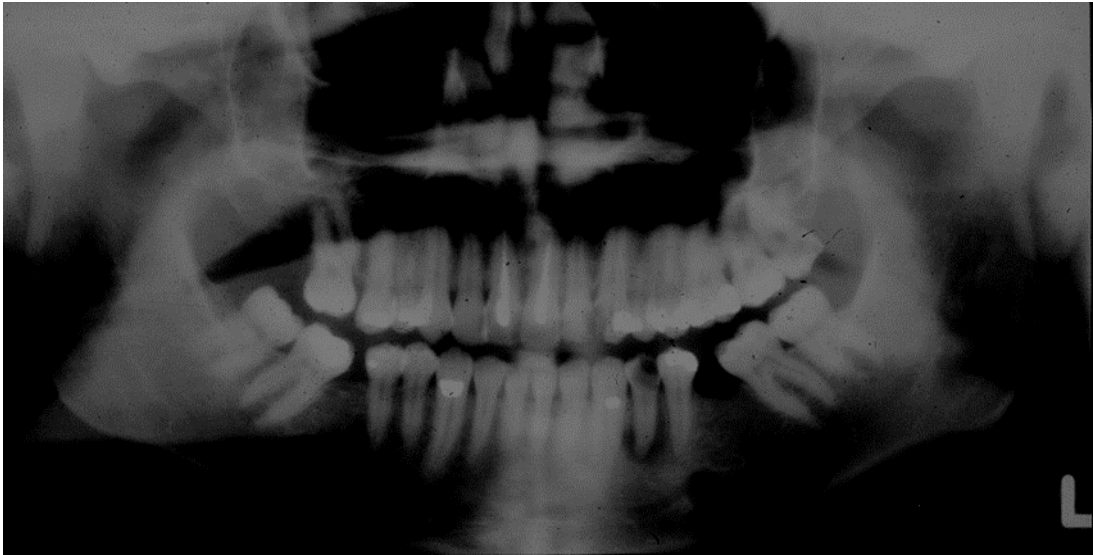
Radiograph shows image distortion due to patient movement during exposure.



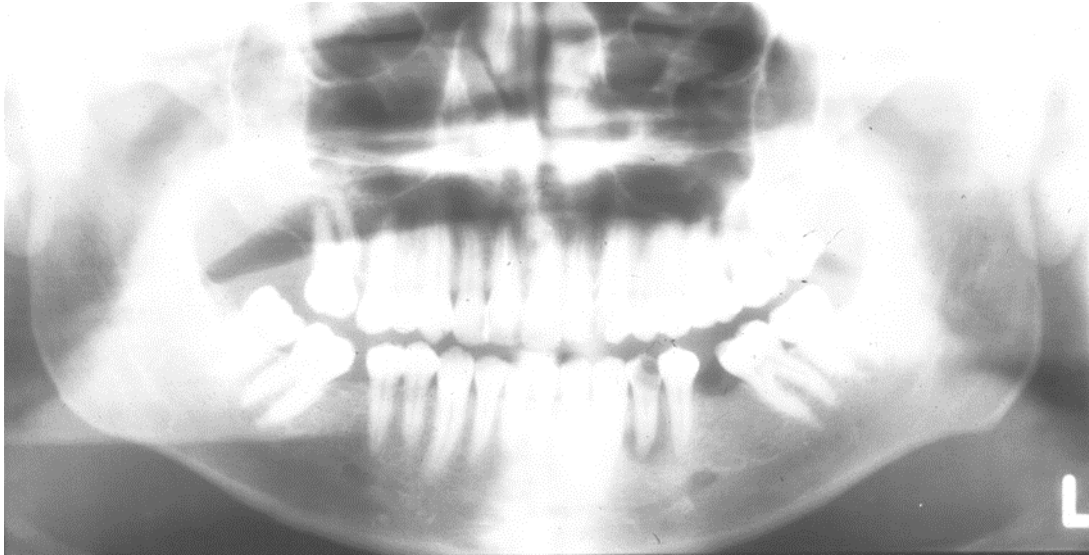
Slight patient movement indicated by notching of mandible at arrow.



Reversed Cassette



Dark image



Light image



Panoramic radiograph shows the patient failure to position the tongue against the palate, leading to a dark shadow over the maxillary teeth between the palate and dorsum of the tongue.

Panoramic Technique Errors:

- Patient Preparation Errors
- Ghost images
- Lead apron artifact

- Failure to remove metallic objects

Patient Positioning Errors:

- Positioning of the lips and tongue
- Positioning of the Frankfurt plane
- Positioning of the teeth relative to the focal trough
- Positioning of the midsagittal plane
- Positioning of the spine

Miscellaneous Technique Errors:

- Static Electricity
- Over-exposure or Under-exposure
- Reversed cassette

REFERENCES:

1. Bushberg JT, Seibert JA, Leidholdt EM, Boone JM: The Essential Physics of Medical Imaging: Lippincott Williams & Wilkins; 2011.
2. Richard R. Carlton, Arlene McKenna Adler (2005) Principles of Radiographic Imaging, Delmar.
3. White SC, Pharoah MJ: Oral radiology: principles and interpretation: Elsevier Health Sciences; 2014.