RADIOGRAPHY + PROCESSING ERRORS

Dentalelle Tutoring

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Errors in improperly exposing or processing dental films can produce undesirable dental radiographs of nondiagnostic quality. These are known as faulty radiographs. The dental x-ray specialist should be familiar with the common causes of faulty radiographs and how to prevent them.

### 3-10. UNDEREXPOSED IMAGE

An underexposed image (see figure 3-11), an image that is too light, may be caused by:

- Insufficient radiation exposure.
- Insufficient development time.
- Use of an overused developing solution.
- Use of a developing solution that is too cold.

![Figure 3-11. Underexposed image.](image)

### 3-11. OVEREXPOSED IMAGE

An overexposed image (see figure 3-12), an image that is too dark, may be caused by:

- Too much radiation exposure.
- Too much development time.
- Use of developing solution that is too warm.
3-12. BLURRED IMAGE

A blurred image (see figure 3-13) is easily recognized by the appearance of more than one image of the object, or objects, on the film. It may be caused by movement of the patient, film, or tube during exposure.

3-13. PARTIAL IMAGE

A partial image (see figure 3-14) may be caused by failure to immerse the film completely in the developing solution, contact of the film with another film during developing, or improper alignment of the central ray.
3-14. DISTORTED IMAGE

A distorted image (figure 3-15) may be caused by improper angulation of the central ray due to bending of the film packet.

3-15. FOGGED FILM

Fogged film (figure 3-16) may be caused by:

- Exposure of film to light during storage.
- Leaving film unprotected (that is, outside the lead-lined box or in the x-ray room during operation of the x-ray machine).
- Use of film that has been exposed to heat or chemical fumes.
- Use of improperly mixed or contaminated developer.
- Defective safelight.
3-16. STAINED OR STREAKED FILM

Stained or streaked film (figure 3-17) may be caused by dirty solutions, dirty film holders or hangers, incomplete washing, or solutions left on the workbench.

3-17. BLEACHED IMAGE

A bleached image (see figure 3-18) is caused by leaving the film in a freshly-mixed fixing solution too long or at a temperature that is too warm.
3-18. LEAD-FOIL IMAGE

A lead-foil image (see figure 3-19) occurs when the embossing pattern from the lead foil backing appears on the radiograph. The embossing pattern consists of raised diamonds across both ends of the film. This happens when the film is put in backwards.

3-19. NO IMAGE

No image may result if no current was passing through the tube at the time of exposure or if the film was placed in the fixing solution before it was placed in the developing solution.
3-20. RETICULATION

A reticulated film appears as a network of wrinkles or corrugations on the emulsion of the x-ray film. When reticulation occurs, the finished film has a netlike or puckered appearance resulting from swelling of the film's gelatin. Swelling is caused by sudden changes in temperature during processing, as in the transfer from a cool fixing bath to warm wash water or from a warm rinse water to a cool fixing bath.

Section IV. MOUNTING AND FILING/DISPOSING OF RADIOGRAPHS

3-21. GENERAL

Cardboard or plastic mounts for 16-film, full-mouth radiographs and bite-wing mounts are available as standard items of dental supply. Sections of these, or small paper envelopes, are used for protecting and identifying individual periapical or bite-wing radiographs. The film mounts are designed so that the film may be arranged in the same order as the teeth in the mouth. Thus, mounting not only protects and labels the radiographs, but also facilitates viewing and studying of the film, particularly in full-mouth examinations. See figure 3-20.

Figure 3-20. Full-mouth radiographic mount.

3-22. MOUNTING

In mounting radiographs, care must be taken to avoid marks from damp or perspiring fingers. Hands and fingers should be clean and dry. The film should be handled only on the edge. Under adequate illumination, the radiographs are removed one at a time from the hanger and placed carefully into the appropriate opening in the film mount. Radiographs are mounted so that the raised part of the embossed dot faces the dental specialist. In this way the radiographs are viewed from the facial aspect in correct anatomical order.

- Maxillary and mandibular radiographs may be identified by the anatomy of the teeth and surrounding structures. (See paragraphs 3-24 through 3-28 for anatomic landmarks.) Radiographs are mounted with apices of maxillary teeth directed upward and apices of mandibular teeth directed downward.
- The mesial aspect of a radiograph may also be determined by the anatomic features of tissues included on the film. If the mesial is to the right (when viewed from the facial side), it is a film taken on the patient's right side. If the mesial is to the left (when viewed from the facial side), it is a film taken of the patient's left side.

3-23. FILING AND DISPOSING

Dental radiograph holders or containers should be identified with the patient's name, address and other pertinent information, such as date and teeth, or area, included in the films.

a. The Dental Health Record. Dental radiographs needed for future treatment or follow-up observation of a patient are kept in the dental health record.
b. **Disposition of Radiographs.** Some radiographs may be kept for extended periods if the dentist deems necessary. These radiographs may serve as history with regard to future treatment of the patient.

**Section V. ANATOMIC RADIOGRAPHIC LANDMARKS**

**3-24. GENERAL**

A number of anatomic landmarks are visible in dental radiographs. Knowledge of the location and normal appearances of these landmarks is important in identification and orientation of radiographs. This knowledge is valuable to the dentist in determining whether the area is normal or abnormal. The landmarks that appear as dark areas on the film are radiolucent. The areas that appear as light areas on the film are radiopaque. Anatomic characteristics and the relationship between individual teeth are anatomic landmarks with which all dental specialists should be familiar.

**3-25. RADIOLUCENT LANDMARKS ON MAXILLARY RADIOGRAPHS**

a. **Maxillary Sinus.** The maxillary sinus (see figure 3-21) is a very prominent radiolucent structure. It sometimes appears as overlapping lobes or a single radiolucent area with a radiopaque border. The maxillary sinus is partially seen in all periapical radiographs of the bicuspido-molar area. It occupies a large part of the body of the maxilla, varying greatly in dimension, but normally extending into the alveolar process adjacent to the apices of the posterior teeth.

b. **Incisive Foramen.** The incisive foramen (see figure 3-22) is seen as a dark area located between and extending above the central incisors. In radiographs exposed from the region of the cuspid or lateral incisor, the incisive foramen may appear as a radiolucency at the apex of one of the incisors.

c. **Median Palatal Suture.** The median suture of the palate (see figure 3-23) may appear as a radiolucent line extending posteriorly from the alveolar border in the sagittal plane of the maxilla, on an anterior periapical film, or occlusal film.

d. **Nasal Fossae.** In a radiograph of the maxillary central incisors, the images of the paired fossae appear as somewhat elliptical radiolucent areas of various sizes separated by a radiopaque band representing the nasal septum (see figure 3-24).
3-26. RADIOPAQUE LANDMARKS ON MAXILLARY RADIOGRAPHS

a. **Maxillary Tuberosity.** The maxillary tuberosity (see figure 3-25) is the convex distal inferior border of the maxilla, curving upward from the alveolar process and distal of the third molar. An extension of the maxillary sinus is occasionally seen within the maxillary tuberosity.

b. **Coronoid Process of the Mandible.** The coronoid process of the mandible (see figure 3-26) sometimes appears on maxillary molar films as a triangular opaque area located in the region of or distal to the maxillary tuberosity.

c. **Zygomatic Process (Malar Bone).** The zygomatic arch (see figure 3-27) commonly appears as a well-defined radiopaque area that may be superimposed over the molar roots. Additional radiographs are sometimes made at adjusted angulation to provide a better view of the molar root area.
d. **Nasal Septum.** The nasal septum is usually seen as a white ridge extending above and between the central incisors.

### 3-27. Radiolucent Landmarks on Mandibular Radiographs

a. **Mandibular Foramen.** The mandibular foramen is seen on extraoral mandibular films as a dark area near the middle of the mandibular ramus.

b. **Mandibular Canal.** The mandibular canal (see figure 3-28) appears as a dark band with radiopaque borders running downward and forward from the mandibular foramen in the ramus to the region of the bicuspid teeth in the body of the mandible. It may be seen below the roots of the posterior teeth.

![Figure 3-28. Mandibular canal.](image)

![Figure 3-27. Zygomatic process (malar bone).](image)

### 3-28. Radiopaque Landmarks on Mandibular Radiographs

a. **Border of the Mandible.** The border of the mandible is seen as a heavy white line (see figure 3-30). A similar line does not appear on maxillary radiographs.
b. **External Oblique Ridge.** The external oblique ridge is a white line of variable density extending into the molar region as a continuation of the anterior border of the ramus of the mandible (see figure 3-31).

![Figure 3-30. Border of the mandible.](image)

![Figure 3-31. External oblique ridge.](image)

c. **Genial Tubercles.** Genial tubercles are seen as round white areas, having dark centers, located below and between the central incisors (see figure 3-32).

![Figure 3-32. Genial tubercles.](image)

d. **Mental Process (Mental VRidge).** The mental ridge may appear as a dense white ridge of varying density extending from the anterior midline to the bicuspid region, usually located below the anterior teeth, but occasionally superimposed over the apices.
e. **Mylohyoid Ridge (Internal Oblique Ridge).** The mylohyoid ridge appears as a white line of varying width and intensity, extending from close to the lower border of the symphysis of the mandible, upward and distally, to end beyond the third molar. It reaches its greatest prominence in the molar region. It is generally not a prominent feature.

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Section II. BISECTING (SHORT-CONE) PERiapICAL EXPOSURE TECHNIQUES

4-6. GENERAL

A short cone is used to take x-rays with bisecting angle exposure techniques.

The target-film distance is 8 inches. The resulting image x-ray is somewhat larger using the short cone rather than using a long cone (see figure 4-1). The bisecting plane is halfway between the plane of the dental film and the longitudinal axis of the tooth. The average angle of projection is the angle between the occlusal plane and the angle of the central ray. The angle of the central ray is in relation to the bisecting plane.

![Figure 4-1. Comparison of 8-inch and 16-inch target-film distances.](image)

4-7. POSITIONING THE PATIENT

Standard radiographic procedures include precise positioning of the patient's head as one step in placing film. The tissues to be radiographed and the x-ray beam must be in proper relationship to produce an accurate radiographic image. This is particularly important when using the bisecting angle technique. In adjusting the backrest and headrest, it is important to make the patient as comfortable as possible to minimize movement during exposure. As in
photography, movement during exposure will result in a blurred image. Blurring may be greatly reduced through the use of ultra-speed film.

a. **Head Positioning in Radiography of the Maxilla Using the Bisecting Technique.** In radiography of the maxilla, the head should be positioned so that the occlusal surfaces of the maxillary teeth are in a horizontal plane (see figure 4-2). This is done by adjusting the headrest so that the median plane (sagittal plane) is vertical and a line from the ala of the nose to the tragus of the ear is horizontal.

![Figure 4-2. Head position for making maxillary periapical radiographs.](image)

b. **Head Positioning in Radiography of the Mandible Using the Bisecting Technique.** In periapical radiography of the mandible, the head should be positioned so that the occlusal surfaces of the mandibular teeth will be horizontal when the mouth is opened to the position in which the radiographs are to be made (see figure 4-3). This is done by adjusting the headrest so the median plane is vertical and a line from the corner of the mouth to the tragus of the ear is horizontal.
Angulation. When the cone is adjusted to project the central beam upward, it will be set at a negative (−) degree angulation. When it is adjusted to project the central beam downward, it will be set at a positive (+) angulation.

4-8. CENTRAL RAY ANGULATION

The angle of the x-ray beam, the average angle of projection of the central ray, is essential for successful use of the bisecting exposure techniques. Both vertical and horizontal angulations must be considered.

a. Vertical angulation is the up-and-down movement of the tube head or x-ray beam. The correct vertical angulation exists when the central ray is directed perpendicular to the bisector of the angle formed by the long axis of the tooth and the plane of the film (see figure 4-4). When this angulation is correct, the vertical dimension of the tooth will be as realistic as possible. Incorrect vertical angulation may cause two problems—foreshortening or elongation.

(1) Foreshortening exists if the vertical angulation is larger than necessary. The image of the teeth appears smaller than normal (see figure 4-5).
(2) **Elongation** exists if the vertical angulation is less than is necessary. The image of the teeth appears larger than normal (see figure 4-6).

Figure 4-5. Foreshortened image caused by projection of central ray from an angle that is too great.

Figure 4-6. Elongated image caused by projection of central ray from an angle that is too small.

b. **Horizontal angulation** is the side-to-side movement of the tube head or x-ray beam. Correct horizontal angulation for successful radiographs exists when the central ray is perpendicular to the facial surfaces of the teeth and parallel to the mesial and distal surfaces (see figure 4-7). If the horizontal angulation is incorrect, overlapping will occur on the radiograph. Overlapping results when the proximal surfaces of adjacent teeth are superimposed over one another (see figure 4-8). When this occurs, there will be a light area where the two teeth are overlapped or superimposed. The resultant light area is the inability of the x-ray beam to penetrate the two dense surfaces. Correct horizontal and vertical angulation of the x-ray beam is necessary to obtain radiographs of diagnostic quality.
4-9. OVERVIEW OF THE BISECTING ANGLE EXPOSURE TECHNIQUES

a. The bisecting method of periapical radiography is used to varying degrees in Army dental clinics. The dental specialist should be familiar with its techniques. The following paragraphs describe techniques using this method to produce a 14-exposure set of radiographs of an adult dentition. Discussion of the techniques for exposure of each area of the mouth will include illustrations and descriptions of film placement, film holding, direction of the central ray, and average angulation. Slight contouring of a corner may facilitate film placement in restricted areas of the mouth, such as those of the maxillary incisors or the maxillary third molar, and make it more comfortable. To shape the film, press it over the rounded contour of a finger to pre-adapt it to the position in the mouth. Use only slight contouring to prevent distortion of the image. (A flat image produces the best image.) Paragraph 4-7 covers proper head positioning and other instructions for intraoral radiography.
b. Various film holding devices may be used to secure the film in place when using the bisecting technique: the Rinn EEZEE-GRIP Film Holder, a hemostat, a plastic or Styrofoam film holder (with 105º angle) (see figure 4-9). When such film holding devices are not available, the finger or thumb may be used.

Figure 4-9. Film holding devices for the bisecting technique.

4-10. MAXILLARY MOLARS

Adjust the head as described for radiographs of maxillary teeth (refer to paragraph 4-7a). Place the film packet in the mouth so that its long axis is horizontal, the anterior border of the film is lingual to the mesial border of the second bicuspid, and the lower border of the film is parallel to and slightly below (approximately 1/4 inch) the occlusal surfaces of the molars. The upper corner of the packet may be contoured slightly but the film packet should not be bent. Adjust the tube to an average angulation of +20º. Direct the central ray straight through the interproximal spaces in the area of the second molar and perpendicular to the bisecting plane (see figure 4-10). Follow the manufacturer's instructions for all exposure times.
4-11. MAXILLARY BICUSPIDS

Adjust the head as described for radiographs of maxillary teeth. Place the film packet in the mouth so that its long axis is horizontal and its anterior border is lingual to the mesial surface of the cuspid. Have its lower border paralleled to, and slightly below, the occlusal surfaces of the teeth (approximately 1/4-inch). Adjust the cone to an average angulation of +30°. Direct the central ray straight through the interproximal spaces of the first and second bicuspids at the center of the film and perpendicular to the bisecting plane (see figure 4-11). Follow the manufacturer’s instructions for all exposure times.

4-12. MAXILLARY CUSPIDS
Adjust the head as described for radiographs of maxillary teeth. Place the film packet in the mouth so that its long axis is vertical and its lower border is parallel to and slightly below (approximately 1/8 inch) the incisal edges of the lateral incisor and cuspid teeth. The anterior border of the film should lie lingual to the central incisor of the same side. The upper anterior corner of the film may be contoured slightly to fit the curvature of the maxillary arch. Adjust the cone to an average angulation of $+45^\circ$. Direct the central ray straight at the cuspid at the level of the root and perpendicular to the bisecting plane (see figure 4-12). Follow the manufacturer’s instructions for exposure times.

Figure 4-12. Maxillary cuspid area.

4-13. MAXILLARY INCISORS

Adjust the head as described for radiography of maxillary teeth. Gently contour both long borders of the film slightly in the direction of the curvature of the palate. Place the film packet in the mouth so that its long borders are vertical and its center is in line with the median plane of the upper arch. Have the lower border of the packet slightly below (approximately 1/8 inch) and parallel to the incisal edges. Adjust the tube to an average angulation of $+40^\circ$. Direct the central ray to pass through the tip of the nose in line with the median plane and perpendicular to the bisecting plane (see figure 4-13). Follow the manufacturer’s instruction for exposure times.

Figure 4-13. Maxillary incisor area.

4-14. MANDIBULAR MOLARS

Adjust the head as described for radiographs of mandibular teeth (paragraph 4-7b). Place the packet in the mouth with the long axis horizontal and the upper border of the film parallel to, and slightly above (approximately 1/4 inch) the occlusal surfaces of the molar teeth. Relieve the lower anterior border by contouring. Place the packet alongside
the tongue and far enough distally to include the entire third molar area. Impacted or malposed mandibular teeth may require special positioning of the film packet. Adjust the tube to an average angulation of -5°. Direct the central ray straight through the interproximal spaces at the center of the film and perpendicular to the bisecting plane (see figure 4-14). Follow the manufacturer's instructions for exposure times.

4-15. MANDIBULAR BICUSPID S

Adjust the head as described for radiographs of mandibular teeth. Place the film packet in the mouth with its long axis horizontal and its upper border parallel to and slightly above (approximately 1/4 inch) the occlusal surfaces of the teeth. Locate the anterior border of the film lingual to the mesial surface of the cuspid. The lower anterior border of the film should be contoured slightly to fit the curvature of the mandibular arch. Adjust the tube to an average angulation of -10°. Direct the central ray straight through the interproximal spaces at the center of the film and perpendicular to the bisecting plane (see figure 4-15). Follow the manufacturer's instructions for exposure times.

4-16. MANDIBULAR CUSPID S

Adjust the head as described for radiographs of mandibular teeth. Place the film packet in the mouth with its long axis vertical and its upper border parallel to and slightly above (approximately 1/8 inch) the incisal edges of the lateral incisor and cuspid teeth. The film's anterior border should be located lingual to the distal surface of the opposite central incisor. Adjust the tube to an average angulation of -20°. Direct the central ray straight through the bisecting plane (see figure 4-16). Follow the manufacturer's instructions for exposure times.
4-17. MANDIBULAR INCISORS

Adjust the head as described for radiographs of mandibular teeth. Place the film packet in the mouth with the long axis vertical. Both the long borders of the packet should be placed under the tongue with the center of the film opposite the midline of the arch and the upper border parallel to and slightly above (approximately 1/8 inch) the incisal edges of the incisor teeth. Adjust the tube to an average angulation of -15°. Direct the central ray straight through the interproximal spaces at the center of the film and perpendicular to the bisecting plane (see figure 4-17). Follow the manufacturer’s instructions for exposure times.

Section III. PARALLELING (LONG-CONE) PERIAPICAL EXPOSURE TECHNIQUES

4-18. GENERAL

A long cone is used to take x-rays with paralleling exposure techniques. Periapical film is held parallel to the long axis of the tooth using film-holding instruments. The central ray is directed to pass at a perpendicular angle to both the tooth and the film. Since the slope and curvature of the dental arches and the alveolar processes will not permit the film to be held close to the teeth and still be parallel to their long axes, the film must be held away from the teeth. This
method provides a target-film distance of approximately 16 inches, in contrast to 8 inches for the bisecting technique (see figure 4-1). The increase in the target-film distance is related to the size of the image produced. If the film is held away from the tooth and the target-film distance kept at 8 inches, enlargement of the image would be unavoidable. Enlargement is minimized, however, by increasing the target-film distance to 16 inches, thus using the parallel rays. An extension cone is used (see figure 4-18) to increase the target-film distance.

![Figure 4-18. Long cone on x-ray unit.](image)

4-19. ASSEMBLY OF FILM-HOLDING INSTRUMENTS

The instruments used to hold the film parallel to the teeth are plastic bite-blocks, indicator rods, and plastic locator rings.

a. **Anterior Instrument.** The anterior instrument (see figure 4-19) is assembled and used as follows.
Figure 4-19. Anterior instrument assemblage.

(1) The shielded or printed side of the film packet is placed against the backing support of the bite-block.
(2) It is inserted vertically into the slot by using a downward motion and, at the same time, placing slight pressure against the backing support to open the slot.
(3) There is an embossed dot on the corner of the periapical film. This embossed dot is always placed in a downward position when placing the film into the slot on the plastic bite-block.
(4) The offset position of the indicator rod is held away from the biting surface of the block. The pins are inserted in the proper holes.
(5) The plastic locator ring is fitted onto the indicator rod opposite the film packet.
(6) The assembly is then positioned in the mouth.

b. **Posterior Instrument.** The posterior instrument (see figure 4-20) is assembled and used as follows:

(1) The shielded, printed or broken side of the film packet is placed against the backing support of the bite-block.
(2) It is inserted horizontally into the slot by using a downward motion and, at the same time, placing slight pressure against the backing support to open the slot.
(3) The embossed dot on the corner of the film is also placed in a downward position when placed in the plastic bite-block.
Figure 4-20. Posterior instrument assemblage.

(4) The right angle portion of the indicator rod is held anterior to the bite-block and away from the film.
(5) The pins are inserted into the proper holes. (The three holes allow a choice for the desired lingual positioning of the film.)
(6) The plastic locator ring is fitted onto the indicator rod opposite the film packet.
(7) The assembly is then positioned in the mouth.

4-20. MAXILLARY MOLARS

Position the posterior instrument assembly in the patient's mouth, with the plastic bite-block centered on the second molar (see figure 4-21). Be sure that the anterior edge of the film is adjacent to the distal of the second bicuspid. Parallel the film with the long axis of the molars. Place a cotton roll between the underside of the teeth and the block and have the patient close his teeth in order to maintain the film position. Move the locator ring along the indicator rod to approximately the skin surface and align the x-ray unit extension tube with the rod and the ring on horizontal and vertical planes.
4-21. MAXILLARY BICUSPIDS

Position the posterior instrument assembly in the patient's mouth with the bicuspids centered on the film parallel to the long axis of the teeth (see figure 4-22). Some patients have small mouths. Therefore, the bicuspids may not be centered on the film. The first priority is to parallel the film to the two bicuspids both vertically and possibly touching the anterior hard palate. Gently contour the anterior superior corner of the film to aid positioning. With the bite-block held on the occlusal surfaces of the maxillary bicuspids, insert a cotton roll between the underside of the block and the mandibular teeth. Have the patient close his teeth holding the film in place. Slide the locator ring along the indicator rod to approximate the skin surface and align the x-ray unit extension tube with the rod and the ring on the horizontal and vertical planes.
4-22. MAXILLARY CUSPIDS

Using the anterior instrument assembly, position the cuspid tooth on the film parallel to the long axis of the tooth and center it (see figure 4-23). Gently contour the anterior corner of the film to maintain position. With the block resting on the maxillary cuspid, insert a cotton roll between the block and the mandibular teeth. Have the patient close his teeth.
holding the film in place. Slide the locator ring along the indicator rod bringing it close to the skin surface and align the x-ray unit extension tube with the rod and the ring on the vertical and horizontal planes.

Figure 4-23. Maxillary cuspid area.

4-23. MAXILLARY INCISORS

Using the anterior instrument assembly, center the film parallel to the long axis of the incisors, ensuring that it is lined up with the midline (see figure 4-24). Use the full length of the block to position the film distally to the region of the first molar. With the block resting on the incisal edges of the teeth to be x-rayed, insert a cotton roll between the mandibular incisors and the block. Have the patient close his teeth holding the film in place. Slide the locator ring along the indicator rod bringing it close to the skin surface and align the x-ray unit extension tube with the rod and the ring on the vertical and horizontal planes.
4-24. MANDIBULAR MOLARS

Position the posterior instrument assembly with the plastic bite-block centered on the second molar (see figure 4-25). Assure that the anterior edge of the film is adjacent to the distal end of the second bicuspid. Ensure that the film is parallel with the long axis of the molar teeth. Place a cotton roll between the block and the opposing maxillary teeth and have the patient close his teeth holding the film in place. Slide the locator ring along the indicator rod bringing it close to the skin surface and align the x-ray unit extension tube with both the rod and the ring on the horizontal and vertical planes.
4-25. MANDIBULAR BICUSPIDS

Position the instrument assembly in the patients mouth with the bicuspids centered on the film assuring that the film is parallel both vertically and horizontally. Centering the bicuspids may not be possible in patients with small mouths. Therefore, position the film in the center of the mouth as far forward as possible, touching the curvature of the lower arch (see figure 4-26). Parallel film placement is the key; it prevents dimensional distortion and overlapping. With the plastic bite-block held in place by the occlusal surfaces of the mandibular bicuspids, insert a cotton roll between the block and the maxillary teeth. Have the patient close his teeth holding the film in place. Slide the locator ring along the indicator rod bringing it close to the skin surface and align the x-ray unit extension tube with both the rod and the ring on the horizontal and vertical planes.
4-26. MANDIBULAR CUSPIDS

Using the anterior instrument assembly, center the cuspid on the film, parallel with the long axis of the tooth (see figure 4-27). With the bite-block resting on the mandibular cuspid, insert a cotton roll between the block and the maxillary teeth. Have the patient close his teeth, holding the film in place. Slide the locator ring along the indicator rod bringing it close to the skin surface and align the x-ray unit extension tube with the rod and the ring on the vertical and horizontal planes.
4-27. MANDIBULAR INCISORS

Using the anterior instrument assembly, center the film parallel to the long axis of the incisor teeth (see figure 4-28). Ensure that the film is situated along the midline of the teeth. The positioning can be accomplished by lingual placement of the film to the area of the second bicuspids. With the bite-block resting on the incisal edges of the maxillary incisor teeth. Have the patient close his teeth holding the film in place. Slide the locator ring along the indicator rod bringing it close to the skin surface and align the x-ray unit extension tube with the rod and the ring on the vertical and horizontal planes.
Figure 4-28. Mandibular incisor area.

Section IV. BITE-WING (INTERPROXIMAL) EXPOSURE TECHNIQUES
4-28. GENERAL

Bite-wing film has many uses. The main use is to detect decay between teeth (including depth of caries) by obtaining an image of the crowns of the teeth without the distortion that often occurs in a periapical examination. This is made possible by using a low vertical angle of projection with the film packet held in a nearly vertical position. No attempt is made to include the apices of the teeth. Bite-wing film is also used to detect calculus and to examine the alveolar crest, margins of restorations, and the pulp chamber. Both the maxillary and mandibular teeth of an area are shown on one film.

4-29. MOLARS AND BICUSPIDS (POSTERIOR TEETH)

For radiographs of posterior teeth, adjust the head so that the occlusal surfaces of the maxillary teeth lie in a horizontal plane. Place a film packet in the mouth so that the resulting radiograph will include the desired teeth. The lower part of the film will lie between the tongue and the mandibular ridge; the upper part will lie against the roof of the mouth. Have the patient slowly close his teeth on the tab. Adjust tube to an average angulation of +8°. Direct the central ray to pass straight through the interproximal spaces to the center of the film at the level of the occlusal plane (see figure 4-29). Follow the manufacturer’s instructions for exposure times.

![Figure 4-29. Posterior bite-wing technique.](image)

4-30. CENTRAL AND LATERAL INCISORS AND CUSPIDS (ANTERIOR TEETH)

Periapical film with an adapter is used for bite-wing radiographs of anterior teeth. Head positioning for anterior bite-wing exposures is the same as for the posterior teeth. Refer to paragraph 4-29. However, a bite-wing radiograph of anterior teeth is seldom requested by a dentist.

a. **Central Area.** Place the film packet in the mouth with the center of the film in line with the median plane. The lower part should be placed between the tongue and mandibular ridge. The upper part is then allowed to lie against the roof of the mouth. Have the patient bite tightly end-to-end against the tab. Adjust the tube to an angulation of +8°. Direct the central ray through the interproximal spaces between the central incisors at the level of the incisal plane. Follow the manufacturer’s instructions for exposure time.
b. **Lateral and Cuspid Area.** Place the packet as specified for the central incisor region. Instruct the patient to bite very gently against the tab to hold it in position. Shift the tab distally until its mesial surface of the film is located at the midline of the arch between the central incisors. Then instruct the patient to bite firmly end-to-end against the tab. Adjust the tube to an angulation of +8º. Direct the central ray straight through the lateral incisor at the level of the incisal plane. Follow the manufacturer's instructions for exposure time.

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Section V. OCCLUSAL EXPOSURE TECHNIQUES

4-31. GENERAL

At times, more extensive radiographic views of oral tissues are desired than are obtainable with periapical or bite-wing film. These views are made by using occlusal film (refer to paragraph 4-3c). The occlusal film will always be exposed through the unbroken side. Periapical film is used at times to obtain occlusal views in children and views of small areas in adults. Follow the manufacturer's instructions for exposure times.

a. **Maxillary Head Positioning.** In all maxillary occlusal techniques, the patient's head is first adjusted so that the median plane (sagittal plane) of the face is in a vertical position and the occlusal surfaces of the maxillary teeth are in a horizontal plane (parallel to the floor). The x-ray is taken through the facial bones. The film is held in place by the patient's teeth, closed gently but firmly against the film packet.
b. **Mandibular Head Positioning.** In the mandibular full and posterior occlusal techniques, the patient is tilted back so that the x-ray is taken through the body of the mandible. In the anterior occlusal technique, the x-ray is taken through the chin. The patient holds the film in place by closing his teeth gently but firmly against the film.

### 4-32. MAXILLARY FULL OCCLUSAL

Position the film packet carefully in the mouth with its short axis in line with the median plane and the film placed far enough distally to include all the teeth. Adjust the tube so that the point of the cone is at the hairline of the forehead, in the median line, and directed downward and perpendicular to the plane of the packet (see figure 4-30).

![Figure 4-30. Maxillary full occlusal view technique.](image-url)
Place the film packet in the mouth with its short axis in line with the median plane. Adjust the tube so that the central ray is directed along the median line and at an angulation of $+65^\circ$ to pass through the bridge of the nose to the film packet (see figure 4-31).

**Figure 4-31.** Maxillary anterior occlusal view technique.

4-34. MAXILLARY POSTERIOR OCCLUSAL
• Place the film packet in the mouth on the side to be radiographed with its long axis parallel to the median plane. Adjust the tube to a vertical angulation of +60°.
• Direct the central ray to pass through the ala of the nose and apical region of the cuspid and first bicuspid to the plane of the film packet (see figure 4-32).

Figure 4-32. Maxillary posterior occlusal view technique.

4-35. MANDIBULAR FULL OCCLUSAL
Tilt the head back so that the occlusal plane of the mandibular teeth is at right angles to the horizontal plane with the median plane (sagittal plane) of the face in a vertical position. Place the film packet in the mouth with its short axis in line with the median plane and its posterior border in contact with the mandibular rami. Adjust the tube to direct the central ray along the median plane so as to be perpendicular to the film packet. The ray should pass through the floor of the mouth and the body of the mandible to the center of the film (see figure 4-33).

4-36. MANDIBULAR ANTERIOR OCCLUSAL

Tilt the head backward so that the occlusal plane of the mandibular teeth is at a +55° angle to the horizontal and median plane. Position the film in the mouth with its short axis in line with the median plane. Adjust the tube to direct the central rays through the point of the chin at a +55° angle to the plane of the packet (see figure 4-34).
4-37. MANDIBULAR POSTERIOR OCCLUSAL

Position the head so that the occlusal plane of the mandibular teeth is perpendicular to the horizontal plane and the median plane of the face is vertical. Place the film packet in the mouth so that it is centered over the teeth on the side to be radiographed. Adjust the tube so that the central ray will pass from below the mandible and through the second molar at a perpendicular angle to the plane of the film packet (see figure 4-35).
Figure 4-35. Mandibular posterior occlusal view technique.