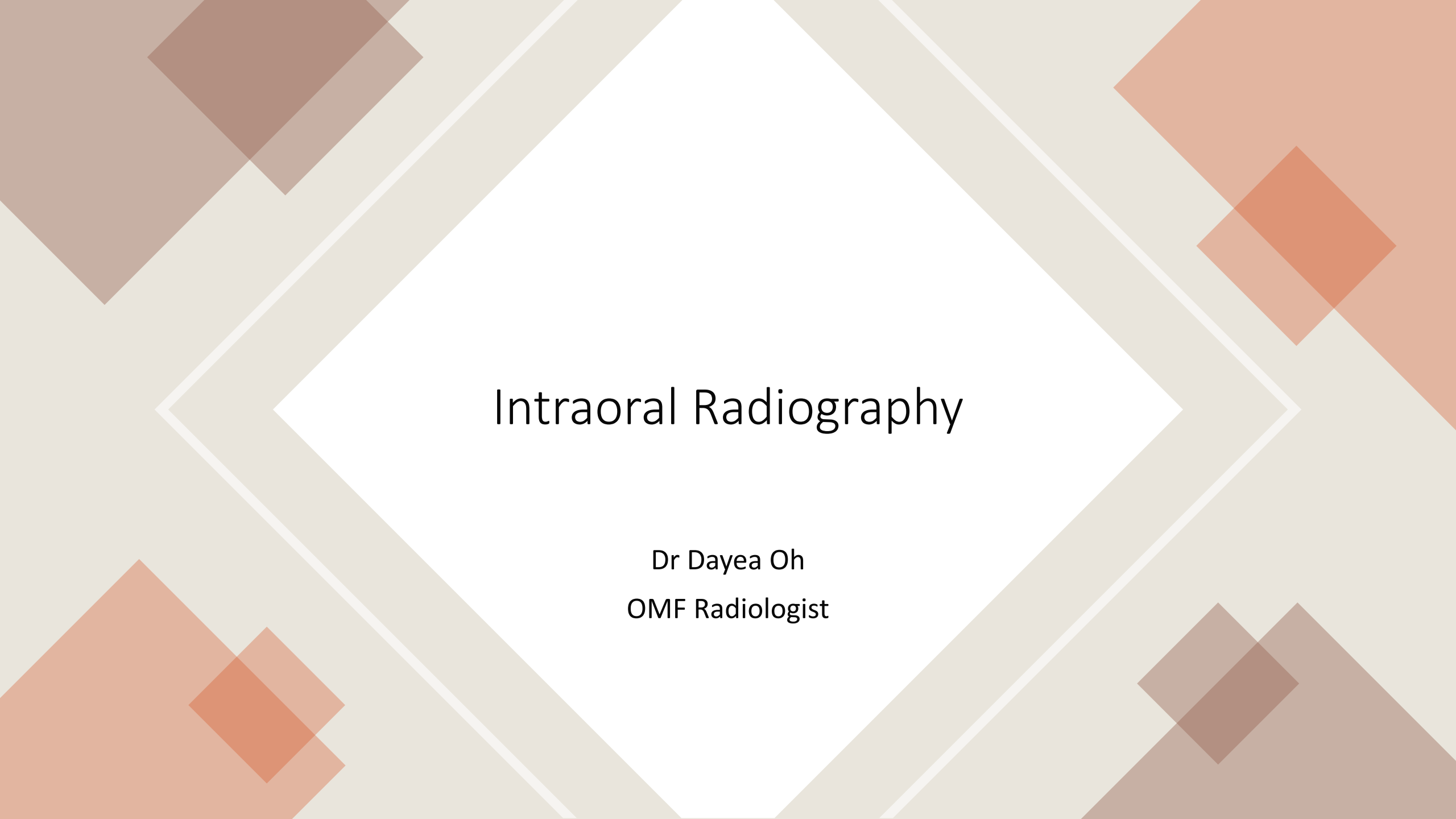




Intraoral Radiography

Dr Dayea Oh
OMF Radiologist

Learning Objectives

- By the end of the lecture, the student should be able to:
 - Understand Intraoral Radiography **techniques**:
 - Bitewing radiographs
 - Periapical radiographs
 - Parallelism
 - Bisecting Angle
 - Occlusal radiographs
 - Understand localisation of an object using intra-oral radiographs
 - SLOB rule
 - Know technical errors in taking intraoral radiographs

Basic Radiographic Terminology

Radiopaque vs Radiolucent

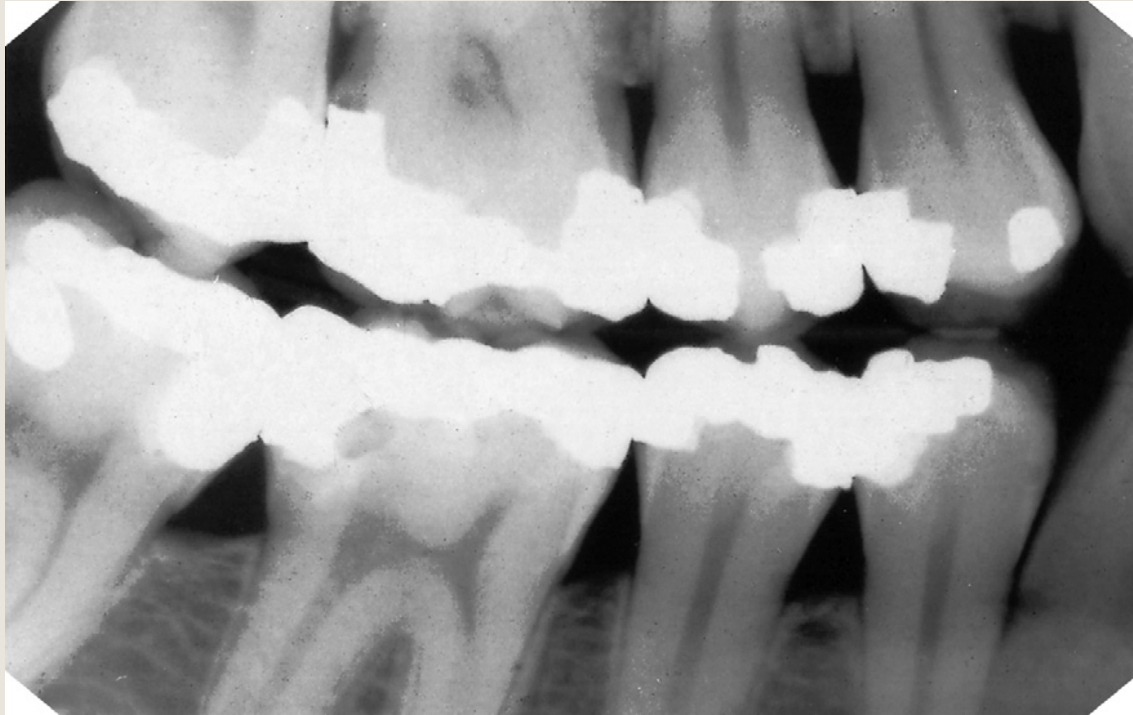
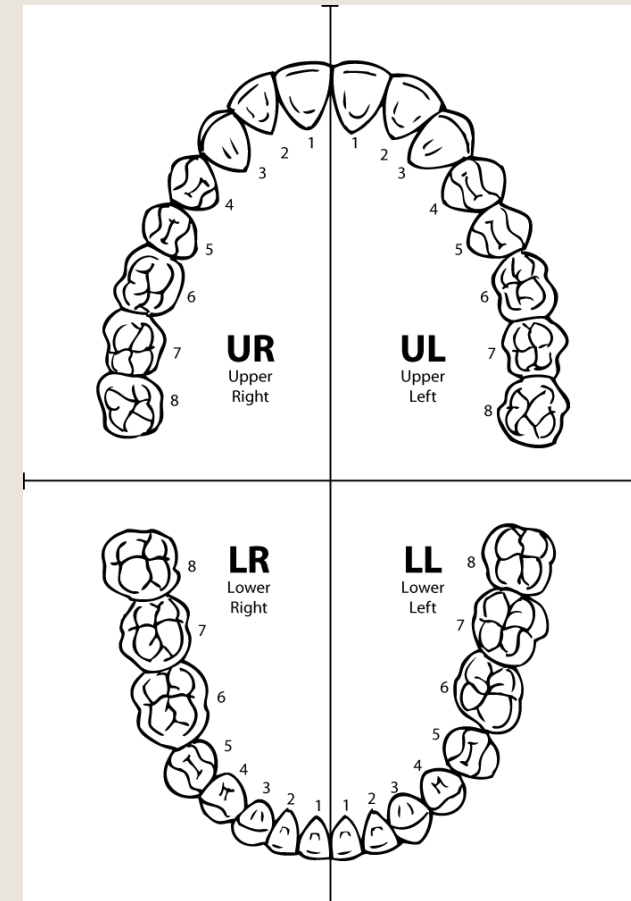


Fig. 1.1 A typical dental radiograph. The image shows the various black, grey and white radiographic shadows. The metallic amalgam fillings have totally stopped the X-ray beam so they appear white or *radiopaque*.

← Right Posterior
Bitewing Radiograph



Conventional Radiograph = 2D picture made up of a variety of black, white and grey superimposed shadows

- The white or **radiopaque** shadows on a film represent the various dense structures within the object which have totally stopped the X-ray beam.
- The black or **radiolucent** shadows represent areas where the X-ray beam has passed through the object and has not been stopped at all.

Intraoral Radiography

‘Intra’ = inside

‘oral’ = mouth

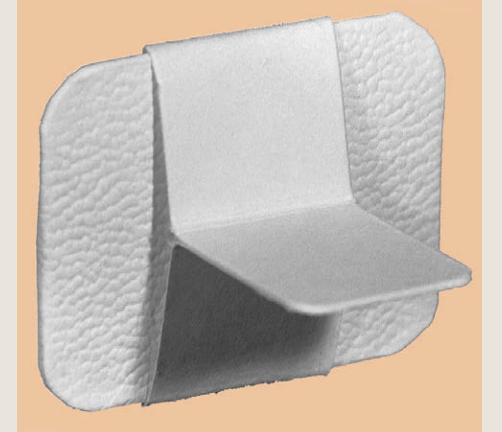
Radiography – the techniques involved in producing the various radiographic images

Radiology – the interpretation of radiographic images (radiographs)

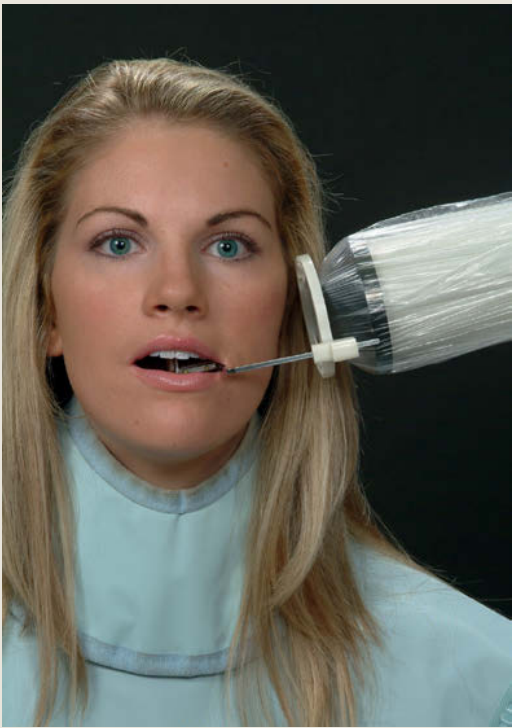
Types of Intraoral Radiographs

THREE (3) Types

- 1. Bite-wing Radiographs (BW)**
- 2. Periapical Radiographs (PA)**
- 3. Occlusal Radiographs / Occlusographs**



Left Posterior Bitewing (BW)



→ Upper (or Maxillary) Left Posterior Periapical (PA)

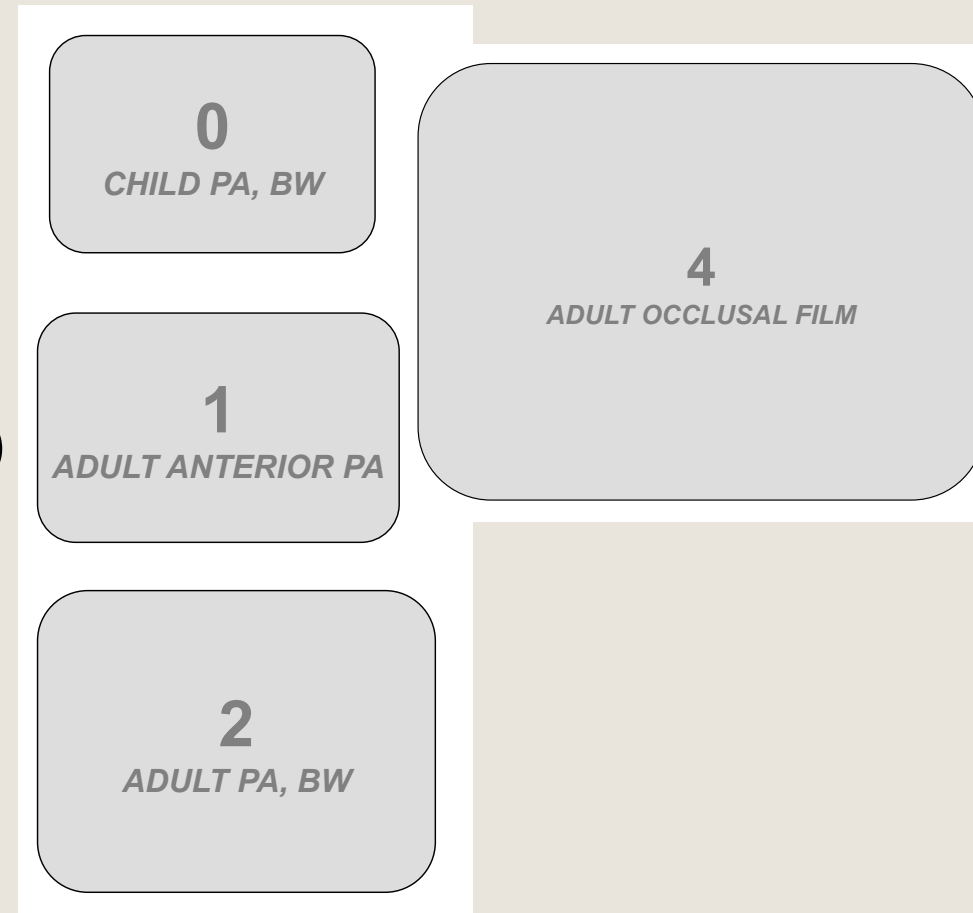
Anterior Maxilla Occlusograph



Film Sizes (Analogue)

FIVE (5) Sizes

1. Size 0
 - Used in children for both PA and BW
2. Size 1
 - Used for adult anterior PA (using paralleling technique)
3. Size 2
 - Used for adult posterior PA & BW
 - Used for adult anterior PA (using bisecting-angle technique)
 - Used for occlusographs in children
 - **Most commonly used**
4. Size 3
 - Extra-long BW (*not commonly used*)
5. Size 4
 - Used for occlusographs in adults





Bitewing (BW) Radiographs

Indications

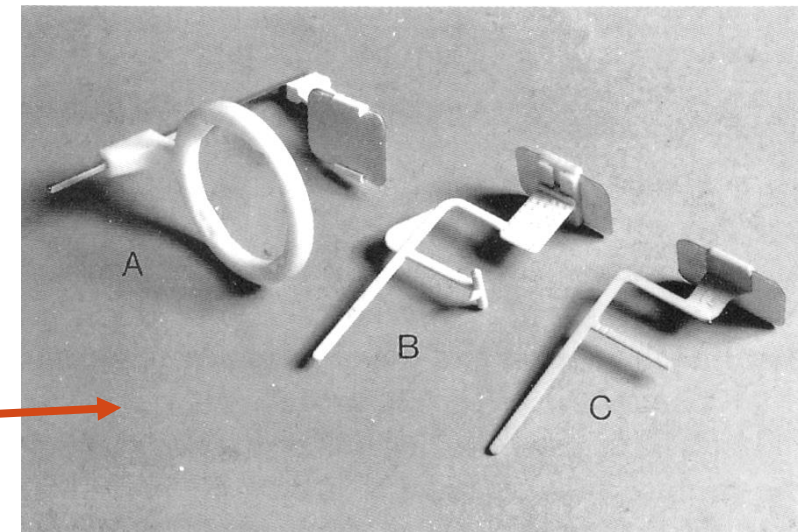
Film holder vs Bite tab



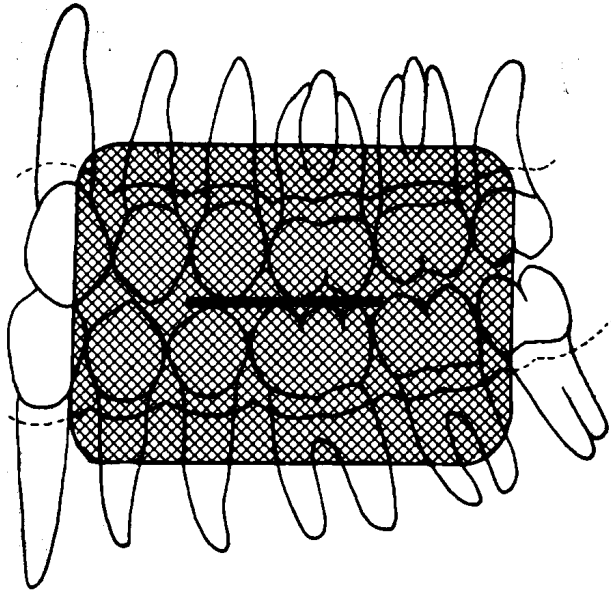
Bitewing (BW) Radiographs



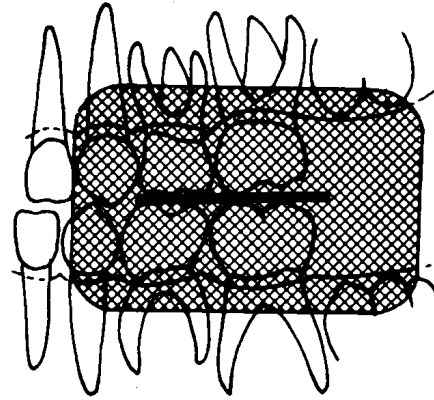
- Patient bites on a 'wing' or tab to correctly position film
- **Indications:**
 - Caries
 - Status of restorations
 - Crestal bone height
 - Periodontal bone loss
- **Techniques:**
 - Film holder techniques
 - Paper / Adhesive tab techniques



BW Coverage



ADULT
size 2 film
Distal canines
Premolars
Molars

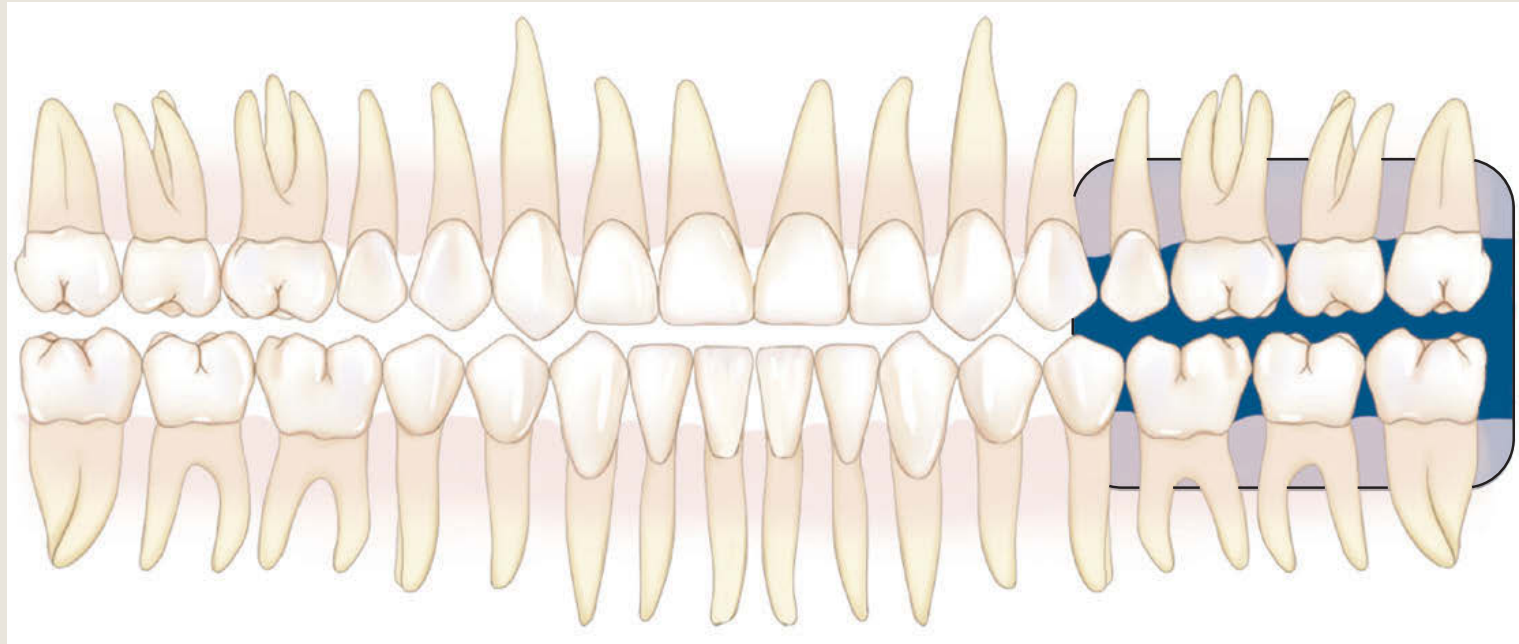


CHILD
size 0 film
Canine
All primary molars
Crown of first permanent molar (if erupted)

BW Coverage



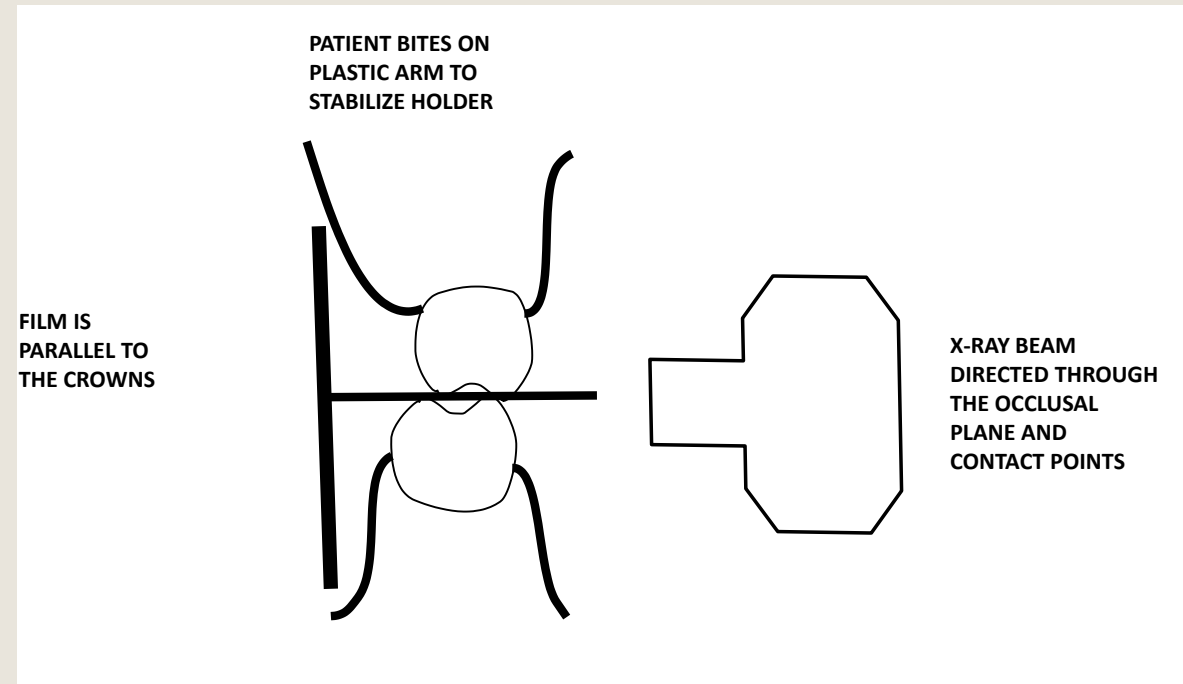
“LEFT POSTERIOR BITEWING” Radiograph



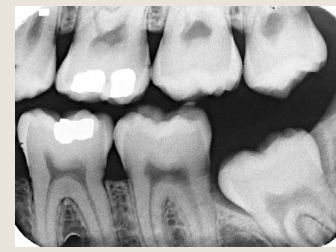
BW – Positioning



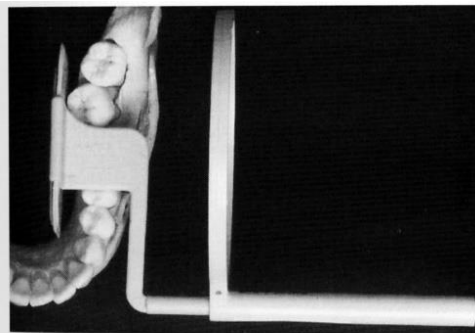
- Patient Position:
 - Remove all dentures, glasses and other metallic objects eg. piercings in line of primary beam
 - Patient's head is supported by head-rest (of dental chair)
 - Patient bites on to the holder/tab
 - Ideally, the occlusal plane is parallel to the floor (sit-up position)
- Beam / X-ray Cone Position:
 - Parallel to, and directed through, the occlusal plane



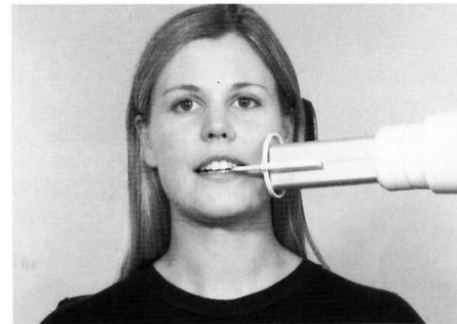
BW Technique 1. Film Holder 😊



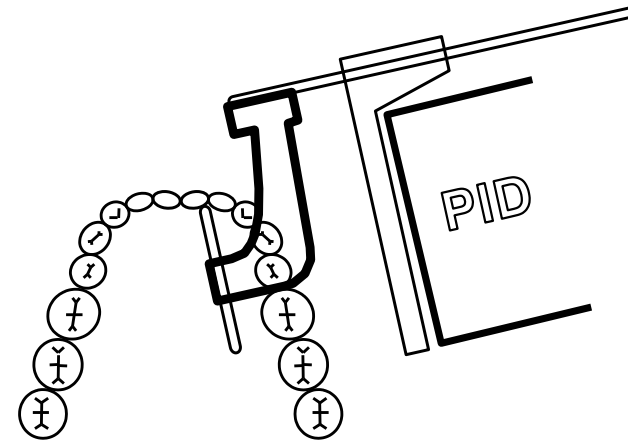
Use the holder at all times, if possible



A

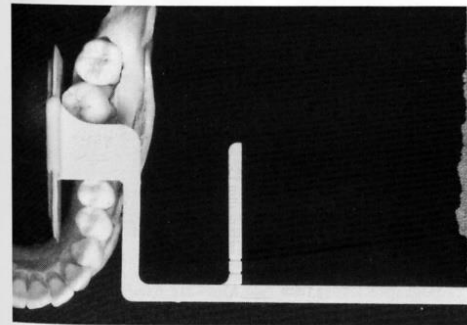


B

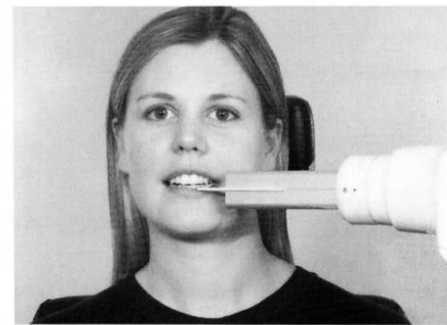


VERTICAL AND HORIZONTAL
ANGULATIONS ESTABLISHED BY THE
HOLDER

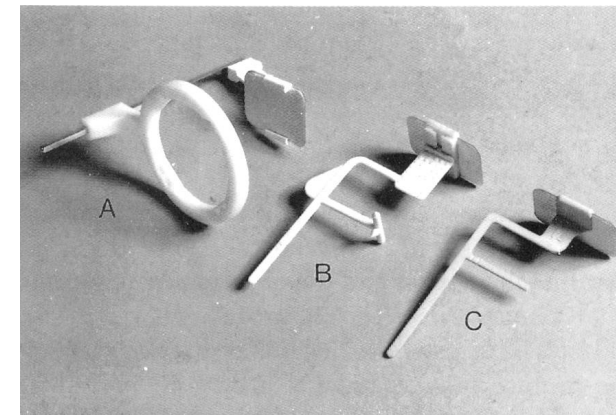
LESS TECHNIQUE SENSITIVE

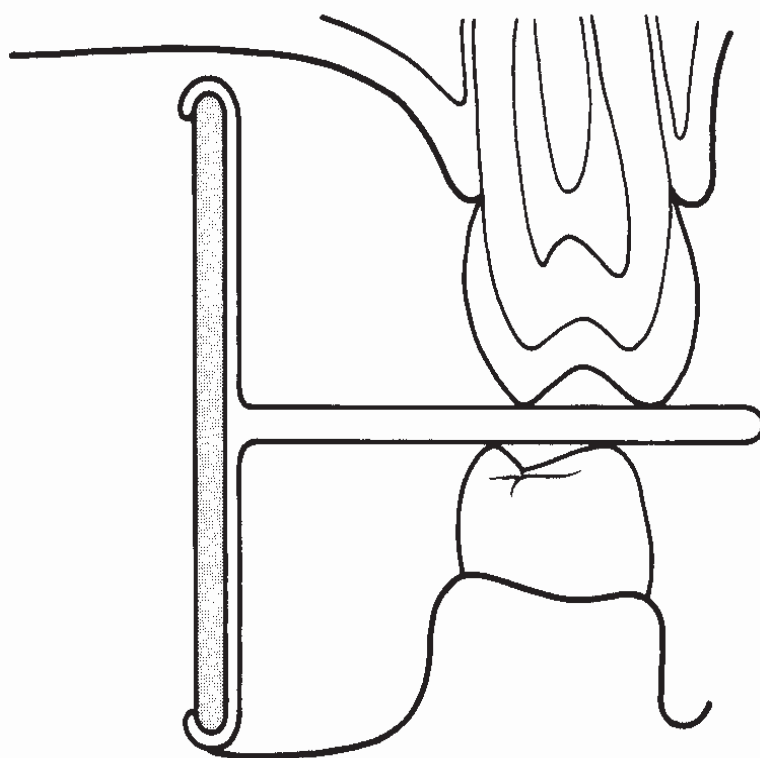


C



D





Receptor Placement. Place the receptor between the tongue and the teeth, far enough from the lingual surface of the teeth to prevent interference by the palate on closing and parallel to the long axes of the teeth. The anterior border of the receptor should extend beyond the contact area between the mandibular canine and the first premolar. Hold the receptor in place until the patient's mouth is completely closed. Holding the receptor while closing prevents it from being displaced distally.

*Note: the film / receptor is sitting far away from the teeth when used with holder (thus, **not** creating any angulation)*

BW Technique 2. Paper / Adhesive Tab



- Horizontal and vertical angulations of primary beam must be **manually adjusted by operator**
- **No guidance** unlike that provided by a film holder
- **Very technique sensitive**
- Unrepeatable



HORIZONTAL ALIGNMENT OF THE CONE

no film holder

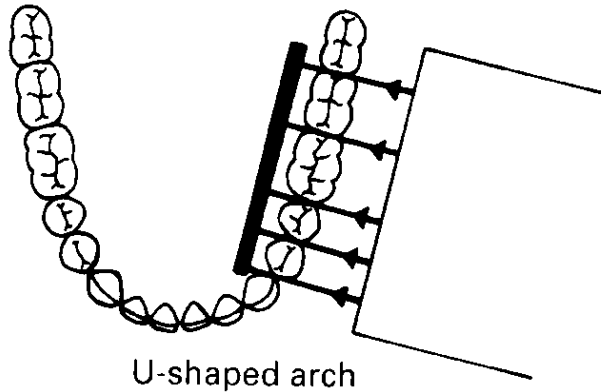


WHY?

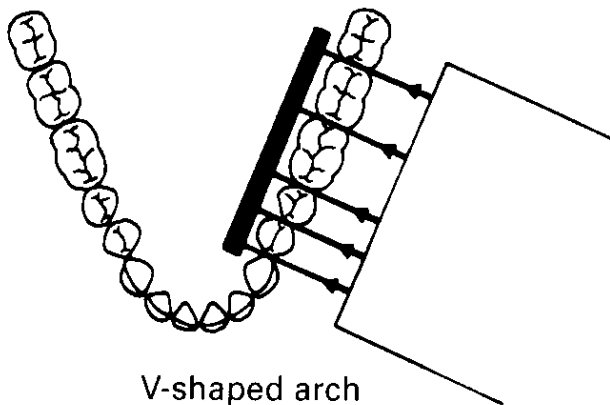
- Ensures the beam will clear the contact points so we can detect interproximal caries
- Ensure we cover all the film with the cone

HOW?

- Ensure that the film covers all the teeth
- Try to keep the film as close to the lingual surfaces of the teeth as possible
- Avoid bending the film
- Align the cone so that it is *parallel to the arch*



U-shaped arch



V-shaped arch

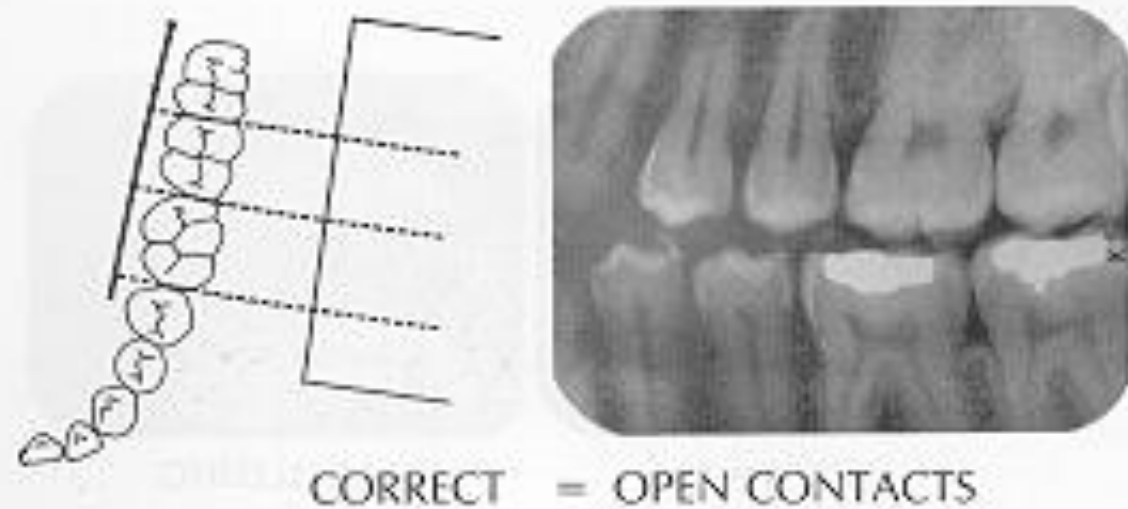
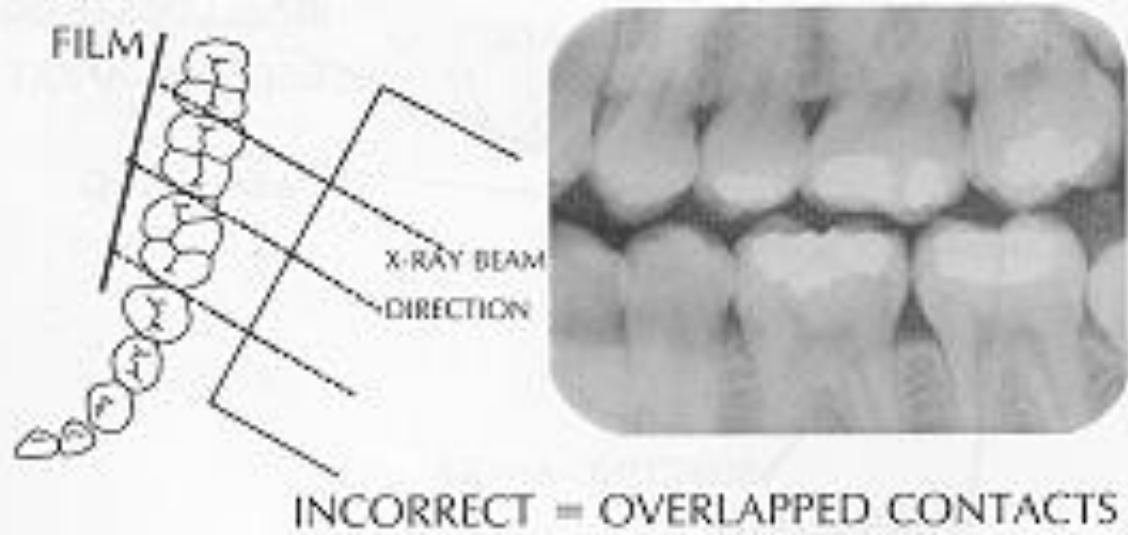


Figure 8-4. Incorrect and correct horizontal angulations and resultant radiographs.



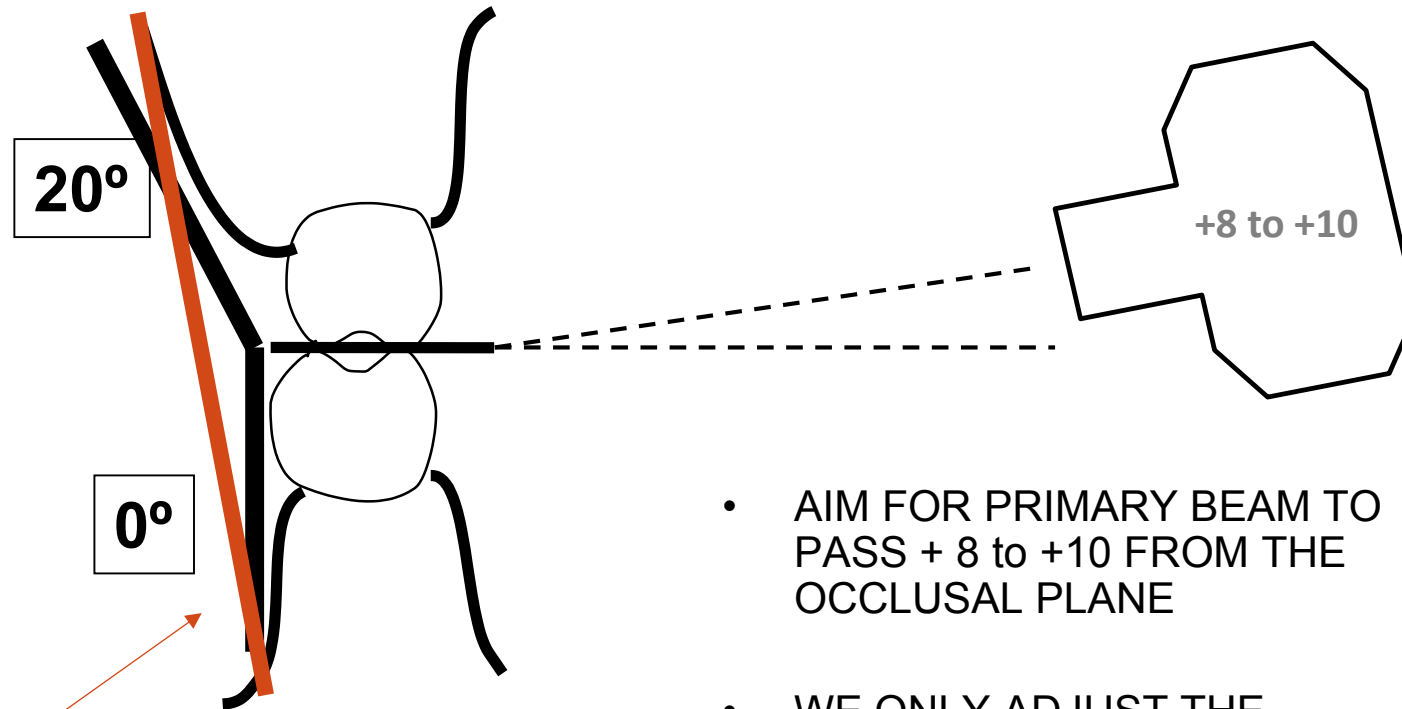
wrong horizontal alignment
 ☹ - overlapping of teeth



FIG. 9-4 Horizontal overlapping of crowns is the result of misdirection of the central ray.

VERTICAL ALIGNMENT OF THE CONE

no film holder



- AIM FOR PRIMARY BEAM TO PASS + 8 to +10 FROM THE OCCLUSAL PLANE
- WE ONLY ADJUST THE VERTICAL WHEN USING TABS NOT FILM HOLDERS!!

The film / receptor sits right next to the teeth, creating slanting

BW – Clinical Problems



- Mandibular Tori
 - Bone overgrowth on the lingual surface of the mandible
 - Difficult to place film
 - *How to correct:* Use the thinnest film eg. Analogue film or digital PSP plate (photostimulable phosphor plate) and place it lingual to the torus
- Missing Teeth
 - Difficult to stabilise / hold film
 - *How to correct:* Place cotton rolls in the edentulous (missing teeth) space to prevent film rotation.

If you examine the patient first you will avoid the majority of mistakes & retakes

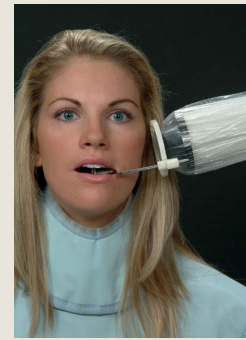


Periapical (PA) Radiographs

Indications

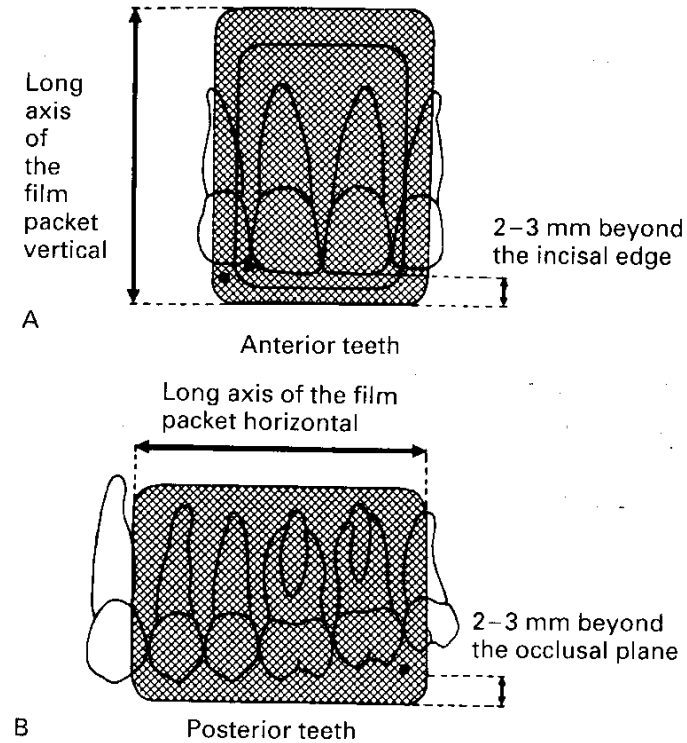
Paralleling Technique Vs Bisecting Angle Technique

Periapical (PA) Radiographs

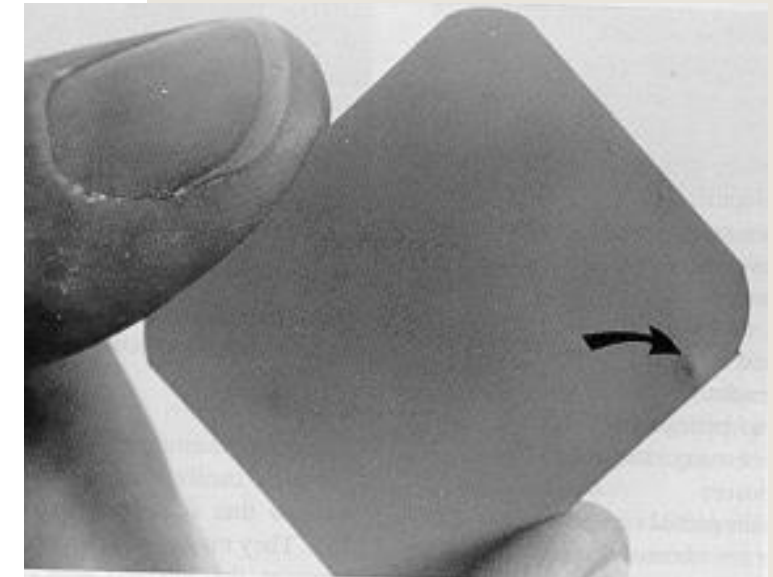


- Periapical = around the apex
- The intention is to visualize the crown, root and periapical tissues
- **Indications:**
 - Periapical inflammation / pathology
 - Root resorption
 - Root fractures
 - Endodontic therapy (pre, peri & post)
 - Localisation of impacted, missing, supernumerary teeth and foreign bodies
 - Implant status
- **Techniques:**
 1. **Paralleling (long cone)**
 2. **Bisecting Angle**

PA Coverage



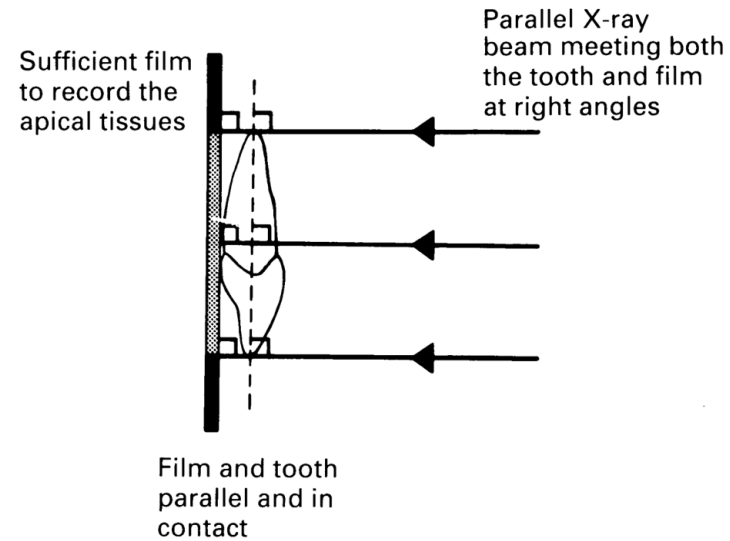
- Cover 2-3 mm beyond the crowns
- Demonstrate all roots
- Demonstrate the apical tissues



'occlusal dot' marked on film

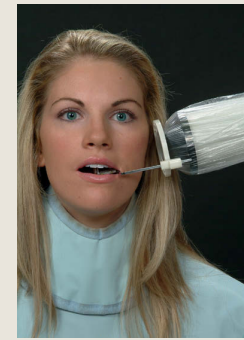
Ideal PA

- Same size
- Same shape
- Good contrast
- Good detail

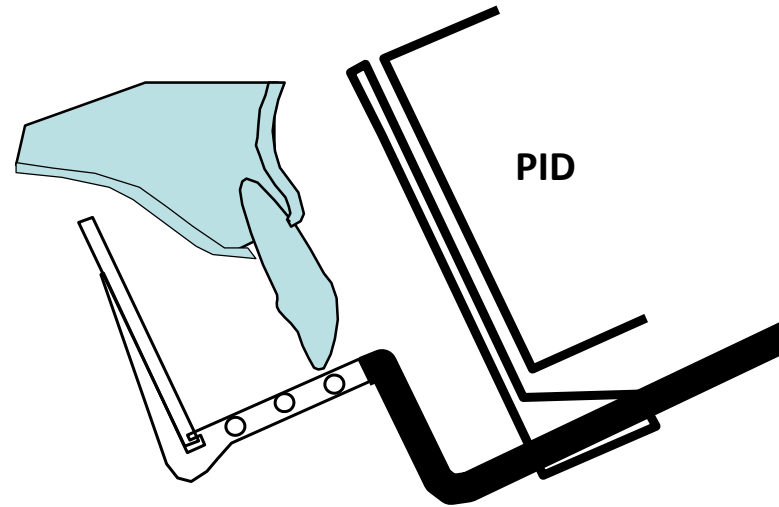


Ideal Tooth/Film relationship not possible to achieve because of anatomic limitations

Techniques used in periapical imaging are therefore a compromise from this ideal

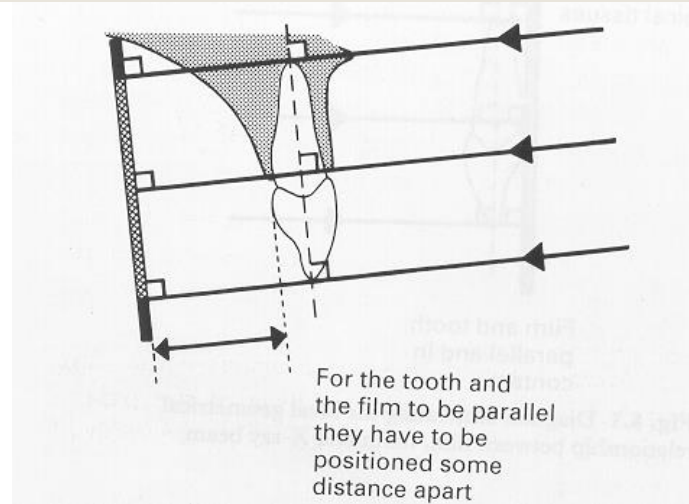


PA – 1. Parallelizing Technique



- Film parallel to the long axis of the tooth
- Primary beam perpendicular to the film

PA – 1. Parallelizing Technique



The longer the cone, the more parallel the beam

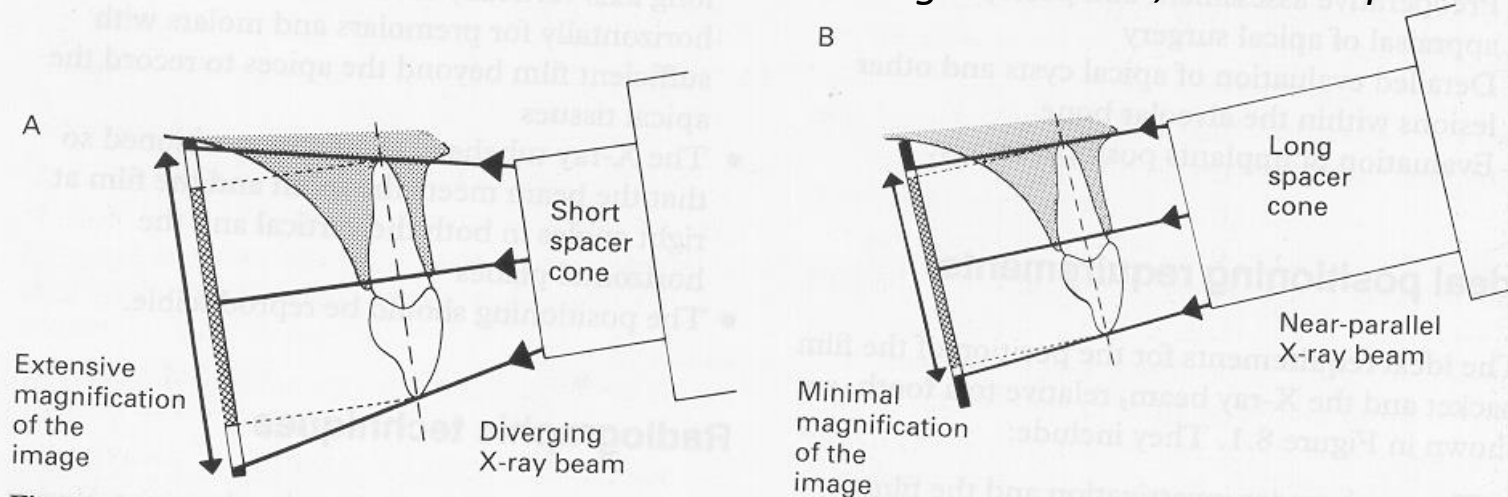
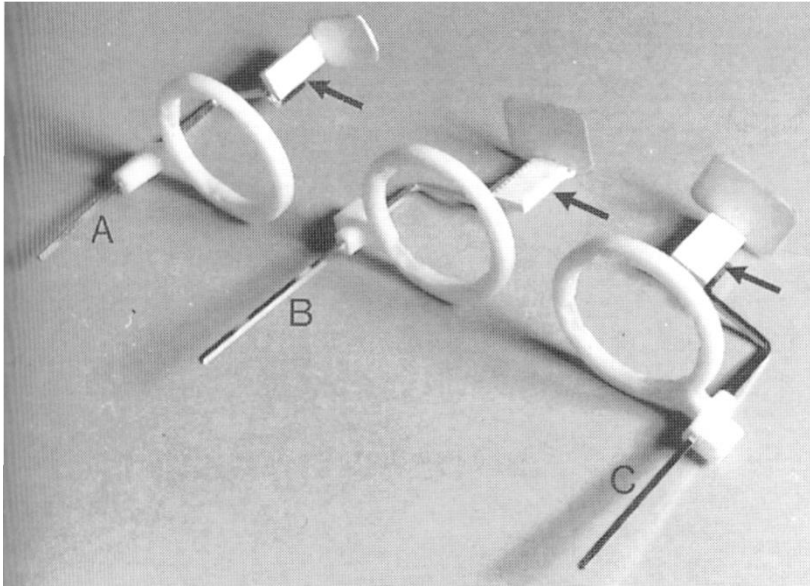
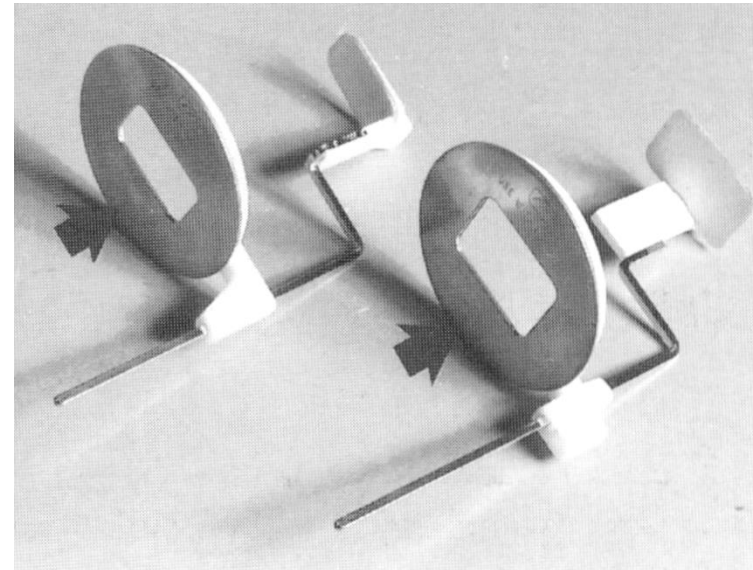


Fig. 8.3 Diagrams showing the magnification of the image that results from using **A** a short cone and a diverging X-ray beam and **B** a long cone and a near-parallel X-ray beam.

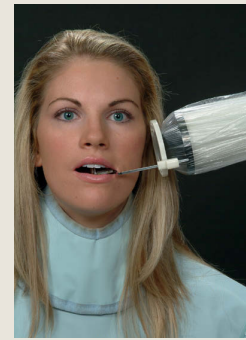
Paralleling technique always requires FILM HOLDERS



EXAMPLES OF FILM HOLDERS
With PID guidance rings



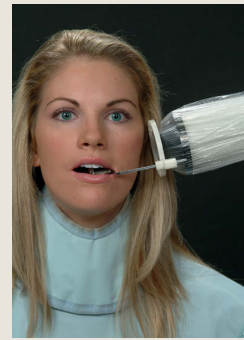
PA – 1. Parallelizing Technique



- Optimally achieved using film holders with PID guidance rings
- ++ Accuracy
- Less technique sensitive - horizontal and vertical angulations determined by film holder
- Recommended for:
 - Endodontic therapy = accurate measurement of length is critical
 - Long term evaluation of crestal bone height around implants

Paralleling Technique

– Advantages

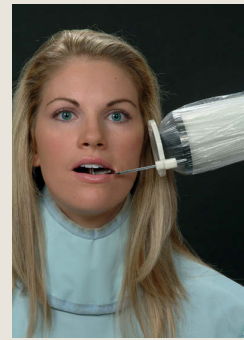


- Dimensionally accurate
- Accurate determination of bone height
- Accurate assessment of dental caries
- Reduced superimposition of the zygoma
- Reduced skin exposure due to greater kVp and parallel beam

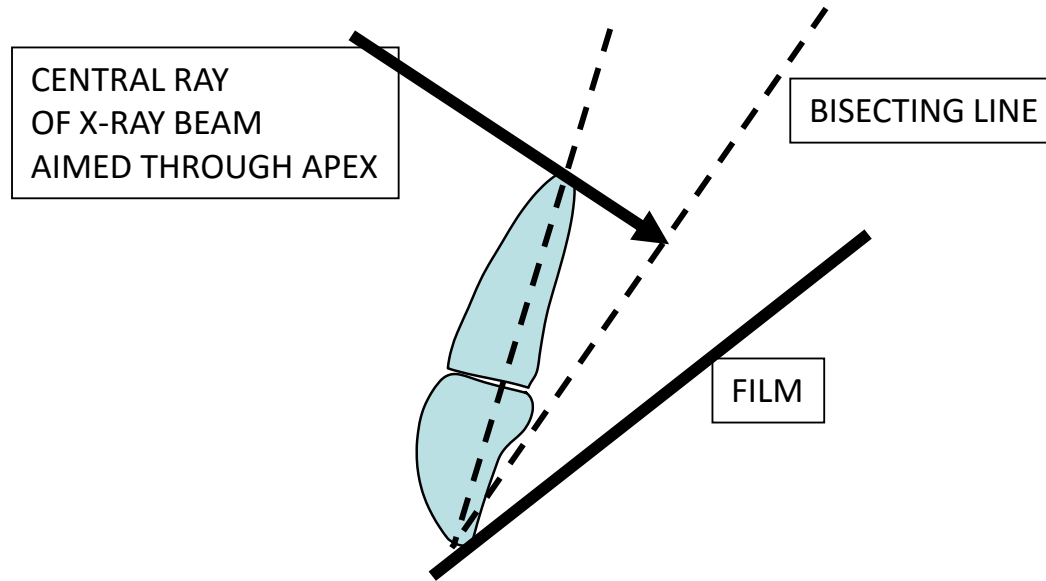
Paralleling Technique

– Disadvantages

- More difficult to place film
- More uncomfortable for the patient
- Higher kVp machine required
- Long cone and film holders required

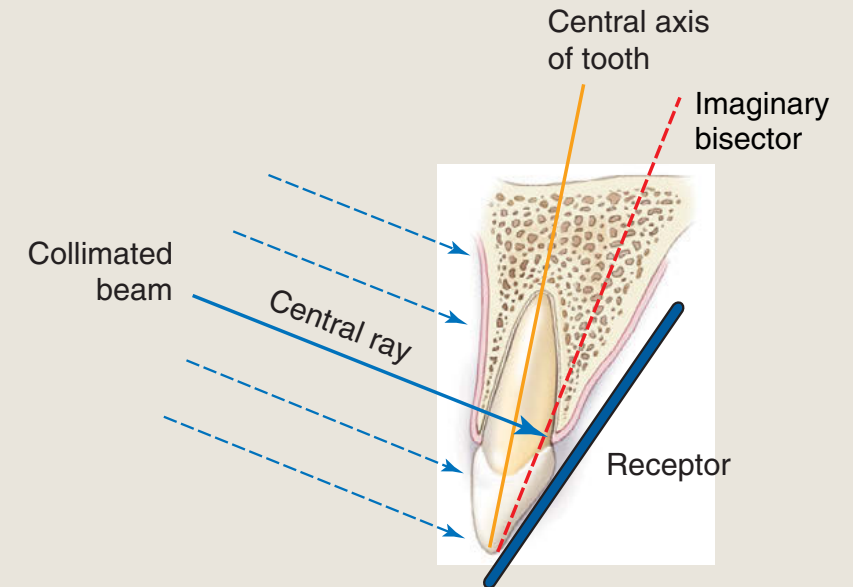


PA – 2. Bisecting Angle Technique



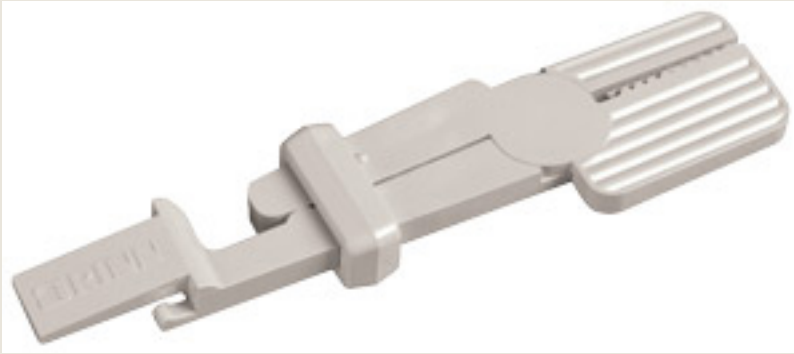
- X-ray beam is directed perpendicular to the bisecting line
- Vertical angulation must be determined manually

* Receptor is placed as close to tooth as possible

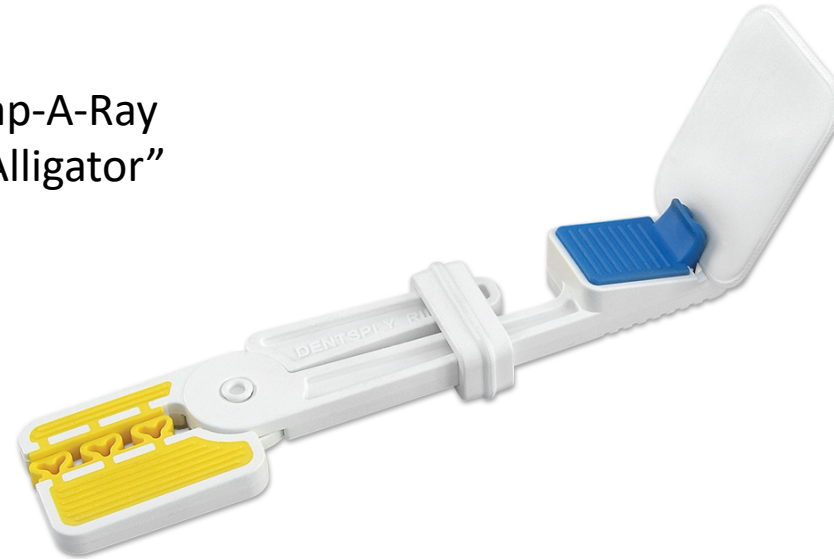


*In any 90-degree arc, there is one angle (bisecting angle) that will allow an x-ray beam to cast an **accurate shadow** of the tooth on the film.*

Film Holders Used in Bisecting Angle Technique



Snap-A-Ray
/ "Alligator"



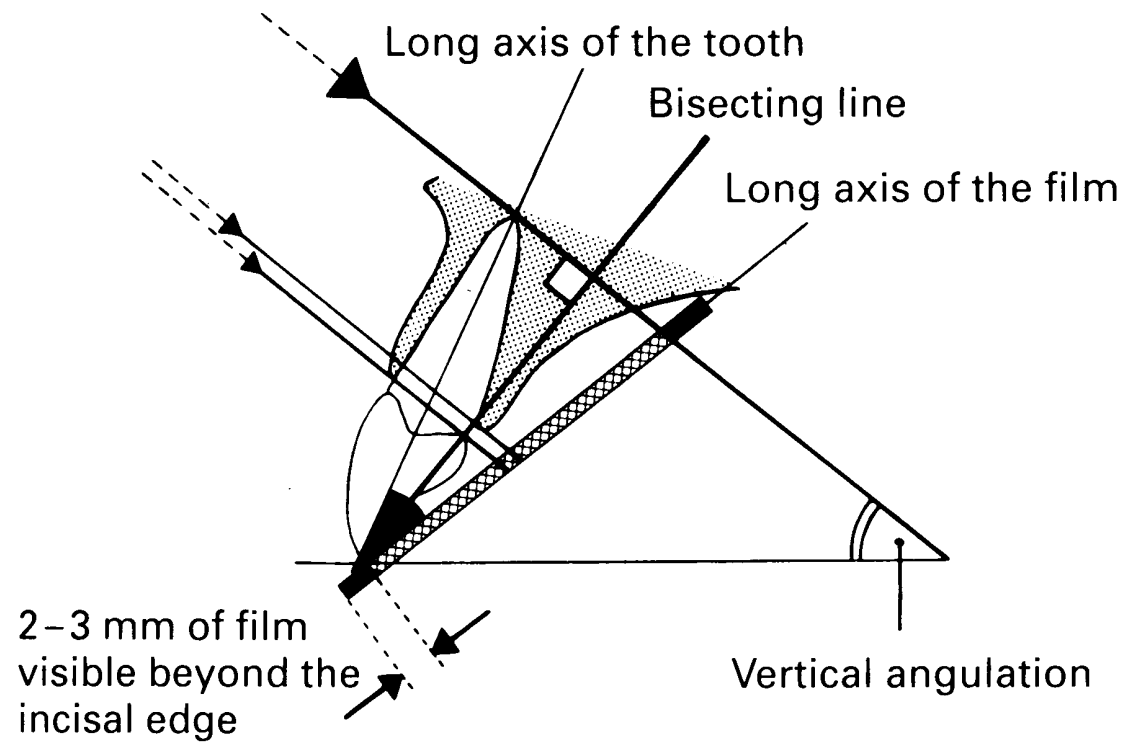
Note: no beam aiming device



<https://dooclip.me/video/bzreH0NM4fk?id=bzreH0NM4fk>

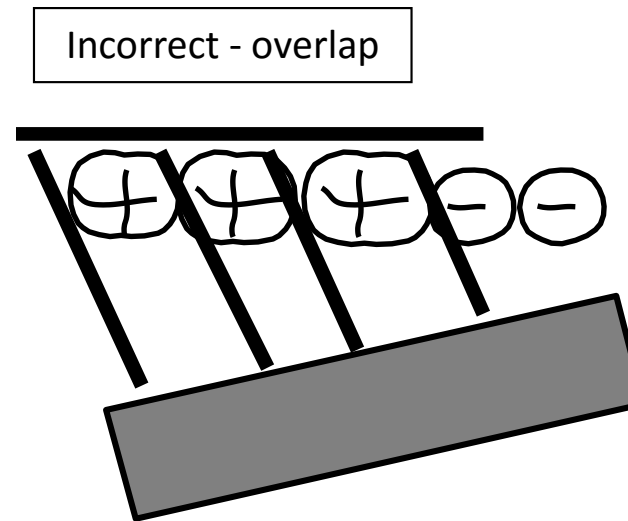
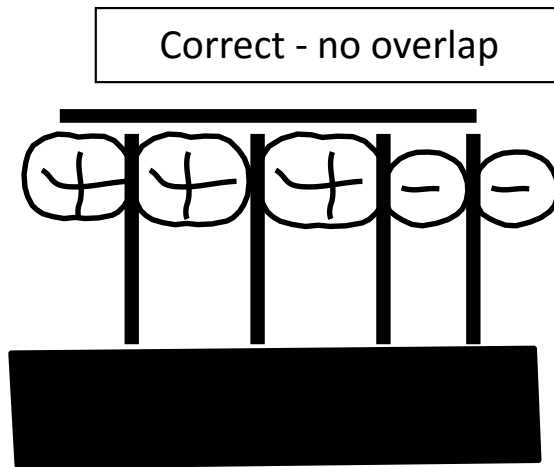


Central ray of the
X-ray beam aimed through
the tooth apex



Principle of the Bisecting angle technique = Cieszynski's rule of isometry

BISECTING ANGLE TECHNIQUE - *HORIZONTAL ANGULATION*



→ Same as the bite
tab technique in
bitewing (BW)

- Horizontal angulation must be corrected manually

Vertical angulation faults

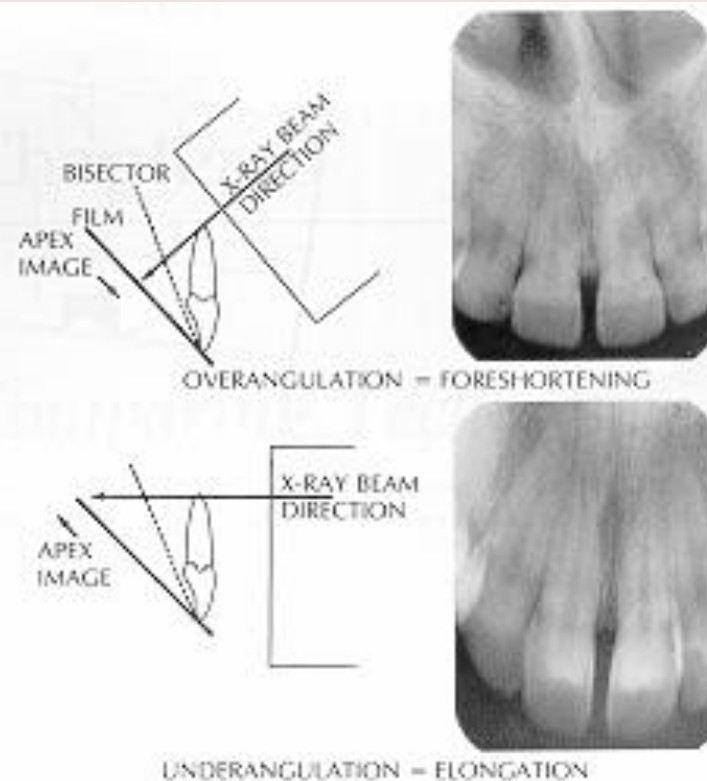
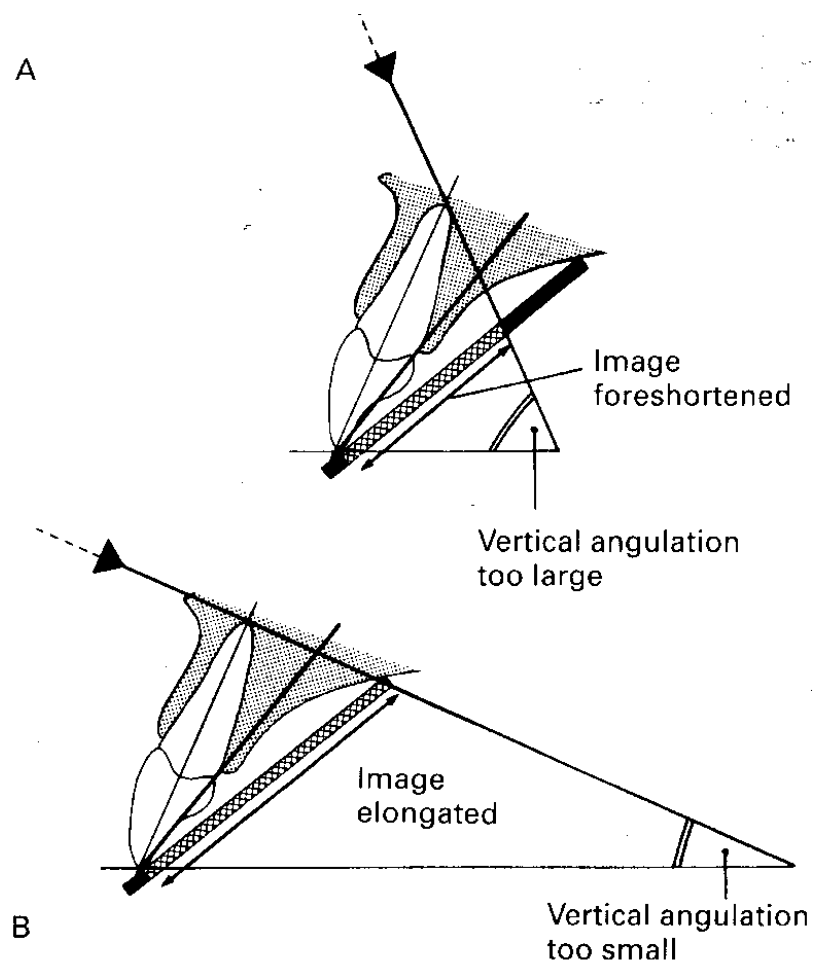
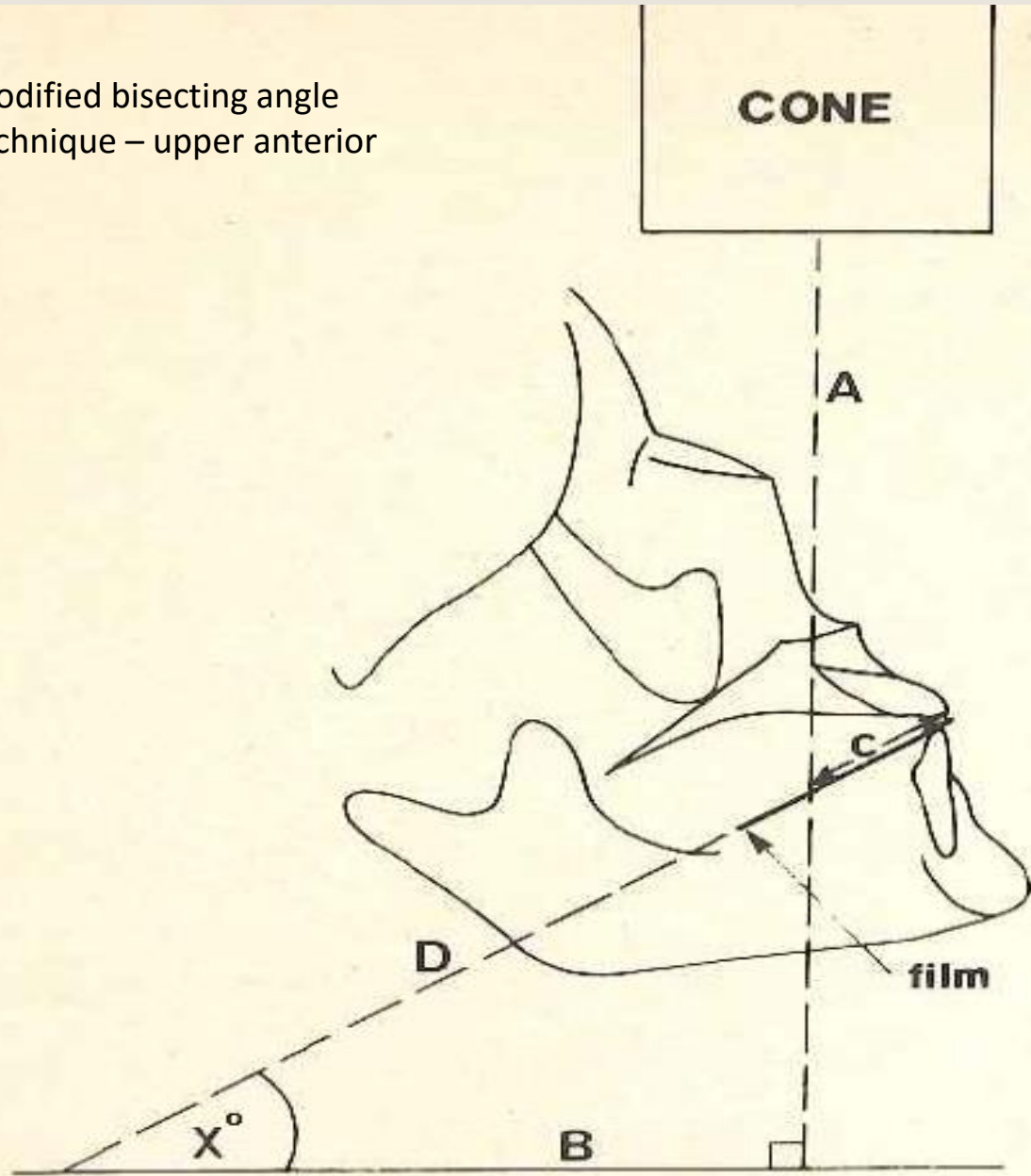


Figure 8-3. Effect of over and under vertical angulation in bisecting-the-angle technic.

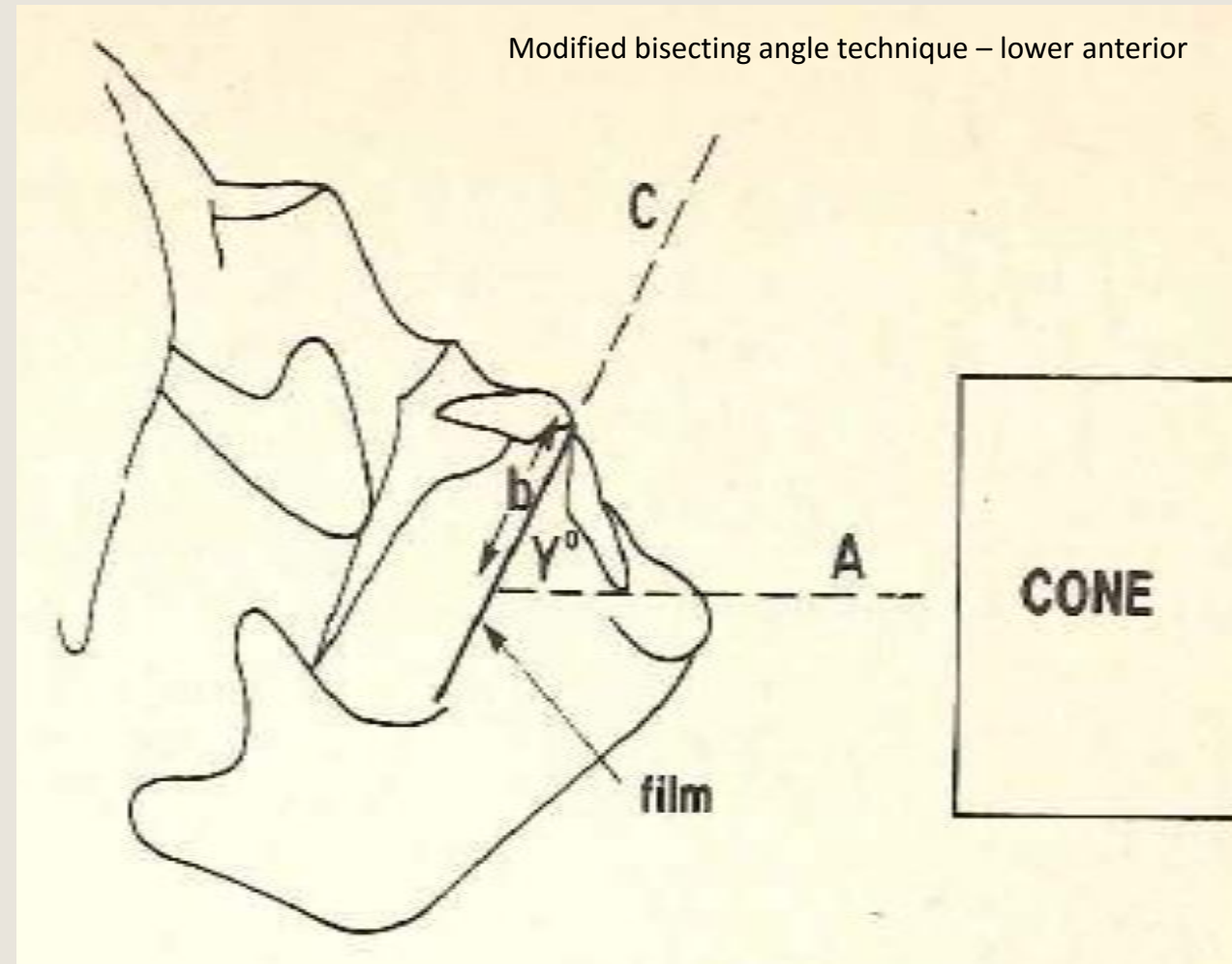
Modified bisecting angle
technique – upper anterior



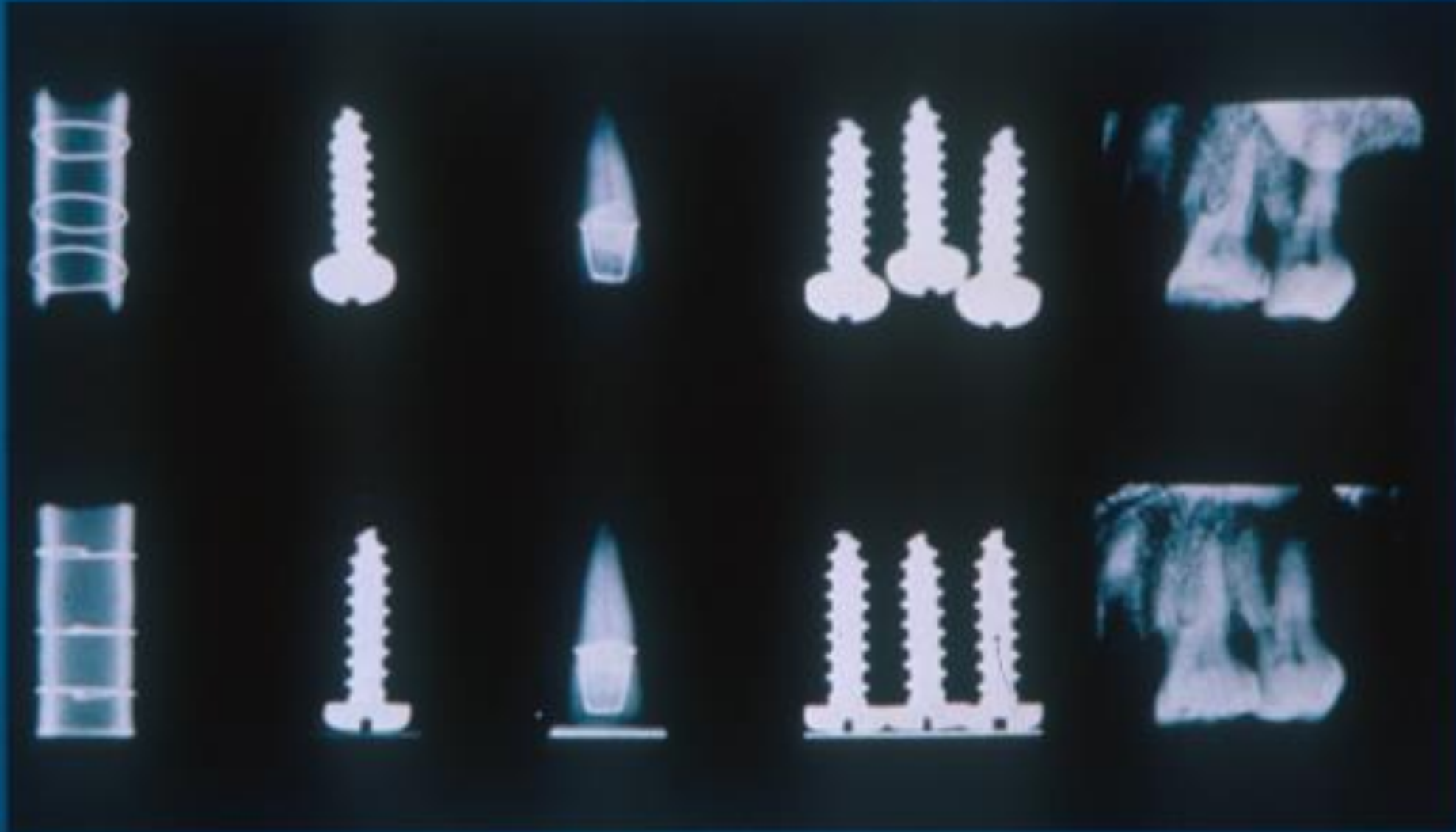
"Sao Biscuit" technique for kids



Modified bisecting angle technique – lower anterior



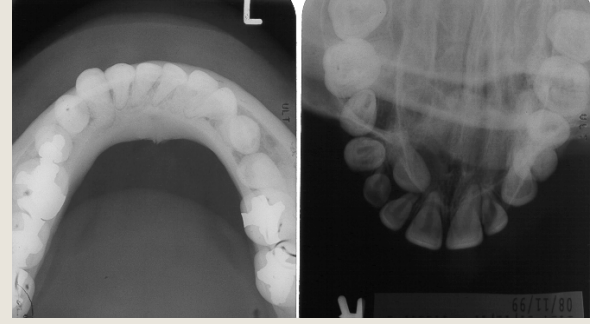
Bisecting Angle Technic



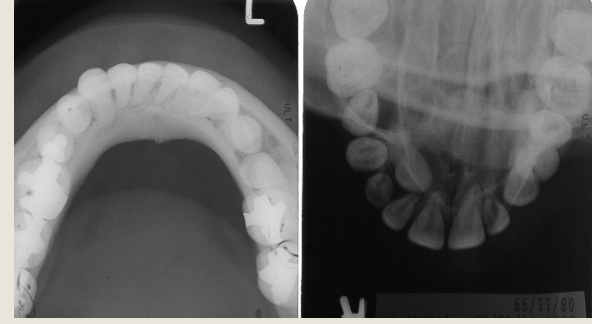
Parallelizing Technic



Occlusal Radiographs / Occlusographs



Occlusal Radiographs / Occlusographs

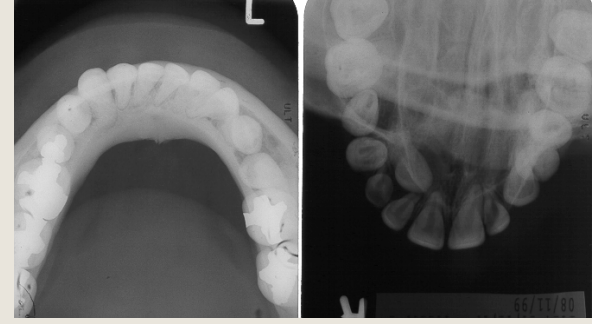


- Largest intraoral film
- Will visualize hard palate, floor of mouth, dentition

Demonstrates:

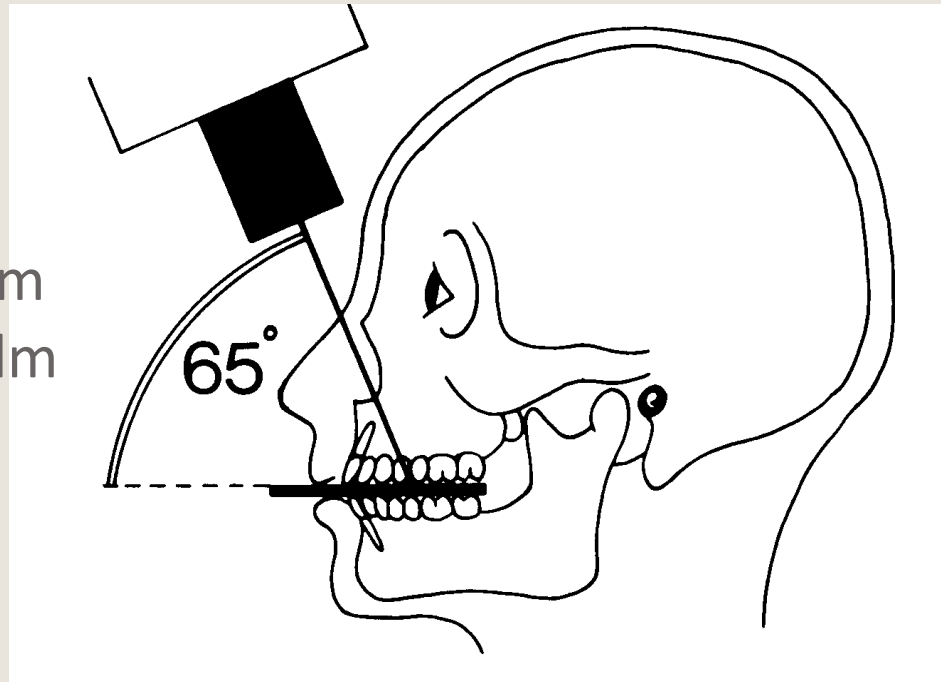
- Trauma / pathology
 - Eg. Alveolar bone fracture, Salivary stones, etc.
- Localization unerupted/impacted teeth
- Localization supernumerary teeth
- View developing anterior dentition

MAXILLARY ANTERIOR OCCLUSAL



Above the nose bridge

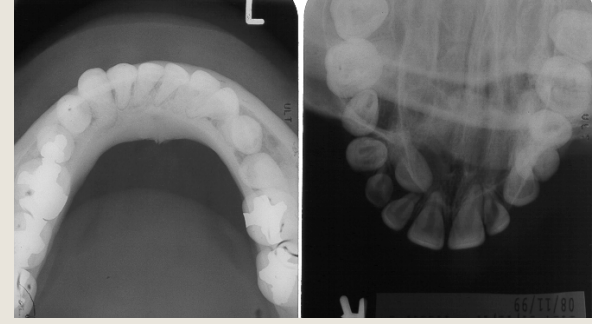
Primary beam
+65° from film



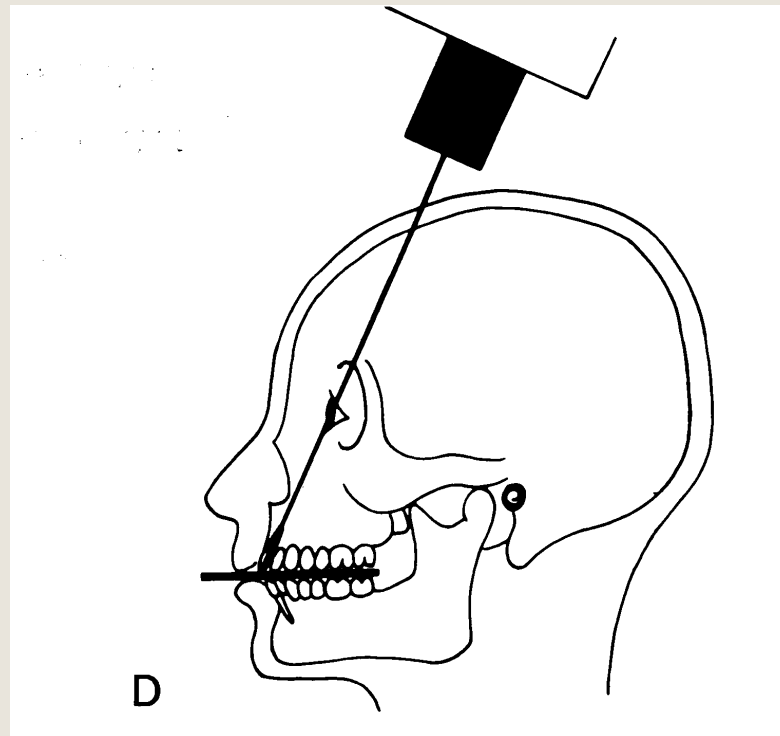
This projection shows the palate, zygomatic processes of the maxilla, anteroinferior aspects of each antrum, nasolacrimal canals, teeth from second molar to second molar, and nasal septum.



VERTEX OCCLUSAL



Above the head → more anatomic structures exposed ☹️

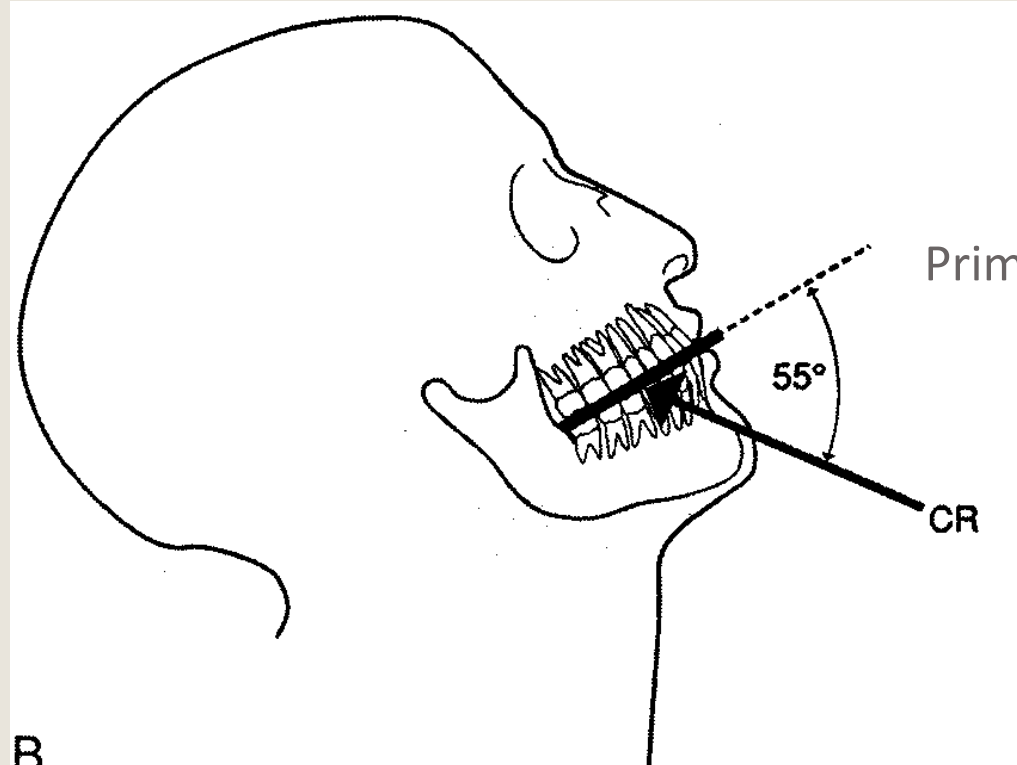
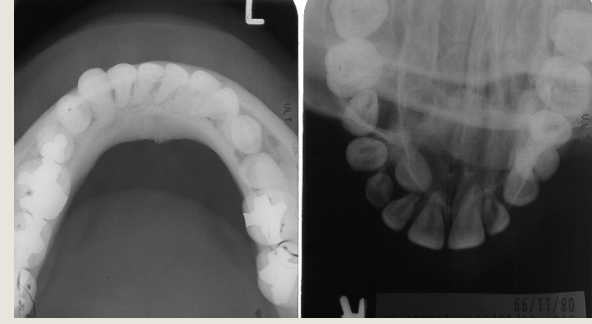


Very rarely used
- no longer recommended

Dosage +++

Proximity to retinal tissues

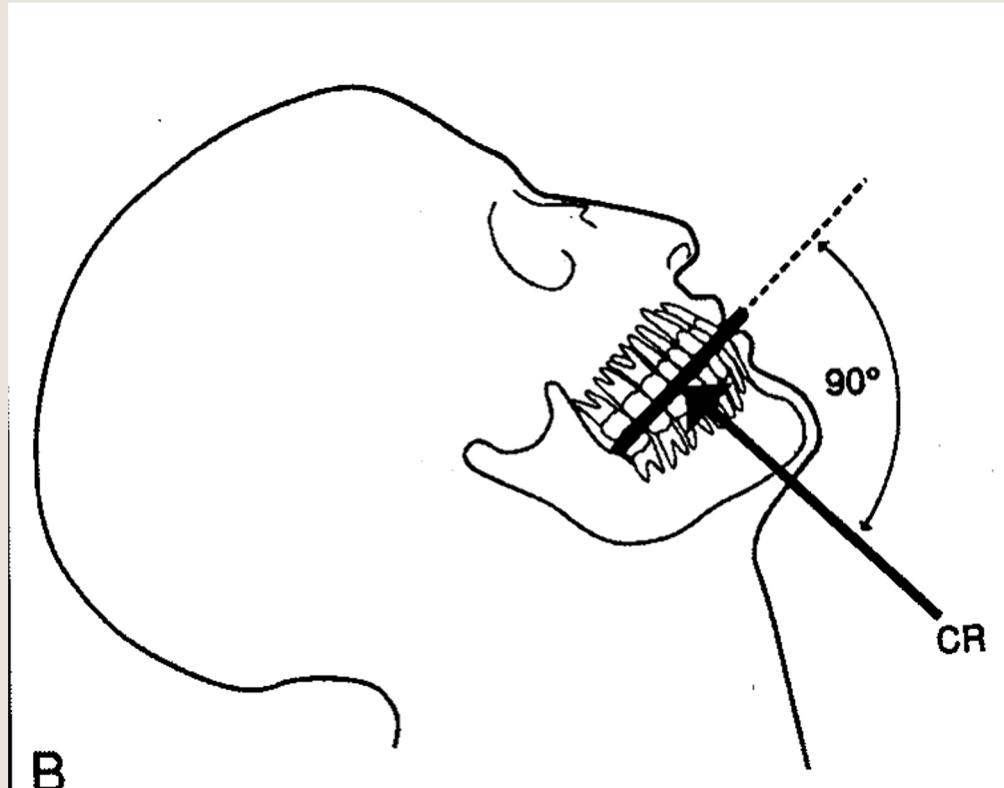
MANDIBULAR ANTERIOR OCCLUSAL



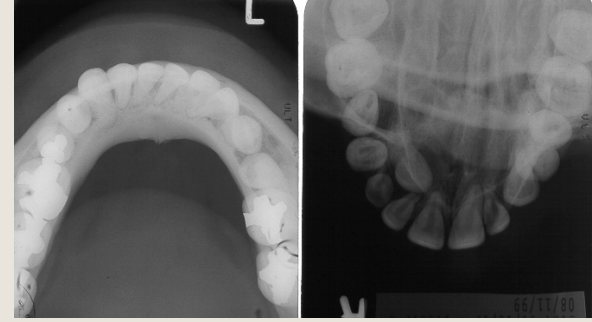
Primary beam -55° from plane of film



MANDIBULAR TRUE OCCLUSAL



Primary beam perpendicular to film



This projection reveals the lingual and buccal plates of the mandible from second molar to second molar. When this view is made to examine the floor of the mouth (e.g., for sialoliths), the exposure time should be reduced to half the time used to create an image of the mandible.



Maxilla



Mandible



Localisation of Objects Using Intra-oral Film



LOCALIZATION USING INTRA-ORAL FILMS

- TO DETERMINE:
 - **Bucco-lingual location** of impacted teeth *such as unerupted ectopic canines*
 - Location of a foreign body in the bucco-lingual dimension

Handy if you don't have access to 3D imaging eg. Cone Beam CT

Techniques for Localisation

- Two Techniques

1. Tube Shift Technique / Parallex Technique / Clark's Rule
 - i. Horizontal Shift
 - ii. Vertical Shift
2. Right Angle Technique / Miller's Technique

TECHNIQUES FOR LOCALISATION

#1 - The Tube Shift Technique

- Two PA images taken
- Film #1 = centered over area of interest *and taken*
- Film #2 - tube is shifted *EITHER HORIZONTALLY OR VERTICALLY* 30-40° *and second image is taken*
- Tube may be shifted in either the *HORIZONTAL* or *VERTICAL* directions
- The direction of motion of the impacted tooth/ foreign body relative to the tube movement shows its location

Same Lingual, Opposite Buccal (SLOB rule or Clark's Rule)

HORIZONTAL TUBE SHIFT TECHNIQUE



PA#1

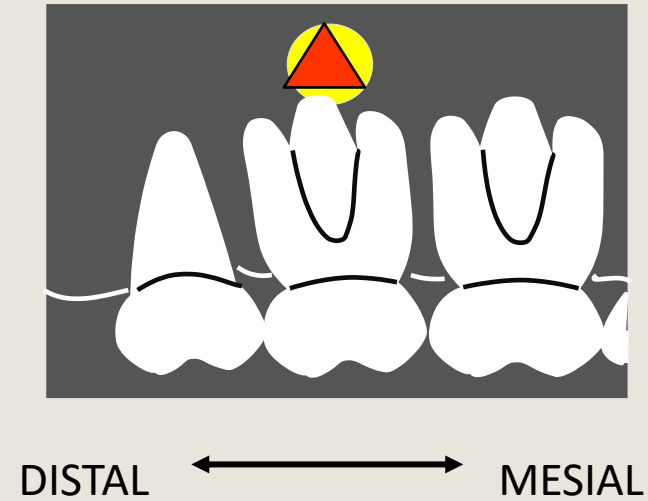
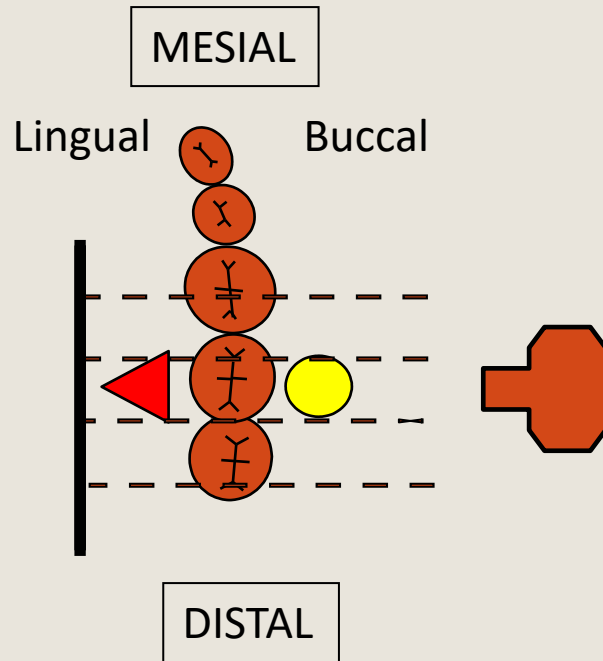


*Shift tube 40-45° horizontal
Vertical PID angulation constant*



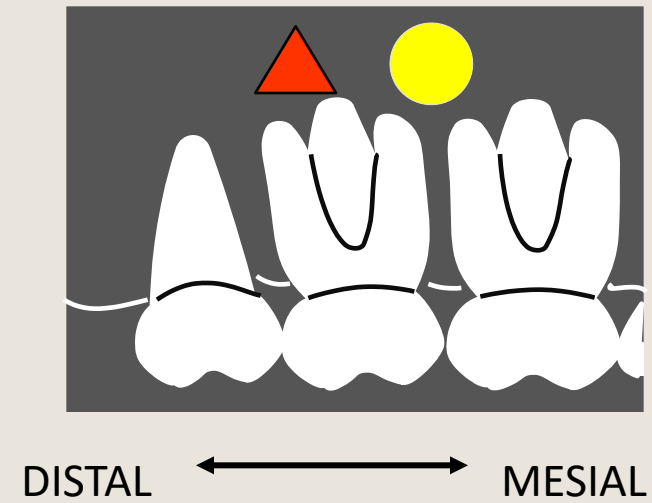
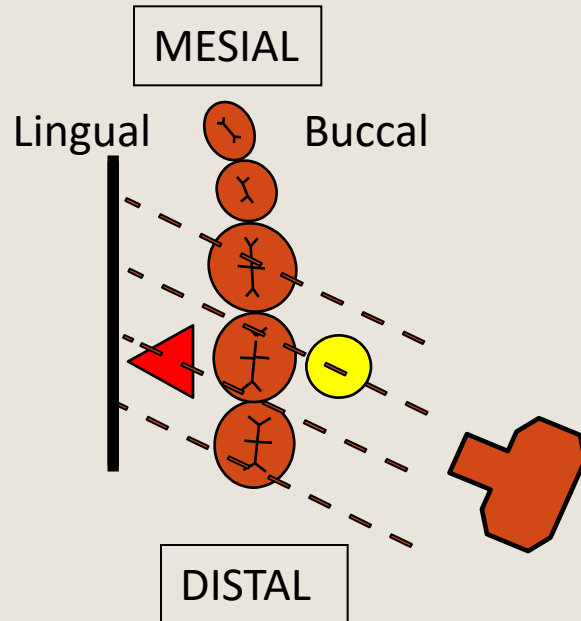
PA#2

HORIZONTAL TUBE SHIFT (Normal Position)

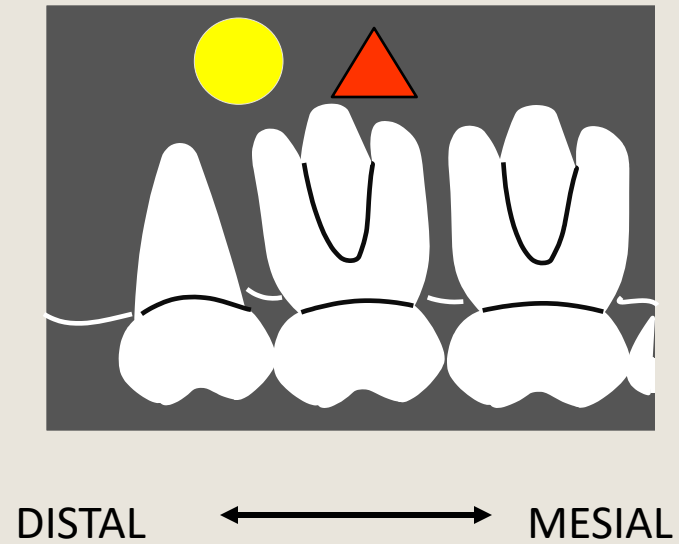
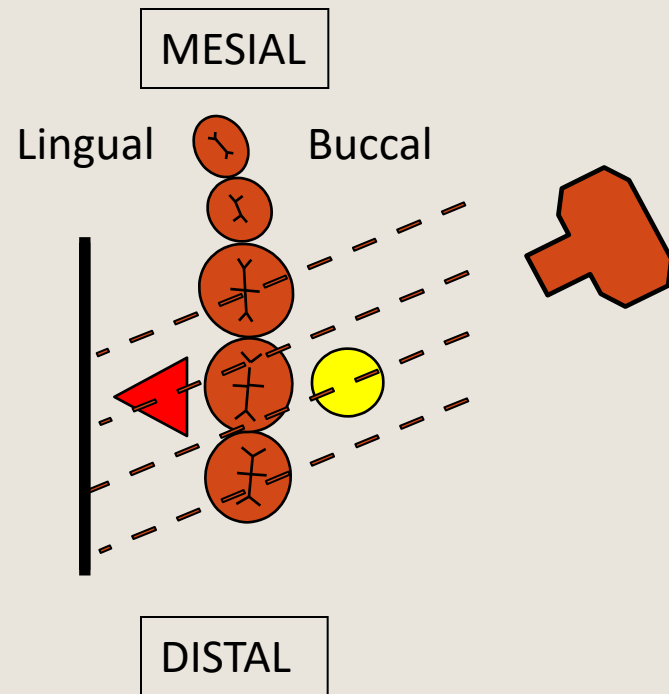


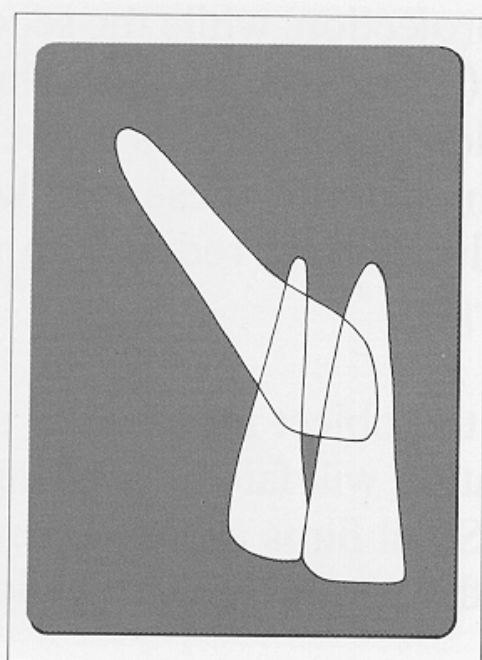
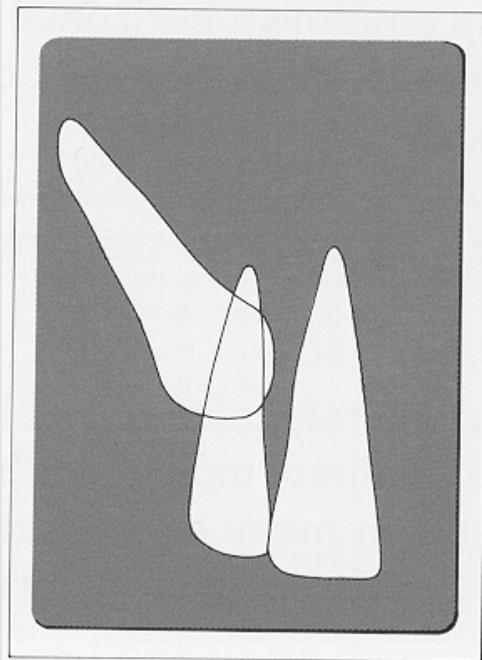
*Right upper / maxillary periapical
(paralleling technique)*

HORIZONTAL TUBE SHIFT – DISTAL SHIFTT

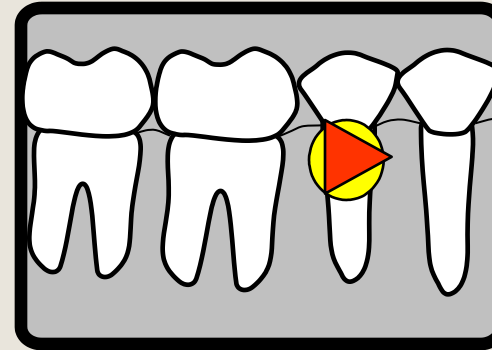
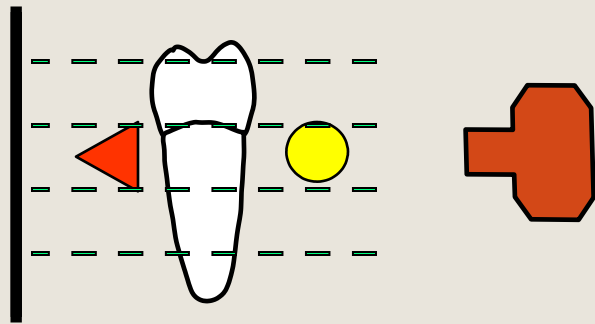


HORIZONTAL TUBE SHIFT – MESIAL SHIFT



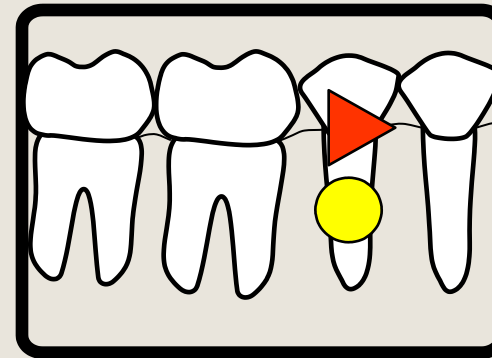
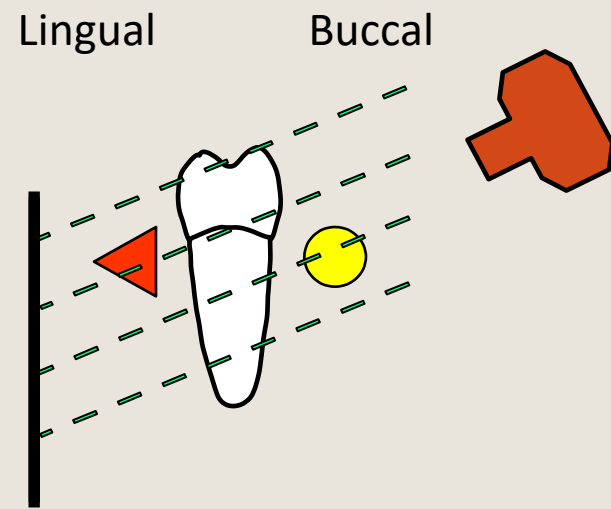


VERTICAL TUBE SHIFT TECHNIQUE

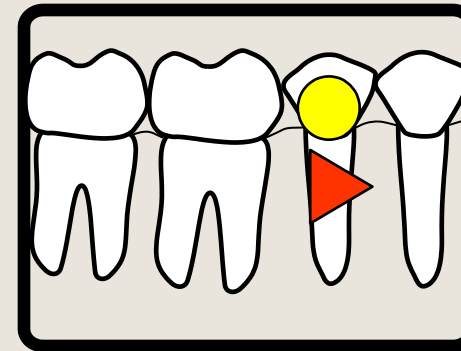
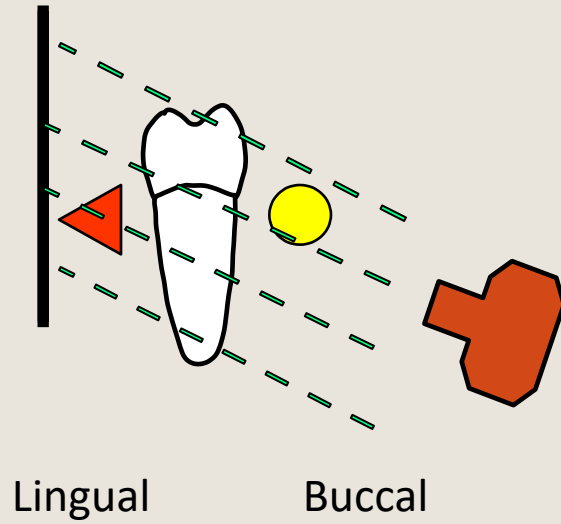


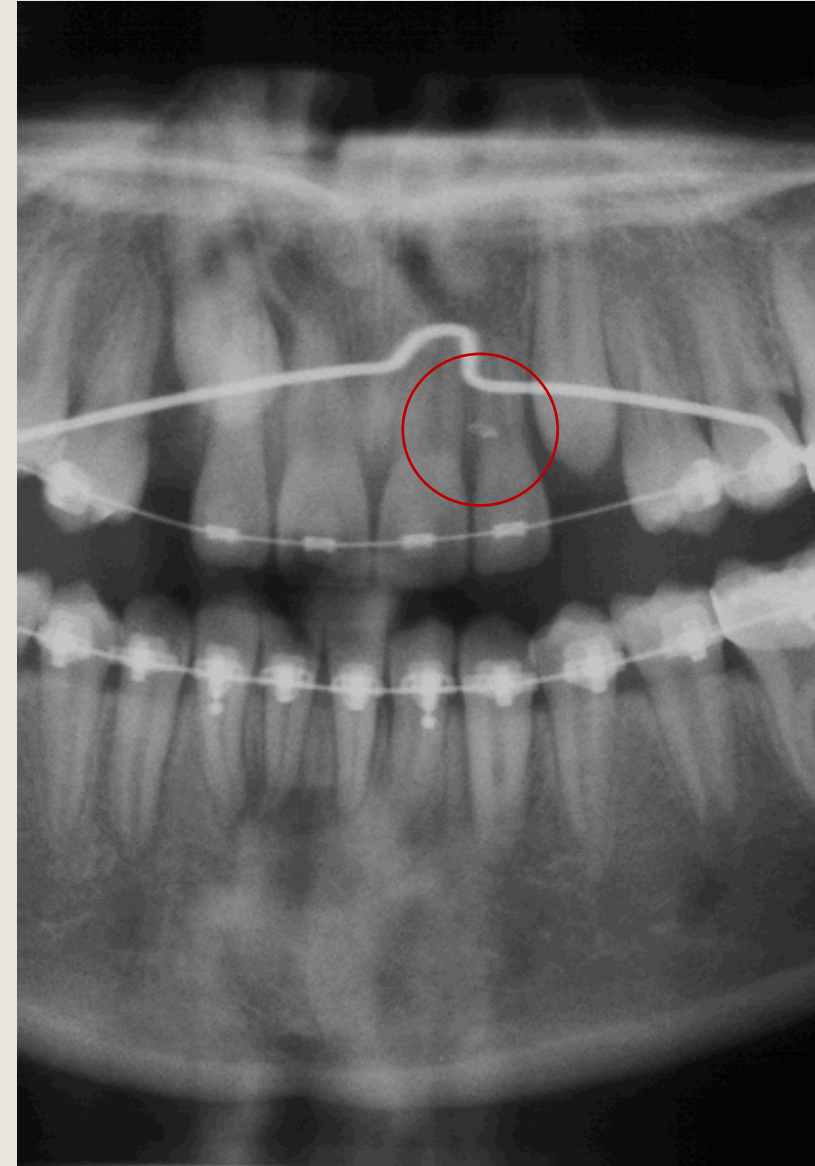
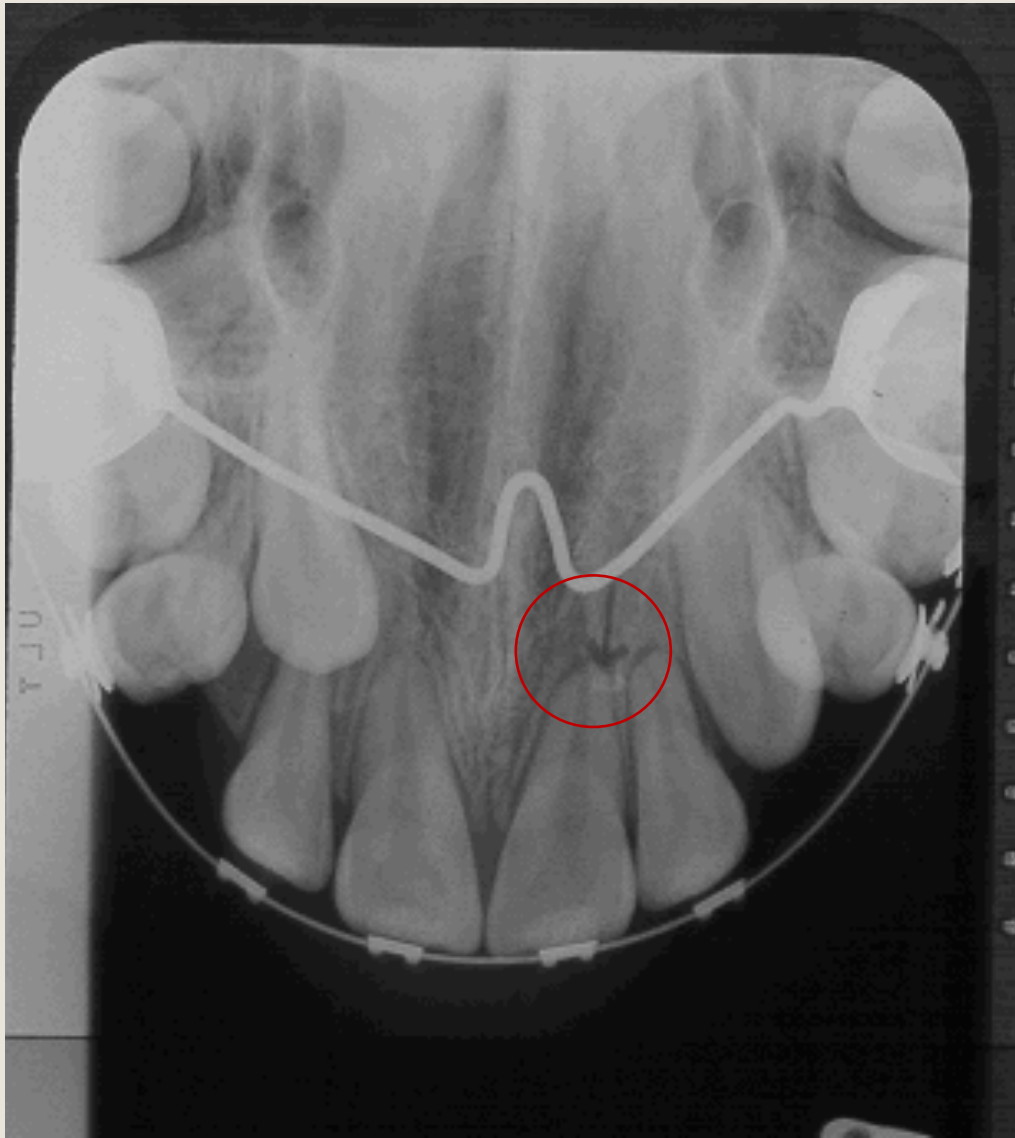
*Right lower / mandibular periapical
(paralleling technique)*

INCREASE VERTICAL ANGULATION (Ascending)



DECREASE VERTICAL ANGULATION (Descending)

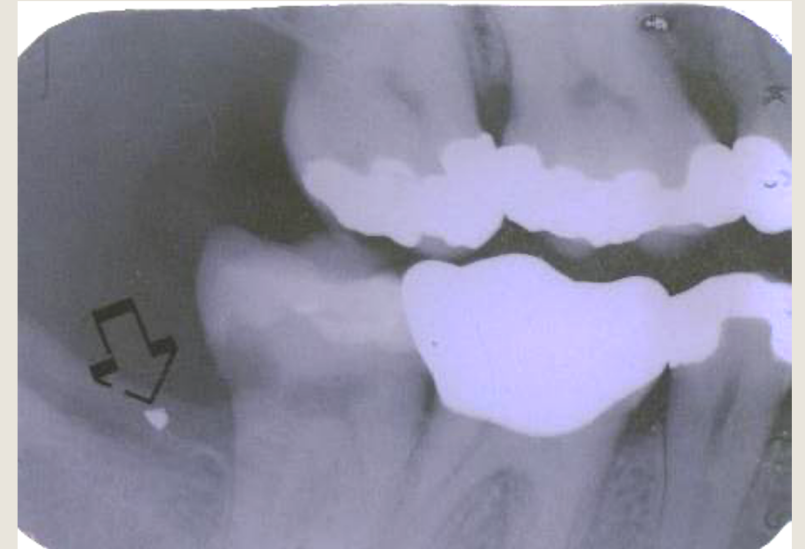




Vertical Tube Shift Technique using Occlusograph & Extra-oral Panoramic Radiograph

QUIZ

- What types of I/O radiographs are these?
 1. Right Posterior BW + Right Upper Posterior PA
 2. Left Posterior BW + Left Lower Posterior PA
 3. Right Posterior BW + Right Lower Anterior PA
 4. Right Posterior BW + Right Lower Posterior PA
 5. Left Posterior BW + Left Upper Posterior PA
- Which technique was used to locate the 'radiopacity'?
 1. Horizontal Tube Shift
 2. Right Angle Technique
 3. Vertical Tube Shift
- Where is the radiopacity (arrow point)?
 1. Lingual
 2. Buccal



TECHNIQUES FOR LOCALIZATION

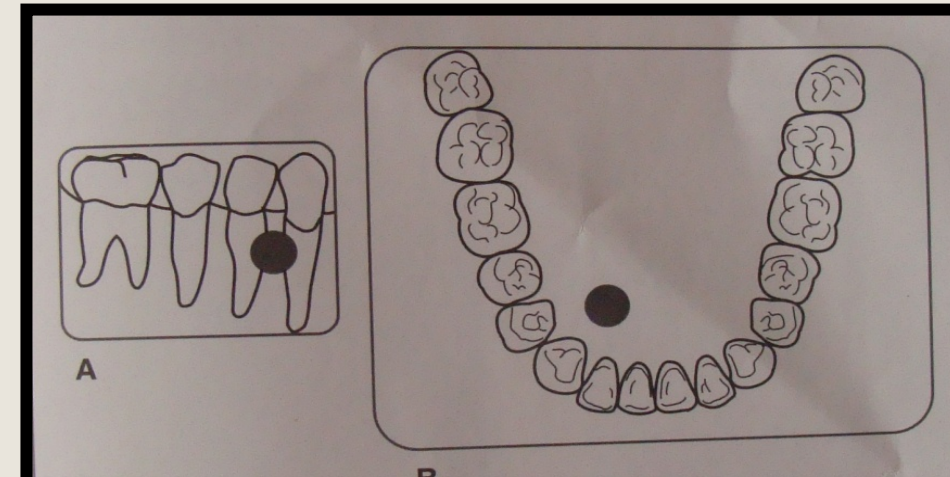
#2 - The right angle technique (Miller's Technique)

- **Two radiographs** are taken
- The second is taken at right angles to the first

Eg. periapical + true occlusal film

- The occlusal film will determine the bucco-lingual position of the object

(Not commonly practiced)





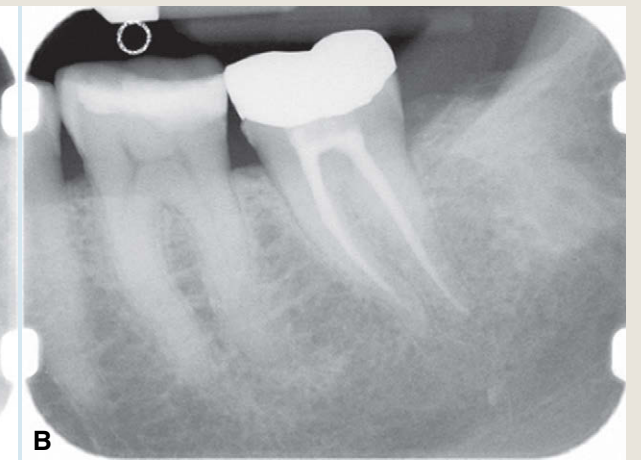
No SLOB rule – Occlusograph shows the B/L position

FILM FAULTS

- **Errors in the surgery**
- Errors in the darkroom *(not covered in this lecture)*
- Errors in film processing *(not covered in this lecture)*

ERRORS IN THE SURGERY

- Overexposure – dark image
- Underexposure – light image
- Patient motion – blurred image
- Film exposed to white light before processing
 - Analogue film or digital Photostimulable Phosphor (PSP) plate
- Not removing foreign objects such as ear-rings, spectacles, body jewellery (including tongue studs), hair clips, hearing aids, neck chains
- Poor patient positioning and incorrect technique – distorted images
 - Cone-cutting
 - Elongation
 - Foreshortening
- Damaged Film
- Double Exposed Film



For your own learning...
Identify Errors

Partial immersion
in developer

Over developed

Fixer splashed
on film before
processing

Cone cutting

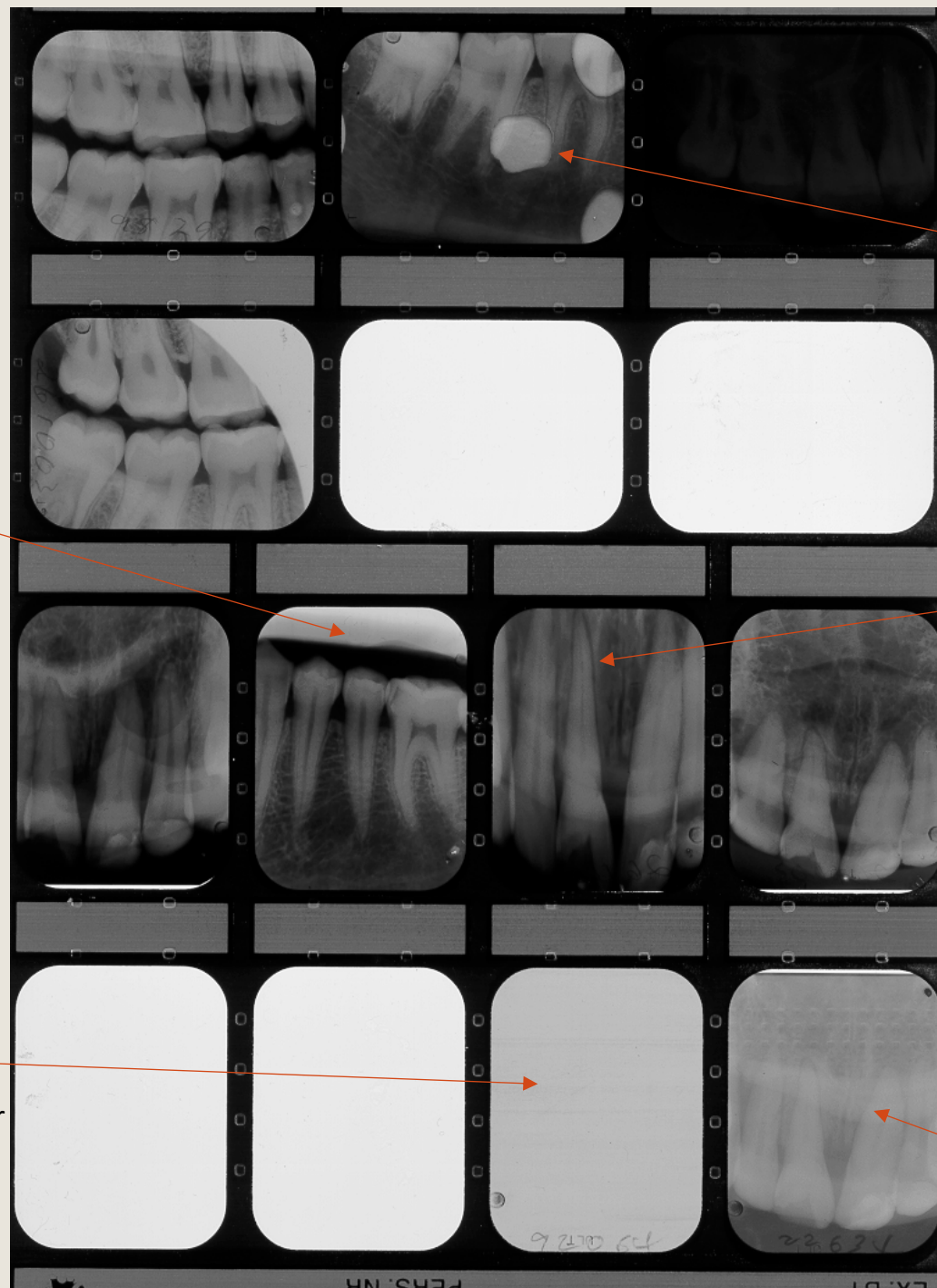
Elongation

Not washing adequately
post development or developer
on film before processing

Forshortening

1. Not exposed
2. Left in wash over-night
3. Put into fixer before developer

Film positioned
backwards



Next lecture on digital & analogue films

