Lecture No.7

**Intra-oral radiographic techniques:**

**Guidelines for ordering radiographs:**
1. Make radiographs only after a proper clinical examinations.
2. Order only those radiographs that directly benefit the patient in term of diagnosis & treatment.
3. Use the least amount of radiation exposure necessary to generate an acceptable view of the imaged area.

**Ideal radiographic projection:**
The objective of radiography in dentistry is a cast shadow of dental structures, such away that these shadows will be most informative. Ideal radiograph demonstrate certain image qualities, which are:
1. An image that's sharp.
2. An image that's shaped-like the object.
3. An image that's of the same size as the object.

To achieve the best possible result, the following **five principles** pertaining to projection geometry should be observed during film exposure:

<table>
<thead>
<tr>
<th>Rule</th>
<th>Description</th>
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<tbody>
<tr>
<td>1. <strong>First rule</strong></td>
<td>The source of radiation should be as small as possible.</td>
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<tr>
<td>2. <strong>Second rule</strong></td>
<td>The distance from the radiation source to the object should be as long as possible.</td>
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<tr>
<td>3. <strong>Third rule</strong></td>
<td>The distance from the object to the recording surface on which the shadow is cast should be as short as possible.</td>
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<tr>
<td>4. <strong>Fourth rule</strong></td>
<td>The object &amp; the recording surface should be parallel.</td>
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<tr>
<td>5. <strong>Fifth rule</strong></td>
<td>The radiation should strike both the object &amp; the recording surface at right angles.</td>
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The first three principles deal with the production of image sharpness. The other two require the alignment of the x-ray beam, object, and film in such a manner that the radiographic image of the object can be easily identified and easily evaluated.

- **Pneumbra**: is the amount of the unsharpness represented as partial shadow due to partial absorption of the light by the object.
- **Umbra**: is the area of total shadowing.

**Intra-oral radiographic techniques**

**1-Periapical techniques:**

Intraoral radiographs are examinations made by placing the X-ray film within the patient’s mouth during the exposure. Views that are most appropriate for revealing caries & periodontal & periapical disease in a localized region. We have two techniques:

1. **Bisecting angle technique** (based on Cieszynki’s rule of geometry, which stated that two triangles are equal when they shared one complete side and have two equal angles).

2. **Paralleling technique** (McCormack technique).

The result of parallel technique (PT) is believed to be superior to those of bisecting angle technique (BAT).

**Parallel angle technique:**

**mandibular premolar area**

**Theory of PT:**

Bisecting angle T. is the older of the two procedures & used by most present day practitioners & is taught in many dental schools. It is generally considered the easier of the two procedures...the PA was originally developed by McCormack .. its taught now in about half the dental schools in the USA. Its believed that the results from PT are superior to those of the BAT & that its not difficult to be learned.

The PT requires a target-object distance (TOD) as long as possible, because if not, magnification will result. so the TOD should be about 16 inch (40 cm) to get rid of magnification.
Lack of parallelism between the object & film also result in: magnification & distortion...the distortion will result when the x-ray:
1. Strike the object at right angle.
2. Strike the film at right angle.
3. Strike neither of them at right angle.

**N.B.: Points Must be followed in PT:**
1. The maxillary teeth are in 15-20 degree inclination away from the head & will be at 15-20 degree in plus.
2. The plane of the film should be parallel to the buccal surface of the examined tooth.
3. There is a need for fairly wide separation of the tooth & the film...the exception only occurs in the mandibular molar region, where the lack of high muscle attachments & a relatively flat lingual surface permit the film to be placed vertically in the mouth...parallel with and close to the molar tooth.
4. X-ray should strike the interproximal surface of teeth & the film at right angle.
5. This is can not be true for crespidance because of severe curvature.
6. Position of the film for the maxillary bicuspid must be parallel with the long axis of the tooth crossing the midline & for molar area, the film must be placed parallel to the midline.
7. For intra-oral film size 1.2 is used and the film must covering the whole area of the teeth only 1-2 mm will be seen before the incised edge of the teeth.

**The advantages of using film holding devices:**
1. to eliminate patient’ hand exposure.
2. when a patient has a brocken or unsteady arm, we can use bite block film holder.
3. avoid con cut the film.
4. assist in identifying horizontal and vertical angulation.

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**Paralleling Technique**

**ADVANTAGES**

(compared to Bisecting Angle technique)

1. Better dimensional accuracy (film/tooth par.)
2. Beam alignment simplified (ring)
3. Easier to standardize films (instrument)
4. Head position not critical (ring)
Theory of BAT:

The operator will imagine an imaginary line bisecting the angle formed by the long axis of the tooth & the x-ray film. The operator required to direct the central x-ray beam through the apex of the tooth at the bisecting line at right angle. Such angulation if properly employed, results in a tooth image that is exactly the length of the object. the film contacts the tooth at the occlusal or incisal surface & then diverges away from the long axis of the tooth.

As a result of lack of parallelism between the rays & the root, film & lack of right angle relationship between the rays, the tooth & the film.. all areas below the apex of the tooth (as well as above) are distorted. the degree distortion can be reduced by the use of a long TOD (10-20 inch)..the longer the distance between the radiation source & the object, the more parallel will be the rays..

When BAT used, its impossible to superimpose labial or buccal entities on their palatal or lingual counter parts, invariably when viewed on the radiograph the labial or buccal counter parts of a similar point on palatal or lingual surface will lie closer to the occlusal or in chisel edge.
this is a disadvantage of the BAT... Conversely, PT is more likely to portray or give an accurate anatomic representation of what accurately exists.

It is preferable to use 17 intraoral films, 5 maxillary anterior & 4 mandibular anterior (1.1 film), plus two 1.2 films of the posterior region of each quadrant. In addition, it is essential to use posterior BWF when anything (other than an edentulous mouth) is examined, unless the proximal surfaces of all teeth can be examined clinically.

**Bisecting Angle Instrument**

When using finger retention, always use the hand opposite to the side of the mouth being radiographed. (e.g., use the left index finger when taking the right maxillary premolar film). Use the thumb for the max. incisor film, the index finger for the mandibular incisor (either hand), the index finger or thumb (opposite hand) for all canines, and the index finger (opposite hand) for the posterior films.

Give patient option to clean hands first.

**Film Size - Adults**

**Bisecting Angle Technique ADVANTAGES**

(compared to Paralleling technique)

- More comfortable (with finger retention)
- No anatomical restrictions (with finger)
- Film holder not essential (finger)

**Angulation procedures:**

- **Horizontal angulation:** refers to the x-ray beam direction in horizontal plane. The x-ray tube head is held on both sides by the ends of the yoke...i.e. parallel to the occluded plane of the patient...the x-ray tube head & yoke swivel on centre point in the yoke to alter the horizontal angle.
• **Vertical angulation:** refers to the x-ray beam direction in vertical plane by the help of yoke ends.

We have two types of vertical angulation:

1. **Plus (positive):** the tube head is directed to the floor.
2. **Minus (negative):** the tube head is directed upward.

With the horizontal plane representing zero....

<table>
<thead>
<tr>
<th><em>Angulation guidelines for BAT</em></th>
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<tbody>
<tr>
<td><strong>Projection</strong></td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Incisors</td>
</tr>
<tr>
<td>Canines</td>
</tr>
<tr>
<td>Premolar</td>
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<tr>
<td>Molars</td>
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### Positioning of patient in dental chair:

When either PT or BAT are used, the patient should be seated in a comfortable position at dental chair, so that the occlusal plane of the jaw examined should be parallel with the floor. Some operators observed that the procedure of tipping the patient head backward in the chair gives them greater opportunities to observe film placement in relation to the long axis of the tooth. The chair must be higher when the lower arch is being examined. High quality intra-oral radiographs can be produced with the patient in supine position, the patient is preferred to be in an upright position.
Maxillary central area viewed by BAT:

- The PAF, preferably the narrow type (1.1), is used.
- The film should be placed in the midline with its upper border contacting the palate, the sides should be parallel with the long axis of the teeth.
- The remaining fingers are rotated as far out of the field as possible.
when the film for the central area is held, either thumb may be used... the thumb also retains the film in other areas of the maxilla or mandible... its customary to use the thumb of the hand on the opposite side from the side being examined.

Its preferable that the thumb contact the film & the palate at the upper border of the film. Every effort should be made not to bend the film.

Under no circumstances, should films be held by the operator or his assistant during film exposure.

Having placed this film in this position, the operator must observe the line of the film & the long axis of the central teeth (generally the anterior teeth protrude buccally at an angle of about 15 degree from the vertical). These two lines form an angle... the operator now must imagine a line bisecting this angle...

Using the cone of his choice, that is, either the short pointed cone (often used) or an open-end, lined cylinder... of any reasonable length. The operator directs the central or middle rays through the middle of the tooth....

No specific angulation has been given... the shape of the dental arches & the positioning of teeth in these arches vary greatly... the use of predetermined angles are contraindicated if superior results are to be obtained..

**Maxillary central lateral area viewed by BAT:**

The same above principles... the centre is the interproximal surface between the central & lateral teeth.
Maxillary cuspid area viewed by BAT:
The same above principles...the centre is the cuspid tooth. 1.2 film rather than 1.1 film is used...it's sometimes necessary to sharply bend the upper anterior corner of the film in order not traumatize the patient's palate.
Maxillary bicuspids area viewed by BAT:

1.2 film is used with the widest dimension placed horizontally...the horizontal angulation should be such that the rays pass directly through the interproximal space between the cuspid & first bicuspid...going distally to include the interproximal space between the second bicuspid & mesial surface of the first molar tooth...this ordinarily necessitates horizontal angulation that is a little anteroposterior to a line perpendicular to the sagittal plane.
Maxillary Molar

Maxillary Molar

Maxillary Molar
Imaging the third molar region when having difficulty placing film far enough posteriorly.

**Maxillary molar area viewed by BAT:**

Film placement & angulation procedures are almost identical to those for the maxillary bicuspid areas, however, the film is placed further distally in the mouth to include the entire 3rd molar area (including the upward curvature of the tuberosity). The horizontal angulation directs the rays at right angles or a little anteroposterior to a line perpendicular to the sagittal plane (i.e. midline of the palate). With the centre is the interproximal surface between the first & second molar.

**Mandibular incisors**

- #1
- #2

Mandibular incisors
Mandibular Incisors

Mandibular incisors

Mandibular Canine

Mandibular Canine
Mandibular Canine

Mandibular Canine

Mandibular Premolar
Mandibular Premolar

Mandibular Premolar

Mandibular Premolar
Mandibular Molar
**Comparison between BAT & PT:**

<table>
<thead>
<tr>
<th>Basic principle of shadow casting (for light &amp; x-ray)</th>
<th>BAT</th>
<th>PT</th>
</tr>
</thead>
<tbody>
<tr>
<td>First rule</td>
<td>Full fill</td>
<td>Full fill</td>
</tr>
<tr>
<td>Second rule</td>
<td>Can be used with either short or extended distance.</td>
<td>Full fill</td>
</tr>
<tr>
<td>third rule.</td>
<td>Full fill</td>
<td>Tooth film distance in somewhat greater</td>
</tr>
<tr>
<td>fourth rule.</td>
<td>There is no parallelism</td>
<td>Full fill</td>
</tr>
<tr>
<td>fifth rule.</td>
<td>No due to lack of parallelism between object &amp; film</td>
<td>Full fill</td>
</tr>
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Bisecting Angle Technique

**ERRORS**

>90° = foreshortening

<90° = elongation

**Elongation**

- long axis of tooth
- bisecting line

PID

Not enough vertical angulation
Elongation

Foreshortening

PID
long axis of tooth
bisecting line
film
Too much vertical angulation

Foreshortening
Film Bending

> 1/4” of film beyond occlusal

Cone-cutting
Black lines result from excessive bending (softening) of film prior to placement in mouth.

Reversed film

Double exposure
Worst technique error; two films need to be retaken

Film/patient movement