Radiographs In Endodonties
- A second pair of eyes

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INTRODUCTION

The benefits of the use of a dental assistant or four-handed dentistry has been well understood and practised since a long time. The use of radiographs in endodontics can be said as four-eyed dentistry as they can act as a second pair of eyes to see those structures which cannot be seen with the naked eye. The following description of the various areas of application of radiographs in endodontics would justify the above statement.

The commonly used radiograph in Endodontics is a periapical radiograph taken using a paralleling technique. The theory of Paralleling Technique is that the film packet is placed in a holder and positioned in the mouth Parallel to the long axis of the tooth. The X-ray tubehead is then aimed at right angles (vertically and horizontally) to both the tooth and film packet. The use of paralleling technique has the following advantages and disadvantages.

ADVANTAGES

- Geometrically accurate images with little magnification
- Minimal foreshortening or elongation
- Shadow of zygomatic process appears above the apices of the molar teeth
- Periodontal bone levels are well represented
- Detection of proximal caries
- Horizontal and vertical angulations of the
- X-ray tubehead are automatically determined by Position indicating devices (PIDs)
- Relative position of the film packet, teeth and X-ray beam are maintained irrespective of position of patient's head
- No coning off or cone cutting
- Reproducible radiographs

DISADVANTAGES

- Uncomfortable for the patient
- Difficult for inexperienced operators
- Difficult in shallow, flat palate
- Sometimes apices appear near edge of the film
- Can be used only with a long cone
- Holders need to be autoclavable

The normal anatomic structures and landmarks which are seen in these radiographs are important to differentiate between normal and pathologic findings.

Lamina dura - anatomically the lamina dura is a layer of compact bone (the cribriform plate or alveolar bone proper) that lines the tooth socket. X-ray beams passing tangentially through the socket must pass many times the width of the adjacent alveolus and are accentuated by this greater thickness of bone producing the characteristic "white line". The presence or absence and the integrity of the lamina dura is determined largely by the shape and position of the root, and, in turn the bony crypt, in relation to the X-ray beam. Noxious products emanating from the root canal system can effect a change in this structure which can be visible radiographically.

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Incisive foramen - Seen as an oval or hear-shaped radiolucency between the apices of maxillary right and left central incisors.

Lateral maxillary fossa - Seen as a diffuse radiolucency between the apices of maxillary lateral incisor and canine due to a bony depression of the labial cortical bone of the maxillary lateral incisor area.

Maxillary sinus - Seen as a well defined radiolucency extending over the apices and sometimes into the space between the apices of maxillary posterior teeth. It may extend into edentulous areas and is known as pneumatization.

Malar process - Or zygoma is seen as a U-shaped radiopaque mass superimposed over the apices of maxillary firsst and second molars.

Nutrient canals - Seen as vertical radiolucent linear shadows between the roots of mandibular anterior teeth.

Mental Fossa - Seen as an area of diminshed radiopacity on both sides of the midline of the mandible due to slight depressions in the bone on the labial aspect.

Lingual foramen - Seen as a radiolucent area in the midline of the mandible.

Genial tubercles - Seen as a round area of increased radiodensity surrounding the lingual foramen.

Mental ridge - Seen as a horizontal radiopaque bar below the apices of mandibular anteriors.

Mental foramen - Seen as a round or oval radiolucency in relation to the apices of mandibular first and second premolars.

Inferior alveolar canal - Seen as a horizontal radiolucent bar bordered by slightly radiopaque margins running below the apices of the mandibular psoterior teeth.

Mylohyoid ridge - Seen as a radiopaque bar superimposed over the apices of mandibular second and third molars.

Submandibular fossa - Seen as a diffuse radiolucency below the apices of mandibular molars extending from the bicuspids to the ramus.

Impacted tooth - Seens as a radiopaque mass in the periapical region of any teeth. Usually in the third molar region or canine region.

Developing teeth with incomplete roots - Seen as well defined radiolucencies of the apices of any tooth with funnel shaped root canals.

In Endodontics, radiographs can serve in the following **areas of application**. They can be used for diagnosis and treatment planning, as a treatment aid, to determine the prognosis and as records for future use.

Diagnosis - The radiograph can help in the diagnosis of pulpal or periradicular pathology with the presentation of certain features which show the cause and effects of a pathology such as

- Deep carious lesion
- Deep and large restoration
- Canal and / or chamber calcifications
- Root resorption
- Radiolucency / radiopacity at / or near the apex
- Widening of periodontal ligament space
- Break in the integrity of the lamina dura
- Tracking a sinus tract with guttapercha (to identify the offending tooth)

A classification of the state of inflammatory process on the periradicular tissues is possible by the type of radiographic changes observed in the periradicular tissues.

Initial acute inflammation

- Widening of the the radiolucent periodontal ligament space, or
- No apparent change

Initial spread of inflammation

- Break in the integrity of the lamina dura

Further spread of inflammation

- Diffuse area of bone loss at the apex

Initial low-grade chronic inflammation

- No apparent bone destruction, or
- Dense sclerotic bone evident around the tooth apex (Condensing osteitis)

Later stages of chronic inflammation

- Circumscribed, well defined radiolucent area of bone loss at the apex, surrounded by sclerotic bone

Treatment Plan- The radiograph can act as a guide in the treatment planning to decide what is suitable to do and how to go about doing the treatment. Radiographs help us to determine the various treatment options available to treat the conditions, the method of treatment to be adopted and the instruments required to provide the treatment. The various observations from the radiograph which would help in the treatment planning are

- Tooth anatomy
- Canal shape
- Number of Roots / Canals
- Canal size
- Canal bifurcation
- Lateral canals
- Calcifications
- Open apex
- Resorption
- Lingual developmental groove
- Root fractures / Level of fracture
- Proximity of apex to other anatomic structures
- Presence or absence of permanent tooth buds
- Restorability - The amount of tooth structure affected

Treatment Aid - The radiograph can be used as a treatment aid during the various stages of root canal treatment to facilitate the rendering of a satisfactory treatment and obtaining a successful result. As a treatment aid it can be used to

1 Determine the shape of access cavity (Angulation and depth of burs over the radiograph)

2 Verification of canal / perforation (check radiograph with a file in position)

3 Working length determination

Ingle's method

- Measure tooth length from preoperative radiograph
- Subtract 1mm for estimated working length
- Place rubber stop in selected instrument
- Expose film with instrument in position
- Working length = file Length ± distance from file tip to the root apex
- Repeat radiograph if neccessary
- Record working length and reference point

Grossman's method (Formula method)

Actual length of tooth =

Actual length of Instrument
Radiographic length of instrument

x Radiographic length of tooth

4 Separated instrument - location and retrieval

5 Vertification of Master cones

6 Evaluation of obturation

7 In apical surgery (position of apex, check spillage)

Prognosis and Treatment record - Radiographs can be used to evaluate the prognosis of the treatment and as a treatment record to

- Compare during recall visits
- Evaluate the healing of lesion
- Identify new pathosis
- Plan Post Endodontic Treatment

ADDITIONAL RADIOGRAPHIC METHODS

Tube shift technique (Clark's rule / Buccal object rule / Parallax / SLOB) - To view buccal and lingual canals which are superimposed in routine radiographs, a slightly angulated radiograph with a mesial or distal 15^0 horizontal angulation can be taken.

Endoray - A specially designed film holder to be used in endodontics with files placed in root canals. It is particularly useful if a rubber dam clamp has been placed far from the tooth being treated.

Digital radiography - A mention of the use of digital radiography is necessary to include the recent advance in the field of radiography which promises to revolutionize the use of radiographs in endodontics and in dentistry as a whole. There are two types. They are:

- Indirect digital radiography / Computed radiography In this system a photostimulable phosphor image plate is used in place of a

radiographic film. the image plate is scanned by a laser beam and information converted into digital data for display on the computer monitor.

- Direct digital radiography / Real-time imaging. In this system a charge coupled device (CCD) is used in place of a radiographic film and the image is relayed directly to the computer for display on the monitor.

The Direct digital radiography is the more recent development and is widely used. As with any new technique or development it has certain advantages and disadvantages.

ADVANTAGES

- Low dose of radiation
- Computer manipulation of images
  - alteration in contrast
  - alteration in resolution
  - image enhancement
- Automated image analysis
- No need for conventional processing
- Storage of patient's records as hard copies
- Teleradiology

DISADVANTAGES

- Expensive
- Large disc space required to store images
- Sensor connected directly to computer
- Some loss of image definition
- Image manipulation - time consuming and needs practice
- Hard copy images may fade with time

Radiographs are a **two dimensional image of a three dimensional object**. It is very important to understand this limitation as the image seen on the radiograph is actually a two dimensional representation of a three dimensional object. The mere availability and taking of a radiograph is not sufficient because **the eyes cannot see what the mind does not know**. A thorough knowledge of the normal radiographic appearance and pathologic changes of various anatomic structures is essential for the proper interpretation of the radiograph. Every radiograph has a short story and reading a radiograph is an art. The use of a magnifying lens will be helpful in reading the radiograph. The human mind is a tricky thing. When we see a radiograph for too long **we see what we want to see and we don't see what we don't want to see**. To prevent a misinterpretation it is suggested that one should view the radiograph for a short period, turn away and see again, instead of viewing it continuously for a long period at one stretch.