Pain Control in Endodontics

The pain reaction threshold (PRT) is defined as that point at which a person will feel the pain. With endodontic therapy hyperresponse to stimulation is significantly increased.

Factors that lower the PRT include:

1- Presence of pain in the beginning of treatment.

2- Fatigue.

3- Fear and anxiety.

By increase of pain sensation, blood level of catecholamine suddenly elevates with an increase in blood pressure and heart rate. This might induce fainting, angina pectoris, asthma and psychiatric reactions. To reduce the possibility of such conditions happening the anaesthesia has to be introduced slowly and in supine position.

Differential diagnosis of dental pain

Pain in the facial region may be of different origins as:

1- Dental: This type is due to reversible pulpitis, irreversible pulpitis and symptomatic apical infection.

2- Musculoskeletal: As temporomandibular joint disease.

3- Neuropathic: Pain may be due trigeminal neuralgia or herpes infection.

4- Inflammatory conditions: As migraine.

5- Inflammatory conditions: As sinusitis.

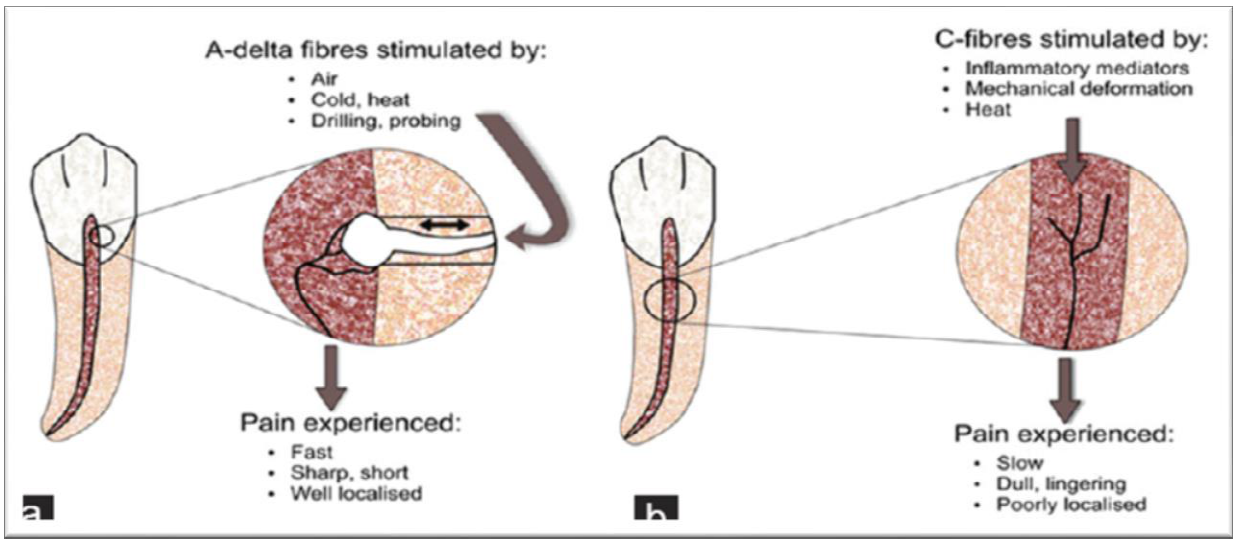
6- Systemic disorders: As cardiac pain.

7- Psychogenic.

Dental Pain

A-fibres in the pulp are responsible for the sensitivity of dentine and thus for the mediation of the sharp pain induced by dentinal stimulation. Prepain sensations induced by electrical stimulation result from activation of the lowest threshold A-fibres some of which can be classified as A beta-fibres according to their conduction velocities. Therefore in reversible pulpitis the A fibres are sensitized.

Intradental C-fibres are activated only if the external stimuli reach the pulp proper. Their activation may contribute to the dull pain induced by intense thermal stimulation of the tooth and to that associated with extensive pulpal inflammation.



Local anesthesia

It is the temporary loss of sensation or pain in a certain part of the body produced by a topically applied or injected agent without depressing the level of consciousness. Prevention of pain during dental procedures eliminates fear and anxiety.

Knowledge of the anatomy prevents problems during anesthestic injection as muscle trismus, hematoma and intravascular injection.

There are 2 general types of local anesthetic chemical formulations:

1- Esters as procaine, benzocaine.

2- Amides as lidocaine, mepivicaine, prilocaine and articaine.

Local anesthetics are vasodilators, absorbed in the circulation and have a systemic effect directly to the blood plasma level. Vasoconstrictors in the local anesthetic constrict the blood vessels to lower the absorption of the local absorption into the blood stream to prolong the anesthetic effect in the area and decreasing the possibility of toxicity. It may be used to stop bleeding by infiltration of few drops in the bleeding area.

The condition of patients with hyperthyroidism, cardiovascular disease, diabetes and having drugs as tricyclic antidepressants and MAO inhibitors need a consultation with the physician before injection with a local anesthetic having vasoconstrictor.

If the local anesthetic is injected in an infected area, its onset will be delayed. The inflammatory process in an area of infection lowers the pH of the extracellular tissue from its normal value to 5-6 or lower. This low pH inhibits anesthetic action because little of the free base form of the anesthetic is allowed to cross into the nerve sheath to prevent conduction of nerve impulses. Inserting a needle into an active site of infection may spread the infection.

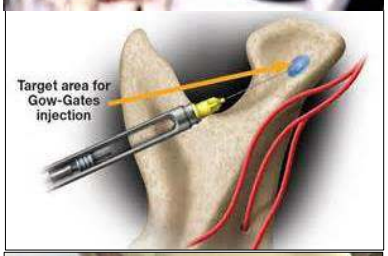
Topical anesthetic

It is effective to minimize surface discomfort of injection of the needle (2-3 mm in depth). This anesthetic is composed of benzocaine (up to 20%) or lidocaine as solution or ointment (5%) or spray (up to 10%) .

Techniques for mandibular anesthesia

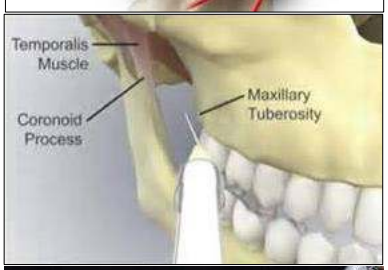
1- Inferior alveolar nerve block.

The site of deposition is near the mandibular foramen before the entry of the inferior alveolar nerve. It anesthetizes the mandibular teeth with the buccal and lingual soft tissues.



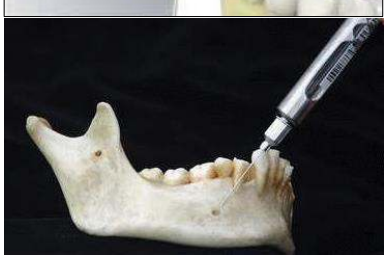
2- The Gow-Gates mandibular nerve block.

The site is the lateral aspect of the neck of the mandible condyle. It is a V3 nerve block anesthetizing all the mandibular teeth in the region with the buccal and lingual soft tissues. It provides sensory anesthesia of the buccal and mylohyoid nerve.



3- The Akinosi-Vazirani nerve block.

The site is the height of the mucogingival junction of the maxillary third molar near the maxillary tuberosity. This is used where there is limited mouth opening.



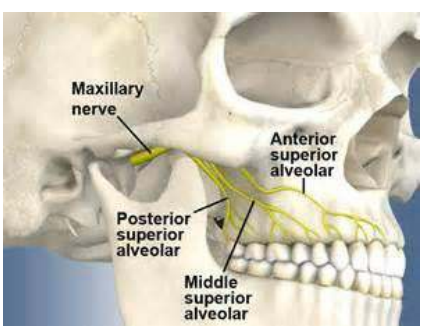
4- The Incisive nerve block.

The site is buccaly between the mandibular two premolars. It provides anesthesia to the premolars and anterior teeth in the region.

Techniques for maxilary anesthesia

1-The posterior superior alveolar nerve block.

The site is in buccal fold of the maxillary 2nd molar. It anesthetizes the maxillary molars and buccal soft tissues.



2-The middle superior alveolar nerve block.

It anesthetizes the 2nd maxillary premolars and the site of injection is in the buccal fold of the premolars.

3-The anterior superior alveolar nerve block.

The site is the buccal fold of the first maxillary premolar and aimed at the infraorbital foramen. The areas anesthetized are the anterior teeth and premolars with overlying soft tissues.

Supplemental injection techniques

1- **Periodontal ligament (PDL) injection.**

This technique is used when no other technique can be used. The needle is inserted between the tooth and PDL with bevel of needle toward the root. Anesthetic solution of 0.2 ml is placed per root. Onset of anesthesia is immediate but duration is variable.

2- **Intraosseous anesthesia.**

Local anesthetic (LA) is directed into the bone surrounding the root. A small perforation is made in the cortical plate of bone with a small bur and the needle is inserted to introduce the LA.

3- Intrapulpal anesthesia.

When full anesthesia is not gained by other techniques, intrapulpal approach is used. The needle is inserted directly in the pulp and LA introduced with force. Onset is immediate.

Dental and referred pain.

Most of oral and dental pain can be traced to its source. There are cases whereby pain might be experience away from its source as the same side but other jaw, ears, eyes and sinus. Careful diagnosis reveals the affected tooth or related anatomic structure (in non-dental pain).

Endodontic Radiography

The dental radiograph allows indirect vision to the dentition and supporting structures, and provides standardization of intracanal procedures. As a result, radiographs are a very important aid for endodontic diagnosis and treatment.

Basic radiographic concepts

1- X-rays are similar to light rays in that both travel in a straight line until deflected or absorbed. Deflected rays reduce image clarity.

2- The radiograph is a shadow image representing differences in a density of objects in the x-rays path. Therefore, the radiograph is a two dimensional image of a three dimensional structure.

3- The size, shape and contrast of the shadow image are subjected to many distortions since they are dependant on the physical properties of:

a) The object through which the x-ray passes.

b) The radiation source.

c) The film on which the image is recorded.

Suggestions for good endodontic radiography

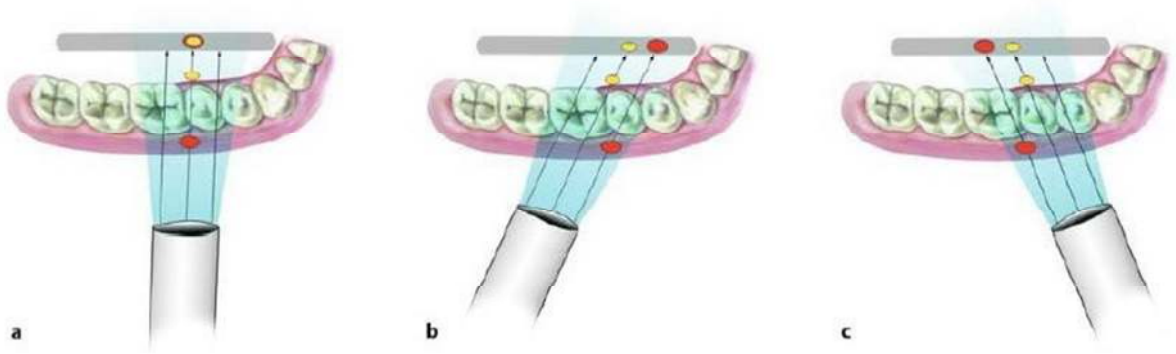
1- For periapical exposures the edge of the film is positioned parallel to and near the incisal or occlusal surface of the teeth so that the tooth apices are near the center of the film.

2- The plastic film holder facilitates standardization of a radiographic technique by aiding in film positioning and preventing movement of the film during exposure.

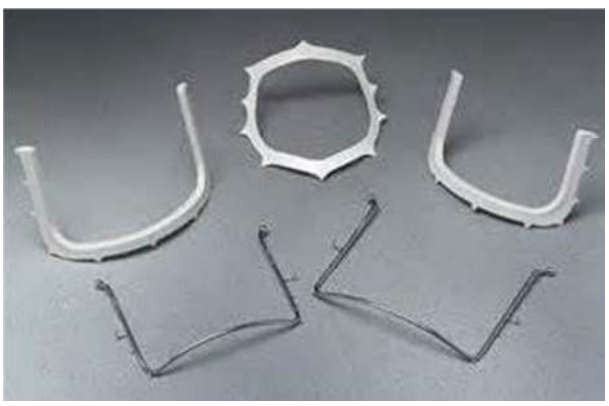
3- Because of the angle of the hard palate the films that are held by the finger usually show maxillary molars with short buccal roots and very long palatal root.

Buccal object rule

When treating premolars and molars, it is often difficult to recognize radiographically which canal is nearer buccal side. When the exposure is done to a multicanaled tooth, the canals may be superimposed and the difficult to differentiate them. If the x-ray cone is deviated mesially or distally with a given angle the roots will separate in the film. Therefore, when the cone is moved distally the buccal canal appears mesial to the lingual or palatal canal and when the cone is moved mesially the buccal canal appears distal to the lingual or palatal canal.



Factors that affect the quality of the radiograph and its interpretation.

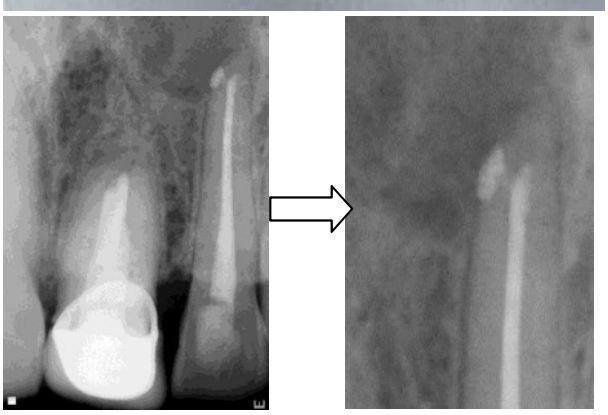


1- Radiolucent rubber dam frames do not interfere with taking radiography. Metal frames may mask important structures on the film.

2- A quick automated processing technique offers a clear radiograph. It maintains a water bath heated by a thermostatically controlled heater that maintains the developer and fixer at 100 F, so shortening the time needed to process a radiographic film. The exposed film is immersed in the developer for 5-10 seconds, rinsed with water and then placed in the fixer until it becomes clear (15-20 seconds).

3- All endodontic radiographs must be dated and mounted in chronological sequence to allow for immediate reference.

4- Film magnification is essential to see clearly detailed structures in the film and this is done a magnifying lens. Nowadays, there is no need for this lens because digital radiography allows detailed picture that can be zoomed in clearly.



Information gained from the radiograph

1- The crown and pulp anatomy
2- Hard tissue alterations in the tooth (sclerosis or resorption)
3- Number, size, location and direction of the roots
4- Estimation of the working length
5- Related anatomical structures as mental foramen, maxillary sinus etc…
6- Confirm position of master cone
7- Evaluation of success of obturation
8- Instrument separations or perforations.

Digital radiography:

As dentistry moves to more precise quality so does diagnosis therefore it was important to change the traditional x-ray films to a more precise film and here digital radiography entered the diagnostic field. Digital radiography used in dentistry is available in three variations:

) Direct digital system: It uses a solid-state sensor such as a charge coupled device (CCD). These systems have a cable that connects the sensor to the computer and in turn to screen monitor.
) Storage phosphor system: It uses a photo- stimulable phosphor plate that stores the image in the phosphor for subsequent readout by an extra- oral laser scanner.
) Indirect digital system: It uses a scanning device connected to a computer for digitizing traditional silver halide dental films.

Advantage of digital radiography

) Image enhancement, contrast stretching and reversing.
) Storage for further use and evaluation.
) Retrieval immediately.
) Transmission of images to remote sites in a digital format.
) Radiation exposure is reduced from 50% to 90% compared with conventional film- based radiography.

Disadvantages:

) High initial cost.
) Reduction in image quality when compared with conventional radiography.

Direct digital systems have three components:

) Radio component: It consists of a high resolution sensor with an active area that is similar in size to conventional film. For infection control, disposable plastic sheaths are used to cover the sensor when it's in use.

) Visio component: It consists of a video monitor and display-processing unit. As the image is transmitted to the processing unit, it's digitized and stored by the computer.
) Printing component: High resolution printer providing a hard copy of the screen image.

Tips for Endodontic Radiography

Radiography is nowadays considered a basic tool in the practice of endodontics. It would be almost impossible to obtain good results from treatment without the use of radiographs. One needs excellent diagnostic preoperative x-rays for evaluation of the case, x-rays during the treatment for verification of the procedures involved in the treatment, and postoperative x-rays to evaluate treatment outcome after completion of endodontic therapy. It is however important to mention that only by following certain criteria in capturing, reading and interpreting x-rays, one can make the best use of this important tool.

An x-ray may supply surprising information about the tooth, pulp chamber and contents, number, patency, curvature and length of the canals. In cases of retreatment, it may demonstrate canal perforations, broken instruments, failure to properly obdurate, ineffective endodontic surgery and a number of conditions well below the standard of care. In order to effectively use and understand x-rays one should go along with the following tips.

The apices of the roots must be completely visible. Each radiograph must include the entire area of interest, and the apices of the teeth must be at least 3 mm away from the border of the radiograph.
Figure 1, clearly demonstrates the importance of this rule.

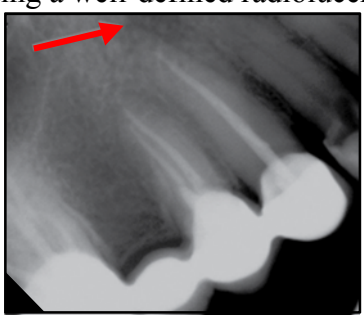
Take two or three radiographs at different angles. The long cone paralleling technique is the technique of choice for endodontic radiography. It projects an accurate radiograph with minimal distortion and a high level of reproducibility. A single radiograph may however show an apparently well accomplished treatment, which when retaken from a second or third viewpoint may demonstrate an important discrepancy relative to the first view. An intentional shift of the x-ray beam from the orthoradial position may provide additional information compared to the zero degrees projection (Fig. 2).

A straight-on diagnostic film should be taken such that the x-ray cone is aimed perpendicular to both the facial aspect and long axis of the tooth. A second, mesially angulated image is attained by horizontally aiming the x-ray cone up to 30°mesial to the straight-on angle and perpendicular to the long axis of the tooth.6 A third, distally angulated image is attained by horizontally aiming the x-ray cone up to 30° distal to the straight on angle and perpendicular to the long axis of the tooth. This is to show a complete image of the root canal system that is as close to a three dimensional image as possible (Figs. 3, 4). It has been demonstrated that the recommended horizontal beam angulation for identification of two canals in one root is dependent on the amount of separation and divergence between canals and is reported to lie between 20° and 40°.

Figure(1)

a) Radiograph of the maxillary canine. The periapical area is not clear.

b) Another x-ray extending beyond the full length of the same maxillary canine demonstrating a well-defined radiolucency at the apex.

a   b

a) Radiograph of the mandibular first molar shows apical radiolucency in spite of well performed endodontic treatment !!

b) The angled x-ray shows incomplete endodontic treatment of mesial root accounting for the observed radiolucency.

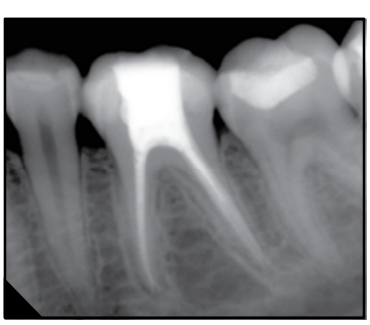
b 

(Figure 3)

a) An x-ray of a mandibular first molar taken in a straight direction showed 2 canals.

b) An x-ray taken in a distal direction showed 3 canals of the same tooth.

c) An x-ray taken in a mesial direction showed 4 canals of the same tooth.

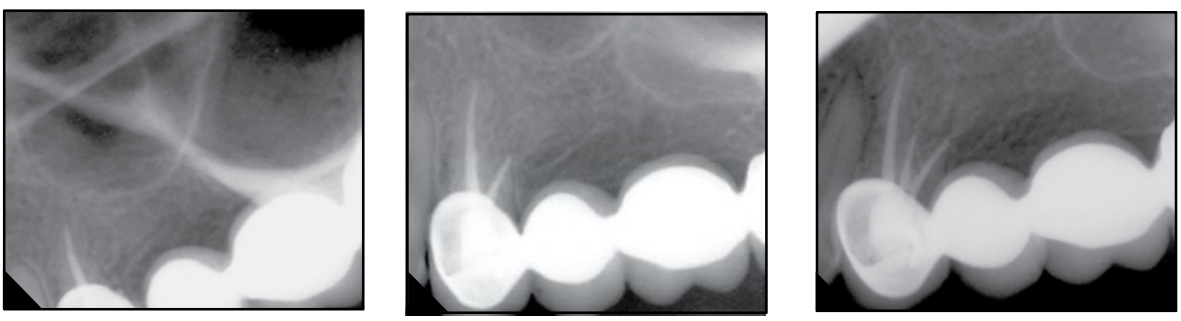


(Figure 4)

a) An x-ray of a maxillary first premolar taken in a straight direction showed 1 canal.

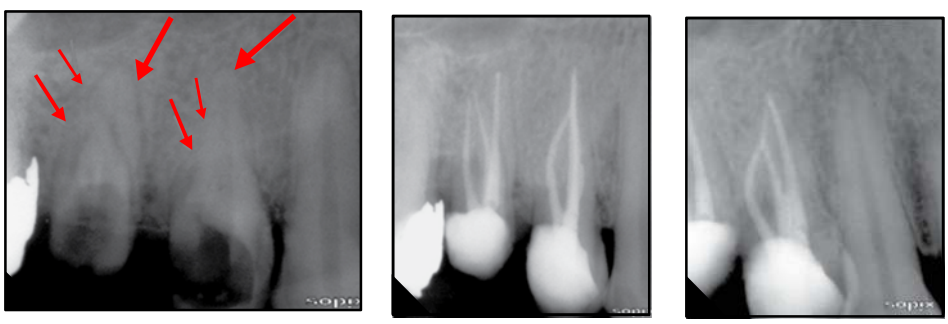
b) An x-ray taken in a distal direction showed 2 canals of the same tooth.

c) An x-ray taken in a mesial direction showed 3 canals of the same tooth.



(Figure 5)

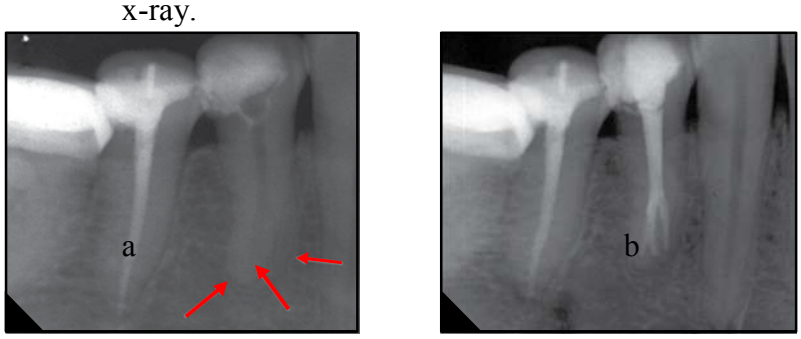
a) Preoperative X-ray of maxillary first and second premolars. Tracing periodontal ligament spaces (arrows) indicates the presence of three roots in each tooth. **b, c)** Postoperative x-rays clearly demonstrate what was pre-operatively traced



(Figure 6)

a) Preoperative X-ray of a mandibular first premolar. Tracing periodontal ligament spaces (arrows) indicates the presence of three canals.

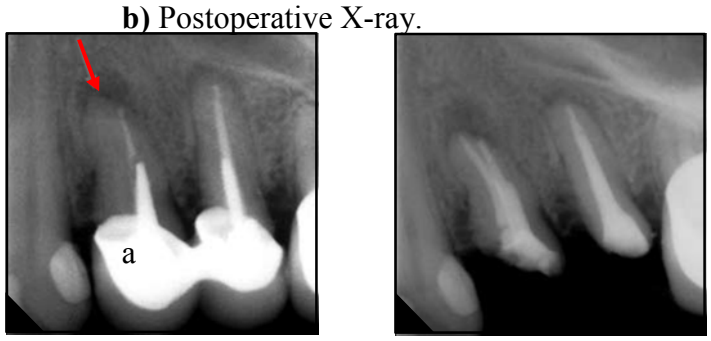
b) This can be readily seen in the post-operative x-ray.



(Figure 7)

a) Preoperative X-ray of a maxillary first premolar. Root canal filling is not centered in the canal (arrow) indicating the presence of a second untreated canal.

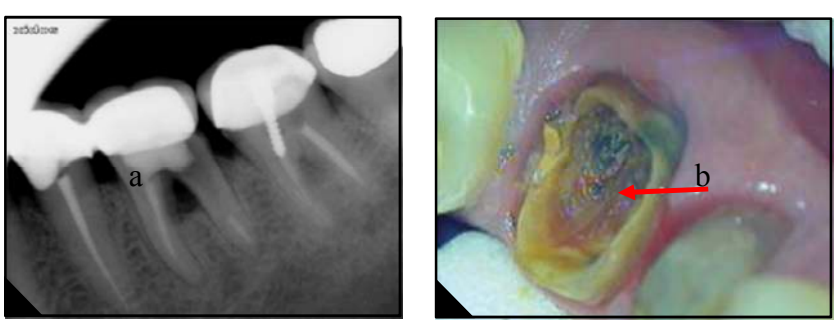
b) Postoperative X-ray.



(Figure 8)

a) Preoperative X-ray of mandibular first molar showing bone loss in the furcation area.

b) Clinical examination shows mesial- to-distal fracture line (arrow) running through the furcation floor.



(Figure 9)

a) The teardrop radiolucency (arrow) present at the apex of this upper second premolar is highly suggestive of a vertically fractured root . **b)** Inserting gutta percha deep into the pocket to the point of resistance.

c) Extension of the gutta percha till the apex confirms the diagnosis.

Careful preoperative assessment of root canal anatomy obtained from a diagnostic radiograph is a key prerequisite for thorough canal preparation and, ultimately, successful therapy. One should always look for periodontal ligament spaces when evaluating x-rays (Figs. 5, 6). By tracing these spaces, one can diagnose multiple roots, bifurcated roots, or teeth with strange anatomy. [10]

If the root canal filling is not centered in the canal, it is a virtual certainty that a second canal exists within the root that is untreated (Fig.7).

An operator should always look at the position of radiolucencies. Lesions of endodontic origin can arise anywhere laterally along the periodontal ligament as often as they are present apically.

An entire bone loss in the furcation area is a strong indication that either one of the roots is fractured or that there is a mesial- to-distal fracture running through the furcal floor (Fig. 8).

Similarly, a teardrop radiolucency that extends up a root, especially in the presence of a post and buildup, is most often associated with a vertical root fracture (Fig. 9). Probing to the apex of the affected root is virtually diagnostic.