Tips for Endodontic Radiography

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Abstract

Endodontic radiographs traditionally form the backbone of the diagnosis, treatment procedures and follow-up of endodontic cases. It is the only method whereby the dentist can "visualize" that which he cannot see or feel during the process of diagnosis and treatment. A radiograph is however a two-dimensional image of an actually a three dimensional object. Some tips are outlined in this articles that have proved to be successful and predictable. If followed, they will greatly improve and simplify root canal treatment.

Key words: Endodontic radiographs; angled radiographs; diagnosis.

No single scientific advancement has contributed as greatly to improved dental health as the finding of the amazing properties of cathode rays by Professor Wilhelm Konrad Roentgen in November 1895. The possibilities of their application to dentistry were realized as soon as two weeks after this finding, when Dr. Otto Walkoff took the first dental radiograph in his own mouth.[1] Three years later (1899), Dr. C. Edmund Kells used the x-ray during root canal therapy to determine the tooth length. One year later (1900), Dr. Weston A. Price called attention to incomplete root canal fillings as evidenced in radiographs and in 1901, he recommended using radiographs to check the adequacy of root canal fillings. [2]

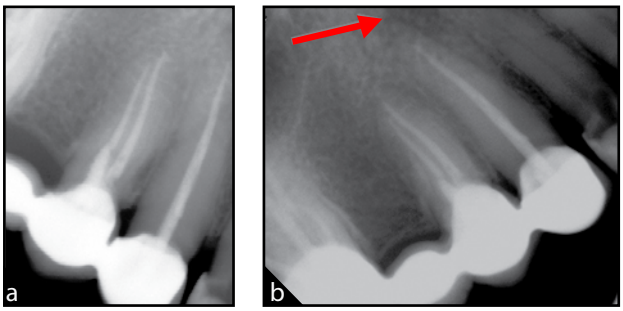
Radiography is nowadays considered a basic tool in the practice of endodontics. It would be almost impossible to obtain good results from treatment without the use of radiographs. One needs excellent diagnostic preoperative x-rays for evaluation of the case, x-rays during the treatment for verification 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. The purpose of this paper is to discuss some tips in endodontic radiography and how to interpret findings in order to obtain the clearest true realistic picture.

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.

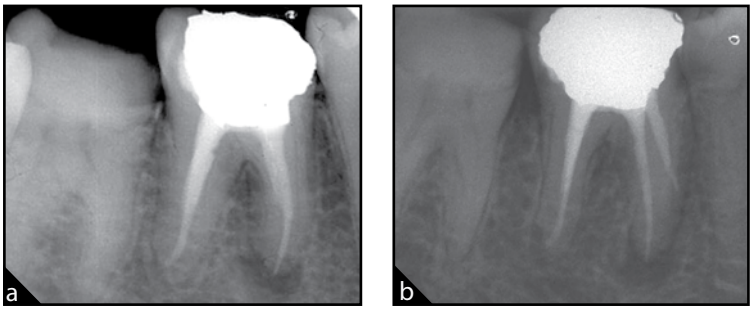
The apices of the roots must be completely visible. Each radiograph must include the entire area of interest, and the apices of the teeth must be at least 3 mm away from the border of the radiograph.[3] Figure 1, clearly demonstrates the importance of this rule.

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.[4] 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. [5] An intentional shift of the x-ray beam from the orthoradial position may provide additional information compared to the zero degrees projection (Fig. 2).

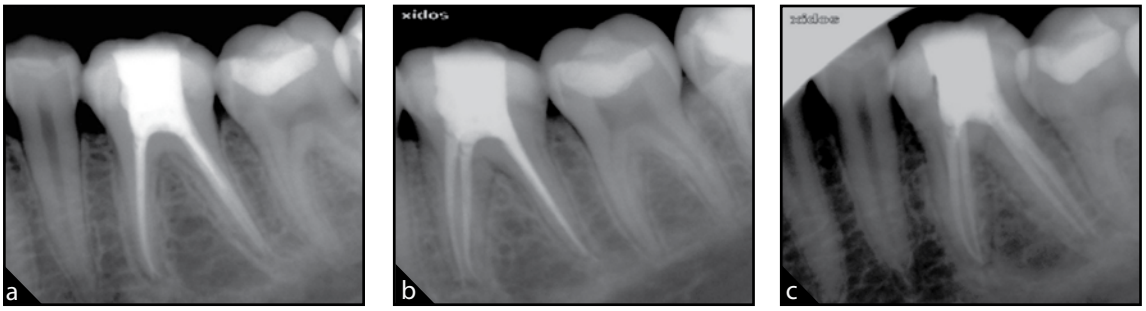
A straight-on diagnostic film should be taken such that the x-ray cone is aimed perpendicular to both the facial aspect and long axis of the tooth. A second, mesially angulated image is attained by horizontally aiming the x-ray cone up to 30°mesial to the straight-on angle and perpendicular to the long 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°. [7, 8, 9]



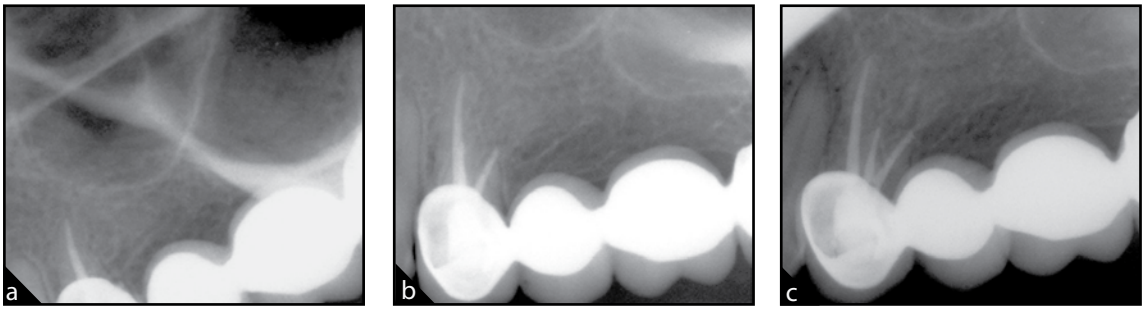
(Figure 1)
a) Radiograph of the maxillary canine. The periapical area is not clear.
b) Another x-ray extending beyond the full length of the same maxillary canine demonstrating a well defined radiolucency at the apex.



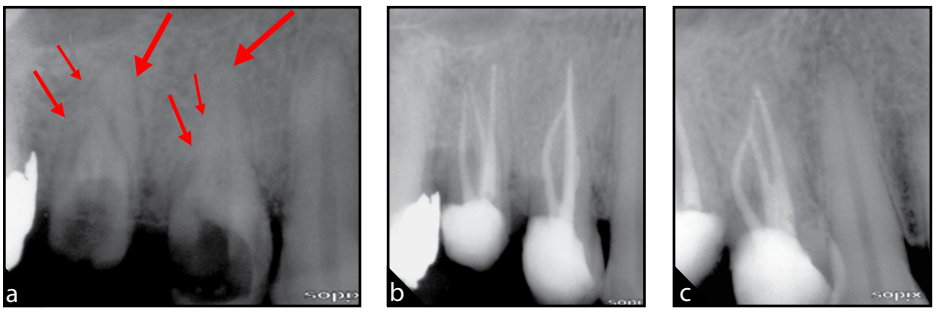
(Figure 2)
a) Radiograph of the mandibular first molar shows apical radiolucency in spite of well performed endodontic treatment !!
b) The angled x-ray shows incomplete endodontic treatment of mesial root accounting for the observed radiolucency.



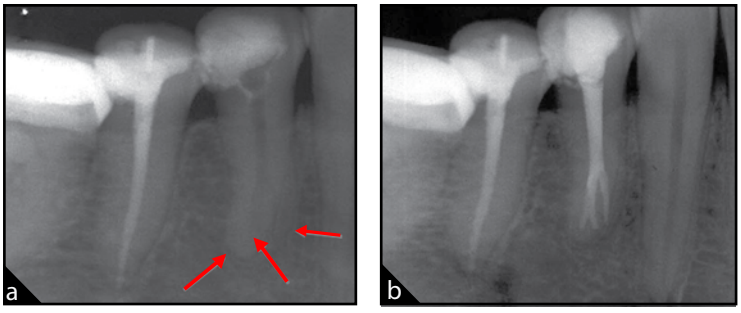
(Figure 3)
a) An x-ray of a mandibular first molar taken in a straight direction showed 2 canals.
b) An x-ray taken in a distal direction showed 3 canals of the same tooth.
c) An x-ray taken in a mesial direction showed 4 canals of the same tooth.



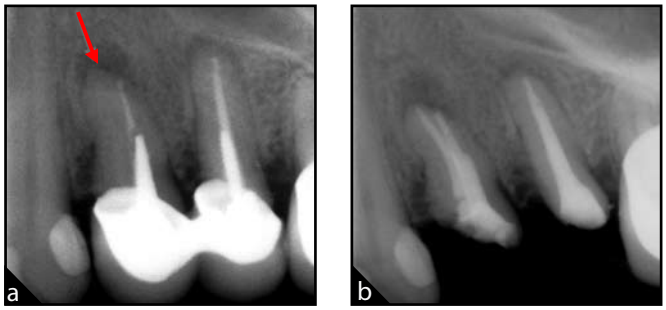
(Figure 4)
a) An x-ray of a maxillary first premolar taken in a straight direction showed 1 canal.
b) An x-ray taken in a distal direction showed 2 canals of the same tooth.
c) An x-ray taken in a mesial direction showed 3 canals of the same tooth.



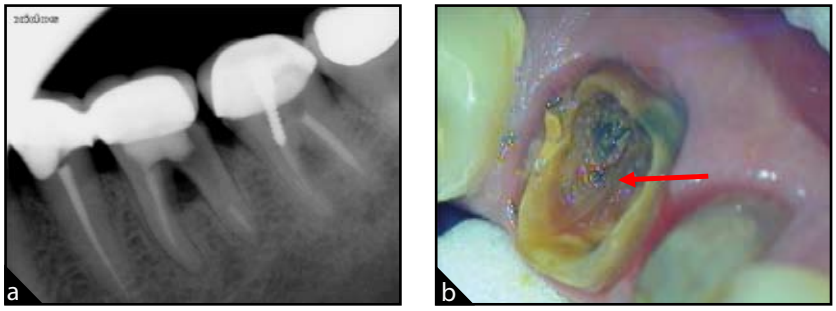
(Figure 5)
a) Preoperative X-ray of maxillary first and second premolars. Tracing periodontal ligament spaces (arrows) indicates the presence of three roots in each tooth.
b, c) Postoperative x-rays clearly demonstrate what was pre-operatively traced.



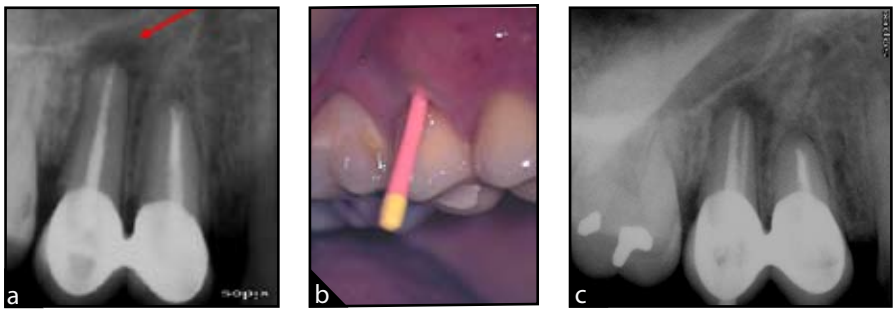
(Figure 6)
a) Preoperative X-ray of a mandibular first premolar. Tracing periodontal ligament spaces (arrows) indicates the presence of three canals.
b) This can be readily seen in the post-operative x-ray.



(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. [11]

Conclusion

Radiographic examination is crucial for providing optimal dental care. In combination with a comprehensive objective and subjective clinical examination, such radiographic interpretation from multiple angles is made much more decisively when consideration is given to the tips presented above. This approach will go a long way towards allowing the dentist to see the often-elusive complete clinical picture.

References

1. Ennis LM, Berry HM. Dental roentgenology. 5th ed. Philadelphia: Lea and Febiger; 1959, p. 13.
2. Glenner RA. 80 years of dental radiography. J Am Dent Assoc. 1975 Mar;90(3):549-63.
3. van Aken J, Verhoeven JW. Factors influencing the design of aiming devices for intraoral radiography and their practical application. Oral Surg Oral Med Oral Pathol. 1979 Apr;47(4):378-88.
4. Fava LR, Dummer PM. Periapical radiographic techniques during endodontic diagnosis and treatment. Int Endod J. 1997 Jul;30(4):250-61.
5. Kaffe I, Gratt BM. Variations in the radiographic interpretation of the periapical dental region. J Endod. 1988 Jul;14(7):330-5.
6. Ruddle CJ. Endodontic Diagnosis. Dent Today. 2002 Oct;21(10):90-2, 94, 96-101; quiz 101, 178.
7. Walton RE. Endodontic radiographic technics. Dent Radiogr Photogr. 1973;46(3):51-9.
8. Klein RM, Blake SA, Nattress BR, Hirschmann PN. Evaluation of X-ray beam angulation for successful twin canal identification in mandibular incisors. Int Endod J. 1997 Jan;30(1):58-63.
9. Martínez-Lozano MA, Forner-Navarro L, Sánchez-Cortés JL. Analysis of radiologic factors in determining premolar root canal systems. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1999 Dec;88(6):719-22.
10. Castellucci A. Diagnosis in Endodontics. In: Endodontics. Florence: IL Tridente; 2004, p. 44.
11. Mounce R. Interpreting endodontic radiographs. Take a trip to a Japanese rock garden. Dent Today. 2003 Dec;22(12):64-6, 68-70.