

Vertical angle variation of periapical radiograph for the diagnosis, planning and endodontic treatment

Clovis Monteiro **BRAMANTE**¹

Eduardo Khouri **DIÉP**²

Alexandre Silva **BRAMANTE**¹

Ivaldo Gomes de **MORAES**¹

Melissa Esther **RIVERA**¹

DOI: <https://doi.org/10.14436/2358-2545.8.1.034-040.oar>

ABSTRACT

Objective: The aim of this study is to discuss the importance of the vertical angle variation of the periapical radiograph in some special situations in endodontics.

Methods: Some references were consulted, in order to analyze the benefits of this technique in endodontics.

Results: The vertical angle variation of the periapical radiograph, can be used in some situations in endodontics, such as the overlapping of the zygomatic arch on the root apex of upper molars, for visualizing thin root

apexes, in cases of cross-sectional fractures and for avoiding the overlapping of the rubber dam clamps wings during rubber dam isolation in upper and lower molars. Also, it can be particularly useful for the detection of root canal obstructions located in the cervical third and short intraradicular posts in teeth with metallic crowns, where it is difficult to identify these details.

Conclusions: The appropriate management of the vertical angle variation could help to resolve these cases.

Keywords: Radiology. Endodontics. Radiography, Dental.

How to cite: Bramante CM, Diép EK, Bramante AS, Moraes IG, Rivera ME. Vertical angle variation of periapical radiograph for the diagnosis, planning and endodontic treatment. *Dental Press Endod.* 2018 Jan-Apr;8(1):34-40.
DOI: <https://doi.org/10.14436/2358-2545.8.1.034-040.oar>

» The authors report no commercial, proprietary or financial interest in the products or companies described in this article.

» Patients displayed in this article previously approved the use of their facial and intraoral photographs.

Submitted: February 17, 2017. Revised and accepted: March 14, 2017.

¹Universidade de São Paulo, Faculdade de Odontologia de Bauru (Bauru/SP, Brazil).

²Universidad Nacional Pedro Henríquez Ureña, Escola de Odontologia (Santo Domingo, Dominican Republic).

Contact address: Clovis Monteiro Bramante
Faculdade de Odontologia de Bauru, USP – Alam. Octavio Pinheiro Brisola 9-75
CEP: 17.012-901 – Bauru/SP – E-mail: clobra@uol.com.br

Introduction

When a periapical radiograph is done, it is important to apply the appropriate vertical angle variation, in order to prevent image alterations, resulting in mistakes of interpretation.^{1,2,3} In some situations, such as diagnosis, treatment planning and during endodontic therapy, it is necessary to vary the vertical angle, in order to visualize further details that would not be observed through the conventional vertical angle technique.^{1,2,3,4,5,6,7}

For this reason, it is essential for the dental professional to learn about this resource, as well as how and when to apply it.

Some of these situations are:^{2,3}

- A) The overlapping of the zygomatic arch on the root apex of upper molars;
- B) For the diagnosis and treatment of cross-sectional root fractures;
- C) To avoid the overlapping of the rubber dam clamp's wings during rubber dam isolation in lower molars;
- D) To visualize thin root apices; and
- E) For the detection of root canal obstructions located in the cervical third and short intraradicular posts in teeth with metallic crowns, where it is difficult to identify these details.

Methods:

Some references were consulted, in order to analyze the benefits of this technique in endodontics.

Results and Discussion

A) Overlapping of the zygomatic arch on the root apex of upper molars:

Le Master's technique:

This technique is applied in upper molars when there is an overlapping of the zygomatic arch on their root apices, which does not allow a correct observation of their roots and apices⁵ (Fig 1).

In this technique, a vertical angle reduction of the X-ray incidence is performed with the purpose of preventing the overlap. Special attention should be given while doing this procedure, because a foreshortened image could be accidentally obtained. The parallelism between the tooth and the radiographic film should be acquired during this technique's execution^{2,3,5} (Fig 2).

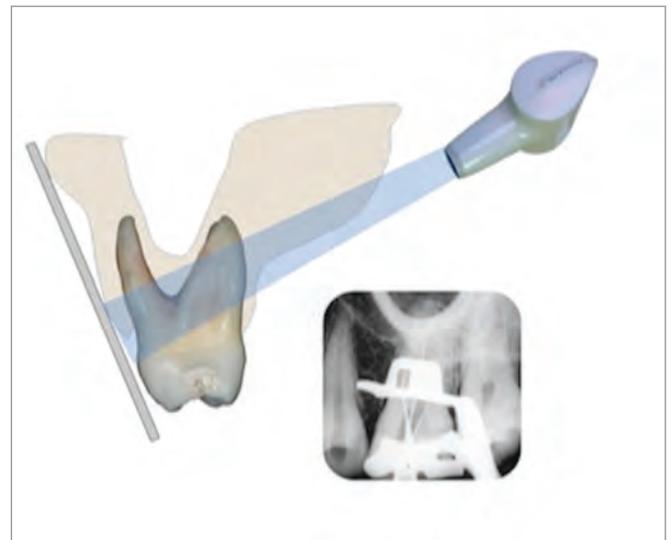


Figure 1. An example of a radiographic image produced through the bisecting angle technique in a case of overlapping of the zygomatic arch on the root apex of an upper molar.

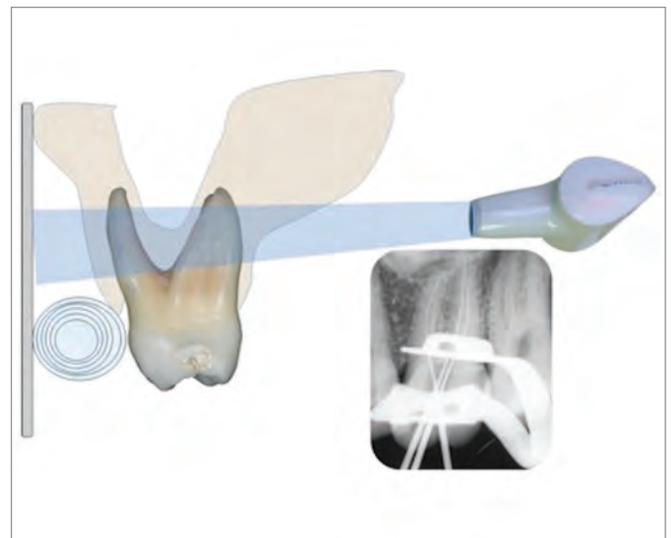


Figure 2. An example of a radiographic image produced through the Le Master's technique as a vertical angle reduction, in order to prevent the overlapping of the zygomatic arch on the root apex of an upper molar.

There are different ways to obtain parallelism between the tooth and the radiographic film with the aid of a cotton roll, which can be placed directly in the tooth or by fixing it with masking-tape. Similarly, if the tooth is already isolated, parallelism can be obtained by placing the cotton roll under the rubber dam clamp^{2,3} (Fig 3).

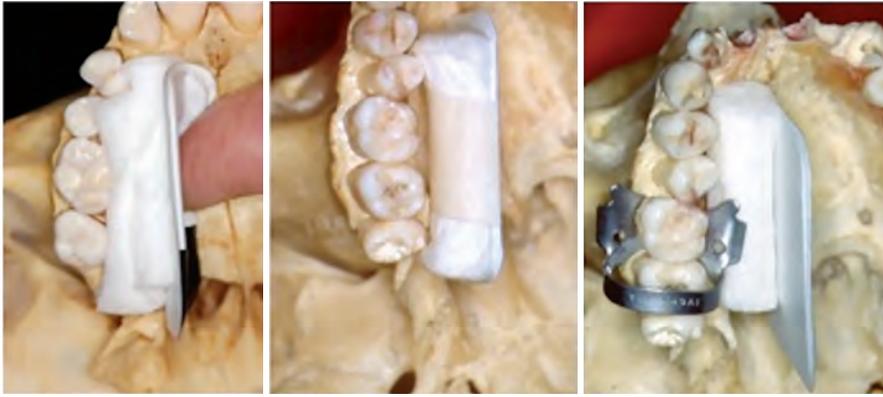


Figure 3. Different ways to obtain parallelism between the tooth and the radiographic film with the aid of a cotton roll and a rubber dam clamp, using Le Master's technique.

Table 1. Comparison between the techniques of bisector and LeMaster in upper molars (Jamdade AS).

Events	Technique	
	Bisecting angle	Le Master
Repetition of radiography	56,50%	17,70%
Zygomatic superposition	37,10%	9,60%
Image distortion	17,70%	4,80%
Incomplete image	1,60%	3,20%
Patient's tolerance	Equal	

As reported by Jamdade in 2014,⁴ the Le Master's technique represents greater advantages when compared to the bisecting angle technique in upper molars. According to his findings, regarding the repetition of radiographs, Le Master's technique presented only a 17.70% of cases, in contrast to the cases in which the bisecting angle technique was used, which 56.50% needed a radiographic image repetition. When the overlapping of the zygomatic arch was tested, the Le Master's technique exhibited a 9.60% of cases for this occurrence, as compared with a 37.10% of cases when the bisecting angle technique was applied. In addition, when image distortion was studied, Le Master's technique produced a 4.80% of cases with this error, observing a 17.70% of cases for the bisecting angle technique. Because the radiographic film was kept parallel and closer to the tooth in Le Master's technique, an apical incomplete image was observed in 3.20% as compared to a 1.6% for cases when the bisecting angle technique was utilized. However, this is a rare occurrence in the bisecting angle technique because

of more inferiorly directed rays. Otherwise, it is higher in the paralleling technique, because of divergent rays between object and receptor and insufficient palatal depth. The only correlation between these two, was the tolerance of the patient to the techniques.

B) Diagnosis and treatment of cross-sectional root fractures:

For the correct treatment of cross-sectional root fractures, some factors should be considered, such as the type of the fracture, its reduction and the immobilization of the root fragments. Root fractures can be simple, multiple or comminuted, being the latter of the worst prognosis. The reduction of the fracture, with the proximity or immobilization of the fragments is essential to their consolidation. If the incidence of the X-ray does not match with the fracture's level, it will appear as a band, showing the area around the line of the fracture, which will serve as a guide to identify the type of fracture (Fig 4). With a vertical angle augmentation of +/-15°, the incidence of the

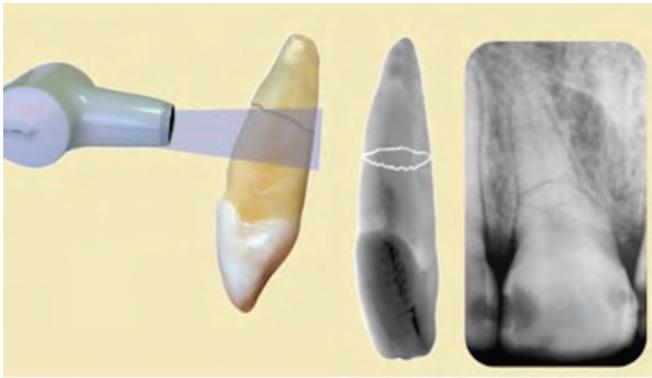


Figure 4. An example of a radiographic image showing how the vertical angle variation of the X-ray tube-head could help identify the types of root fractures.



Figure 5. An example of how the X-ray incidence could help identifying the alignment and approximation of root fragments.

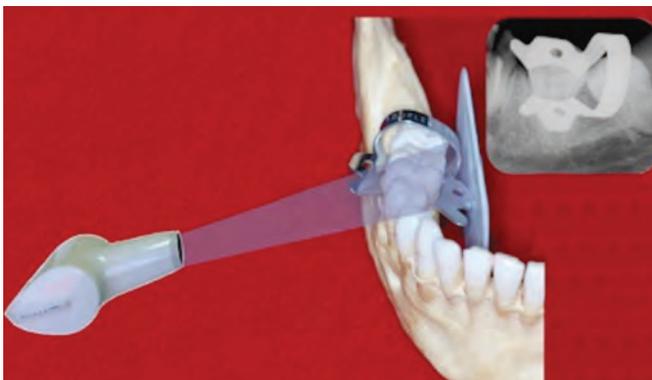


Figure 6. A radiographic image with overlapping of the rubber dam clamp's wing on the root apex of a lingually inclined lower molar.

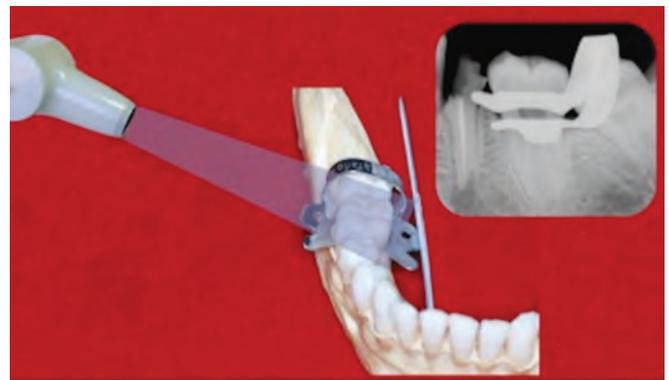


Figure 7. An example of how a vertical angle augmentation could help prevent the overlapping of the rubber dam clamp's wing on the root apex of a lower molar.

X-ray will match the fracture's level. This would help to identify the alignment and approximation of the root fragments.^{2,3}

C) Avoiding the overlapping of the rubber dam clamp's wings during rubber dam isolation in lower molars:

Lower molars can be vertically positioned and can present a lingually or buccally inclined crown. During the conventional radiographic examination, there is a vertical angle incidence of (-5,-10°). These inclinations cause the projection of the rubber dam clamp's wings on the root apices of the teeth, preventing the clear visualization and interpretation of the image, resulting in complications during the different stages of endodontic treatment (Fig 6). Hence, a vertical angle variation should be made, in order to lead a projection of the X-

ray on the same level as the buccal and lingual clamp's wings (Fig 7). If the tooth is in a vertical position, the vertical angle should be of 0° to -5°; if it is lingually inclined, then, the vertical angle should be positive (+5° to +10°) and if there is a buccal inclination, the angle should be negative (-10° to -15°).^{2,3}

This situation of overlapping of the rubber dam clamp's wings on root apices, could happen in other upper or lower teeth, during the odontometry, conometry or root canal filling verification. In these cases, a vertical angle variation (positive or negative) is required, with the purpose of preventing this from happening. Figure 8 is an example of an overlapping of the rubber dam clamp on the root apex of an upper incisor during conometry. In this case, the reduction of the vertical angle, allows to clearly observe the root apex and the master cone^{2,3} (Fig 9 and 10).

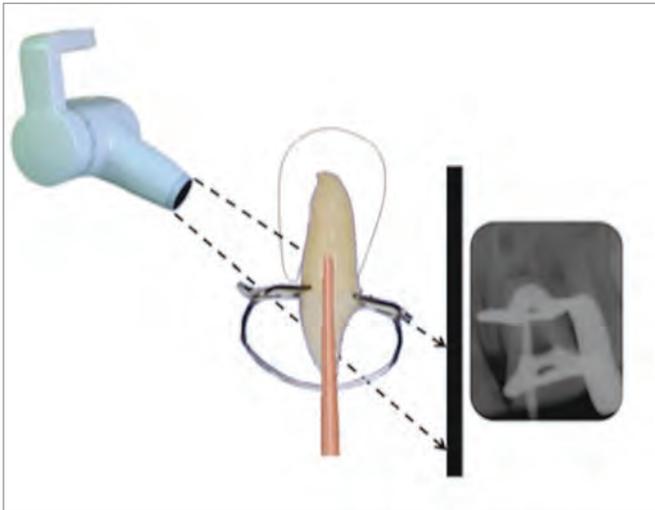


Figure 8. Overlapping of the rubber dam clamp on the root apex of an upper incisor during conometry.

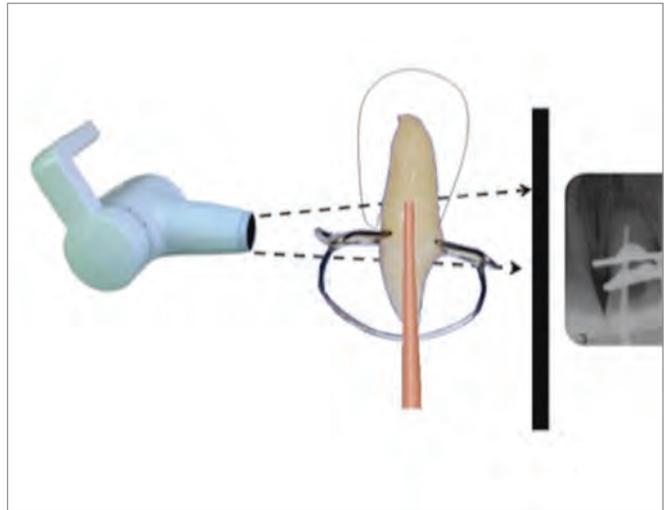


Figure 9. The reduction of the vertical angle, allows to clearly observe the root apex and the master cone.



Figure 10. Radiographic images with (A) and without (B) overlapping of the rubber dam clamp on the upper incisor.

D) Visualizing thin root apexes:

Some teeth like upper canines and pre-molars can have very long and thin roots, being difficult to observe through the conventional radiographs, complicating some of the stages of the endodontic treatment such as odontometry and conometry, as well as during the obturation's level confirmation (Fig 11).^{2,3}

For the solution of this problem, the vertical angle of incidence could be increased, 5° or 10° compared to the conventional angle. This action will result in a

foreshortened radiographic image, which will allow a better view of the root apex^{2,3} (Fig 12).

E) Detection of root canal obstructions located in the cervical third and short intraradicular posts in teeth with metallic crowns, where it is difficult to identify these details:

Sometimes, root canal obstructions located in the cervical third and short intraradicular posts in anterior or posterior teeth with metallic crowns, can not be observed through a

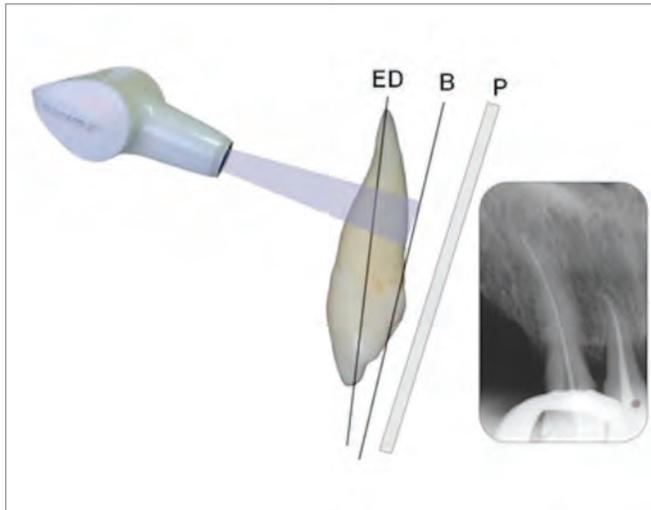


Figure 11. If the canine has a long and thin root, it will be difficult to clearly observe its root apex through a conventional radiograph: DE=Dental axis, B=Bisecting angle, P=Radiographic film.

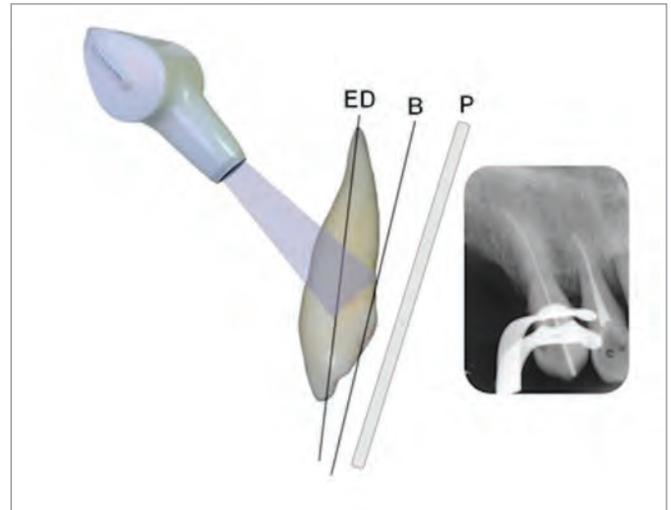


Figure 12. The augmentation of the vertical angle of the X-ray's tube-head, causes a foreshortened radiographic image, resulting in a better view of the root apex. DE=Dental axis, B=Bisecting angle, P=Radiographic film.

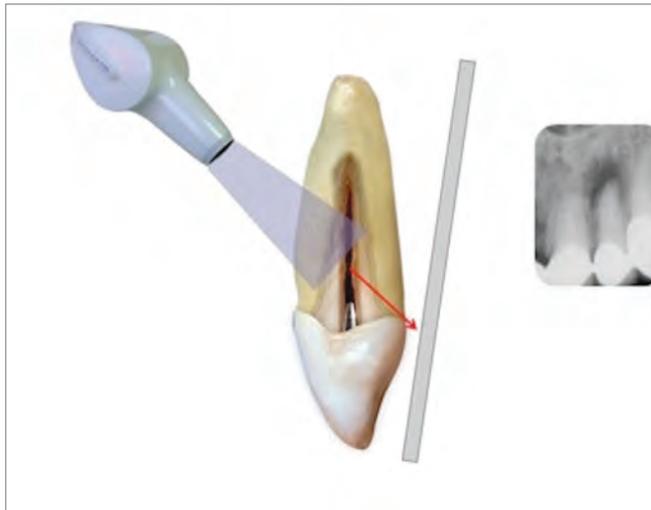


Figure 13. An example of a radiographic image with a conventional vertical angle's variation, in which two intraradicular posts can not be observed.

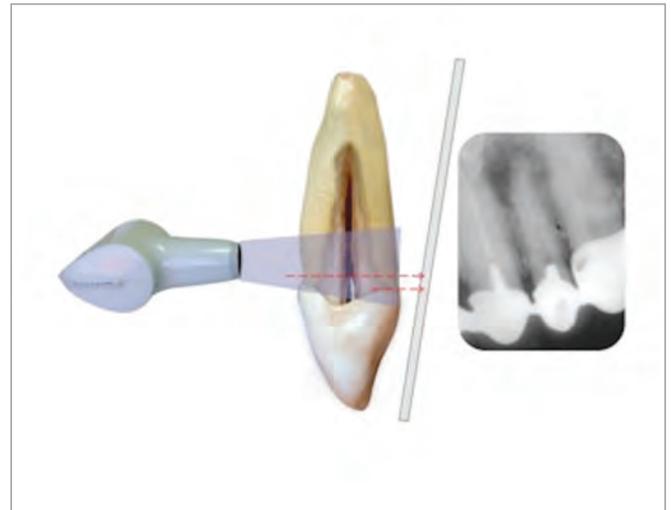


Figure 14. An example of a radiographic image taken with a vertical angle reduction (figure 13's case), in which two intraradicular posts can be observed.

radiographic image taken by the conventional vertical angle technique. This could significantly complicate the access to the root canals, because of the presence of a projection of the marginal border of the metallic crown on the obstruction or intraradicular post. In this case, this factor could lead to incorrect radiographic interpretations, misleading the dental professional and its treatment planning^{2,3} (Fig 13).

For visualizing root canal obstructions located in the cervical third and short intraradicular posts, it is convenient to execute a vertical angle reduction, which is a prearranged distortion of the image. This technique will produce an elon-

gated radiographic image, allowing the observation of these details^{2,3} (Fig 14).

As suggested by these authors, in teeth with metallic crowns, besides making the first radiographic examination for these cases through a conventional technique, another initial radiograph should be done with a vertical angle reduction, with the objective of identifying these clinical situations. In figure 15, the presence of an intraradicular post can not be observed through a conventional radiograph (a), but with a vertical angle reduction, it is possible to observe it in the mesial root^{2,3} (b and c).

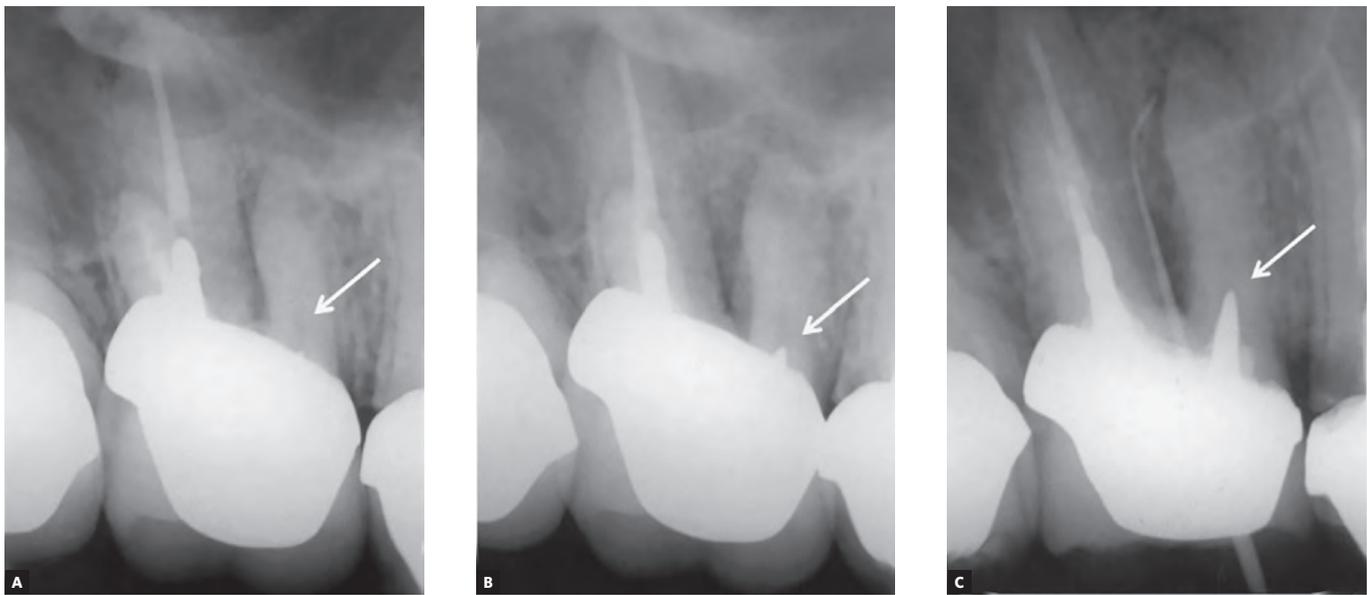


Figure 15. Conventional radiograph of (A) an upper molar in which an intraradicular post can not be observed in the mesial root. Radiographic images taken with vertical angle reduction (B, C), where the intraradicular post of the mesial root can be observed.

Conclusions

It can be deduced from this work that in some special situations, the vertical angle variation would be extremely useful for the dental professional, that should always be prepared to apply this resource whenever is necessary. In this prearranged distortion, it is important to remember that this could result in a foreshortened or elongated image. Consequently, a conventional radiograph without vertical angle variations, should be obtained as a guide to observe other anatomic details.

References

1. Aydos J. Distorções preconcebidas em radiografias intra-orais. *Rev Fac Odontol Porto Alegre.* 1962;4:59-81.
2. Bramante CM, Berbert A. Recursos radiográficos no diagnóstico e no tratamento endodôntico. 3ª ed. São Paulo: Pancast; 2002.
3. Bramante CM, Berbert A, Bernardinelli N. Recursos técnicos radiográficos aplicados à Endodontia. *Rev Bras Odontol.* 1980;37(1):8-24.
4. Jamdade AS. Modified bisecting angle technique in eliminating sygomatic superiposition over apices of maxillary molars. *Indian J Dent Res.* 2014 July-Aug;25(4):521-6.
5. Khouri ED. Variación del ángulo vertical de la radiografía periapical para visualización de perno intra conducto. In: Bramante CM, Berbert A. Recursos radiográficos no diagnóstico e tratamento endodôntico. ed. São Paulo, Pancast 2002.
6. Le Master CA. A modification of technique for roentgenographic upper molar. A speedy technique for roentgenographing the teeth. *Dent Cosmos.* 1924;66:433-6.
7. Rosh JE, Tavares D. Métodos radiográficos especiais para o dentista clínico. Rio de Janeiro: Epume; 1988.
8. Tamse A, Kaffe I, Fishel D. Zygomatic arch interference with correct radiographic diagnosis in maxillary molar endodontics. *Oral Surg Oral Med Oral Pathol.* 1980 Dec;50(6):563-6.

License information: This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.