

Evaluation of Different Radiographic Methods for the Localization of Impacted Maxillary Canine –A Comparative Study

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ABSTRACT

Introduction: Maxillary canines are the most frequently impacted teeth after the third molars. The position of impacted maxillary canines in the dental arch is variable, as the teeth may become impacted in the alveolus buccally, palatally, or in line with the dental arch. Many methods for canine localization using traditional dental radiographs have been described in the literature but none of these methods alone has 100% accuracy. Study was done to evaluate the different radiographic methods for the accurate determination of impacted maxillary canine.

Material and methods: A sample of 80 patients, who were radiographically diagnosed with impacted maxillary canines, was randomly selected for the study. The patients were equally distributed into four groups and evaluated for bucco palatal localization using one of the four different radiographic techniques, viz –a viz, horizontal parallex, vertical parallex, magnification method using single panoramic x ray and angulation method.

Results: Horizontal parallex is much more accurate in diagnosing palatally impacted maxillary canines and the angulation method is very poor in diagnosing palatally impacted maxillary canines. But in case of buccally impacted maxillary canines, horizontal parallex method showed very poor results when compared to other three methods of our study. Horizontal parallex and angulation method are better in excluding the palatal diagnosis as compared to other methods but all the methods are same to exclude the diagnosis of buccally located maxillary canine.

Conclusion: Horizontal parallex method using two periapical films taken at different horizontal angles is an accurate and easily available method for the localization of impacted maxillary canine. But when there is difficulty in locating the impacted tooth, it is recommended to employ a combination of methods to accurately locate it.

Keywords: Radiographic Methods, Impacted Maxillary Canine

INTRODUCTION

Ectopic eruption and impaction of the permanent maxillary canines during dental development is a significant clinical problem encountered in oral surgery and orthodontics, affecting an estimated 1-3% of the general population.¹ A tooth is considered impacted when its eruption is delayed and it is not expected to erupt completely based on clinical and radiographic findings.^{3,4} Maxillary canines are the most frequently impacted teeth after the third molars.⁵

Many methods for canine localization using traditional dental radiographs have been described in the literature, including tube-shift intraoral radiographs,^{7,8} two extraoral projections at right angles⁶, and magnification in panoramic radiographs.^{10,11} but none of these methods alone has 100% accuracy. Evidence suggests that even the best traditional methods of buccopalatal localization result in a misdiagnosis of canine position once in every six to twelve cases. The study was aimed to evaluate different radiographic methods for accurate and reliable

localization of impacted maxillary canine

MATERIAL AND METHODS

This prospective study was conducted on patients who were radiographically diagnosed as cases of maxillary impacted canines. Four different radiographic techniques were used to localize the impacted tooth and for each radiographic method, 20 patients were evaluated for the diagnosis of impacted canine. The four radiographic methods in our study were:

- Horizontal parallex method using two periapical radiographs at two different angulations (SLOB technique)²
- Vertical parallex method using one panoramic x ray and one maxillary occlusal view.²
- Magnification method using a single panoramic x ray
- Angulation method using a single panoramic x ray.

Horizontal parallex method

It was described in 1910, also known as the buccal object rule, Clark's rule, SLOB technique. The principle of this method is based on the change in relationship between radiologic images of two separate objects when the angle of projection is changed.² Due to parallex, the more distant object appears to move in the same direction as the tube shift and the object closer to the tube appears to move in opposite direction (Figure-1).⁸

The radiographs taken for horizontal parallex in our study were two periapical radiographs which were taken at two different horizontal angulations.

Vertical parallex method

The principal of this method is same as that of horizontal parallex method but the change in angulation is taken in vertical direction.² The two radiographs which were taken in our study for vertical parallex method are one panoramic view and one maxillary occlusal view. The position of the cusp tip of impacted maxillary canine was compared between the two radiographs. If the position of the cusp tip was more apical on occlusal view as compared to panoramic view, it was diagnosis as palatal impaction. In case of buccally positioned impacted maxillary canine, the cusp tip is more cervical on occlusal view as compared to panoramic view. There is no change in cusp tip location in case of intermediate positioned impacted canines.

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Magnification Method

This method uses the difference in magnification of the crowns of ectopic upper canines on the same panoramic radiograph to determine the position of one canine relative to the other canine.¹⁵ The crown of a palatally displaced canine will appear magnified compared with the image of a contralateral tooth that is in the line of the arch or buccally displaced.

The magnification was assessed by comparing the widest mesiodistal dimensions of the impacted maxillary canine (C_{im}) to that of ipsilateral central incisor (I). The ratio between (C_{im}) and (I) gives the net magnification and is represented as canine incisor index (CII).

Canine incisor index (CII) = mesiodistal dimension of impacted maxillary canine (C_{im}) / mesiodistal dimensions of ipsilateral central incisor (I)

Angulation Method

This method involves a single panoramic radiograph and measures the angulation of the impacted maxillary canine with the occlusal plane.¹⁵ A horizontal line is drawn from the mesiobuccal cusps of right and left maxillary first molars. Another line is drawn along the long axis of the impacted maxillary canine. The angle formed at the intersection of the two lines is measured. If the angle formed is greater than 65° , the impacted tooth is considered as buccally placed and if it is less than 65° , it is diagnosed to be palatally impacted.

Diagnosis of Palatal or Buccal Impaction

Six examiners; three consultants, two registrars and one post graduate student, examined the radiographs before the surgical procedure was undertaken. All the four radiographic localization methods were explained to the examiners beforehand. Final diagnosis of the case was given after mutual discussion among the examiners concerned. The cases were diagnosis either as buccal, palatal or intermediate. Actual diagnosis was confirmed only after surgical exposure of canine and was compared with the predicted radiographic diagnosis.

STATISTICAL ANALYSIS

Descriptive statistics like mean and percentages were used to interpret results. Microsoft office 2007 was used to make tables.

RESULTS

A statistical analysis of the results was done which are summarised in Table-1. In our study, the horizontal parallax method of localization of impacted canine had 85% of palatal sensitivity and 75% of buccal sensitivity. The vertical parallax method showed 71% palatal sensitivity and 100% buccal sensitivity. The results obtained from magnification method for the palatal and buccal sensitivity of maxillary canine location were 71% and 100% respectively while as in case of angulation method of maxillary canine location, the values of palatal sensitivity and palatal sensitivity were 57% and 100% respectively. The results from the four different radiographic techniques show that horizontal parallax is much more accurate in diagnosing palatally impacted maxillary canines and the angulation method is very poor in diagnosing palatally impacted maxillary canines. But in case of buccally impacted maxillary canines, horizontal parallax method showed very poor results when compared to other three methods of our study. The palatal and buccal specificity for horizontal parallax

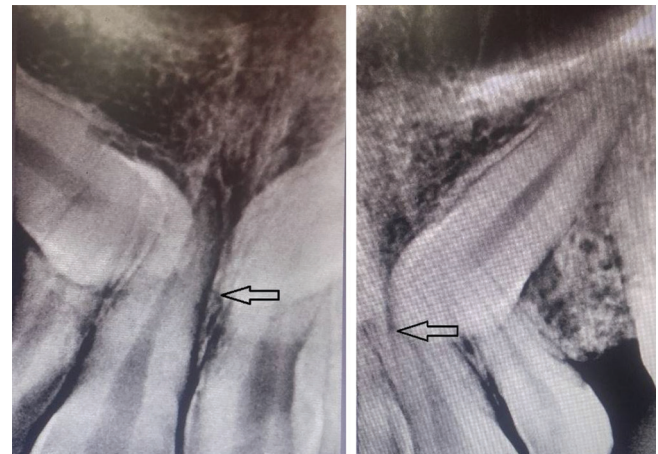


Figure-1: Horizontal parallax method



Figure-2: Vertical Parallax Method using OPG and Occlusal Radiography

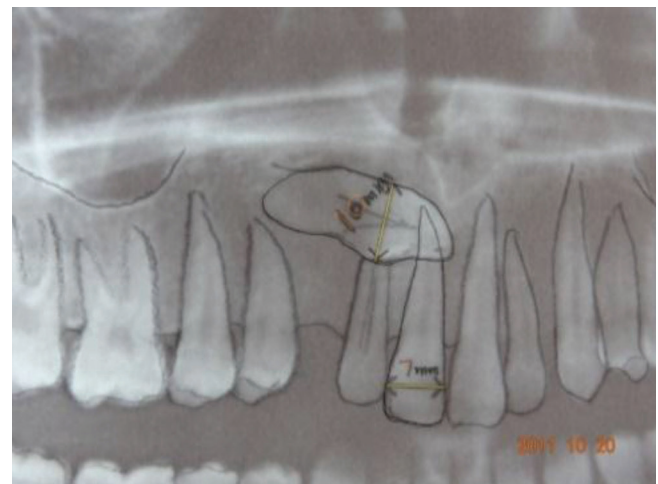


Figure-3: Measurement of impacted canine magnification.

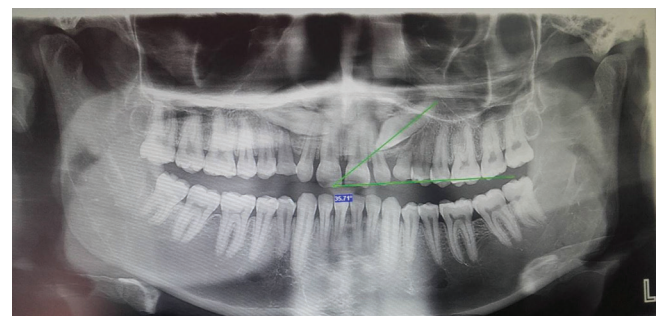


Figure-4: Angulation method for localisation of impacted maxillary canine.

method are 66% and 100% whereas the results for vertical parallax method for same parameters are 50% and 100%. In case of magnification method, the values for palatal and buccal specificity are 50% and 100% respectively and for angulation method the values are 66% and 100% respectively for palatal

Radiographic Method	Palatal Sensitivity	Palatal Specificity	Buccal Sensitivity	Buccal Specificity	Palatal Positive Predictive Value	Palatal Negative Predictive Value	Buccal Positive Predictive Value	Buccal Negative Predictive Value
Horizontal Parallax Method	85%	66%	75%	100%	2.16	2.5	2.33	2.0
Vertical Parallax Method	71%	50%	100%	100%	2.4	3.0	2.0	1.12
Magnification Method	71%	50%	100%	100%	2.4	3.0	2.0	2.0
Angulation Method	57%	66%	66%	100%	2.75	2.5	2.5	2.0

Table-1: Study parameters and their results

and buccal specificity.

The results show that among the four radiographic methods of our study, horizontal parallax and angulation method are better in excluding the palatal diagnosis as compared to other methods but all the methods are same to exclude the diagnosis of buccally located maxillary canine.

DISCUSSION

Buccopalatal localization is the primary diagnostic task of radiographic examination of impacted maxillary canines for proper management. Different radiographic techniques have evolved from time to time to accurately localize the maxillary impacted canine but none of them could provide 100% reliability. Therefore, a combination of more than one technique was used to improve the diagnostic accuracy of each method.

In our study, the horizontal parallax method of localization of impacted canine had 85% of palatal sensitivity and 75% of buccal sensitivity. The vertical parallax method showed 71% palatal sensitivity and 100% buccal sensitivity. These results are in agreement with the previous studies of different authors.⁷⁻⁹ The results obtained from magnification method for the palatal and buccal sensitivity of maxillary canine location were 71% and 100% respectively corresponding to the results of other studies.^{10,11} In case of angulation method, the values of palatal sensitivity and palatal sensitivity were 57% and 100% respectively which are similar to the values obtained in previous studies.¹⁵ The results from the four different radiographic techniques show that horizontal parallax is much more accurate in diagnosing palatally impacted maxillary canines and the angulation method is very poor in diagnosing palatally impacted maxillary canines. But in case of buccally impacted maxillary canines, horizontal parallax method showed very poor results when compared to other three methods of our study.

The palatal and buccal specificity for horizontal parallax method are 66% and 100% whereas the results for vertical parallax method for same parameters are 50% and 100%. In case of magnification method, the values for palatal and buccal specificity are 50% and 100% respectively and for angulation method the values are 66% and 100% respectively for palatal and buccal specificity.

The results show that among the four radiographic methods of our study, horizontal parallax and angulation method are better in excluding the palatal diagnosis as compared to other methods but all the methods are same to exclude the diagnosis of buccally located maxillary canine.

These results are in agreement with the findings of Mason et al.¹⁴ and Armstrong et al.² which place the diagnostic accuracy of vertical and horizontal parallax localization methods in the range of 68-83%. Similarly, Mason et al.¹⁴ and Chaushu et al.¹²

found localization from panoramic radiographs alone to be 66-88% accurate. All of these studies used the operative notes from canine exposure as their gold standard for canine location.

The higher accuracy of horizontal parallax method in our study may be explained due to more familiarity with this method as compared to the less commonly used methods of maxillary impacted canine localization. Moreover, the interexaminer bias was removed in our study by mutual discussion of each case before final diagnosis.

CONCLUSION

To conclude, it can be stated that horizontal parallax method using two periapical films taken at different horizontal angles is an accurate and easily available method for the localization of impacted maxillary canine. But when there is difficulty in locating the impacted tooth, it is recommended to employ a combination of methods to accurately locate it.

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