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Radiological assessment of impacted upper cannine

A Project Submitted to The College of Dentistry, University of Baghdad, Department of Oral Diagnosis in Partial Fulfillment for the Bachelor of Dental Surgery

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Certification of the Supervisor

I certify that this project entitled " **Radiological assessment of impacted upper canine** " was prepared by the fifth-year student **Taqwa Makey Jafar** under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

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Date

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Abstract

Maxillary canine impaction is a fairly common phenomenon in dental practice. Most studies indicate its palatal position. For a successful orthodontic and/or surgical therapy, it is necessary to correctly identify the impacted canine in the depth of the maxillary bone, using conventional and digital radiological investigations, each with their advantages and disadvantages. Dental practitioners must indicate the most “targeted” radiological investigation. review the various radiographic techniques available for determining the location of the impacted maxillary canine.

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Abbreviation	Meaning
OPT	Orthopantomography
CT	Computed tomography
CBCT	Cone-beam computed tomography
3D	Three dimensional
2D	Two dimensional
SLOB	Same lingual opposite buccal
CAT	Computed axial tomography
CBVT	Cone-beam volumetric tomography
FOV	Field of view

Introduction

Maxillary canines are the most commonly impacted teeth, second only to third molars .Disturbances in the eruption of maxillary permanent canines are common because they have the longest period of development, the most superior area of development and the most difficult path of eruption compared with any other tooth in the oral cavity Impacted canines may result in several complications such as displacement and root resorption of adjacent teeth, cystic degeneration, canine ankylosis, shortening of the dental arch or combinations of these factors**.**

The maxillary canines are developing deep in the jawbone and travel a longer way to erupt into the oral cavity compared to other teeth. Females are considered to have impacted maxillary canines more frequently than males. Maxillary canines have important aesthetic and functional roles. The treatment of impacted maxillary canines is a real challenge for the whole arsenal of specialists: pedodontists, orthodontists, periodontologists, prosthetists, and especially maxillofacial surgeons. Each of these has an important role in therapeutic management, and individual treatment of this anomaly is subject to failure unless there is close interdisciplinary collaboration. Such a treatment would involve obtaining the necessary space on the arch through orthodontic treatment, surgical exposure of the included tooth and its orthodontic traction. The most common maxillary dental inclusion, palatal inclusion of the upper canine, represents a particular challenge in orthodontic practice . A number of questions arise regarding the management of an impaction, such as: Where is the impacted tooth positioned? What is the appropriate treatment? How long will the treatment take? What is the final prognosis of the treatment? and What is the degree of resorption of the neighboring teeth? Interpreting radiographs helps orthodontists answer these questions. Early diagnosis of impacted canine is possible through clinical examination combined with the radiographic one. Orthopantomography (OPT), lateral cephalography, posteroanterior cephalography, single-tooth radiograph, as well as computed tomography (CT) and cone-beam computed tomography (CBCT) are the radiographic methods used for diagnosis.

Aim of study

present the most used radiological techniques for highlighting the canine impaction, for the correct development of the diagnosis and a correct treatment plan.

Chapter one

Review of literature

1. Prevalence and etiology of impacted upper canine

Maxillary canines are the most commonly impacted teeth, second only to third molars. ***(litsas G.,2011)***Maxillary canine impaction occurs in approximately 2% of the population and is twice as common in females as it is in males. The incidence of canine impaction in the maxilla is more than twice that in the mandible. Of all patients who have impacted maxillary canines, 8% have bilateral impactions. ***(Bishara SE ,1992)***Approximately one-third of impacted maxillary canines are located labially and two-thirds are located palatally. ***(Mitchell L,2007)***Canine impaction can be caused by various factors. The exact etiology of palatally displaced maxillary canines is unknown. The results of Jacoby's study showed that 85% of palatally impacted canines had sufficient space for eruption, whereas only 17% of labially impacted canines had sufficient space. Therefore, arch length discrepancy is thought to be a primary etiologic factor for labially impacted canines. Several etiologic factors for canine impactions have been proposed: localized, systemic, or genetic.

2. Sequelae of canine impction

Shafer *et al*,1963. suggested the following sequelae for canine impaction:

1. Labial or lingual malpositioning of the impacted tooth,
2. Migration of the neighboring teeth and loss of arch length,
3. Internal resorption,
4. Dentigerous cyst formation,
5. External root resorption of the impacted tooth, as well as the neighboring teeth,
6. Infection particularly with partial eruption, and
7. Referred pain and combinations of the above sequelae.

It is estimated that in 0.71% of children in the 10–13 year age group, permanent incisors have resorbed because of the ectopic eruption of maxillary canines. ***(Ericson S,et al ,1986)***On the other hand, the presence of the impacted canine may cause no untoward effects during the lifetime of the person.

These potential complications, as well as others that will be detailed later, emphasize the need for close observation of the development and eruption of these teeth during "routine" periodic dental examination of the growing child.

3. Occurrence of maxillary canine impactions and types

The impacted maxillary canine teeth (*n* = 351) were classified according to gender, tooth direction and position. The female patients showed higher proportion of impacted maxillary canine (184/351) compared to male patients (167/351). **Figure1** represents the description of types of impacted canines and their representative OPG images. The highest proportion of impacted maxillary canines matched to Type II (51.6%) followed by Type IV (28.2%), Type I (12.5%), and Type III (4.8%). Type VII impacted canines were 2.3% and Type VI were only 0.6%. There was no case of Type V in the chosen population **[Table 1]**. The frequency of Type II MCI was significantly higher compared to any other type (*P* = 0.053). ***(Zhong YL et al , 2006)***

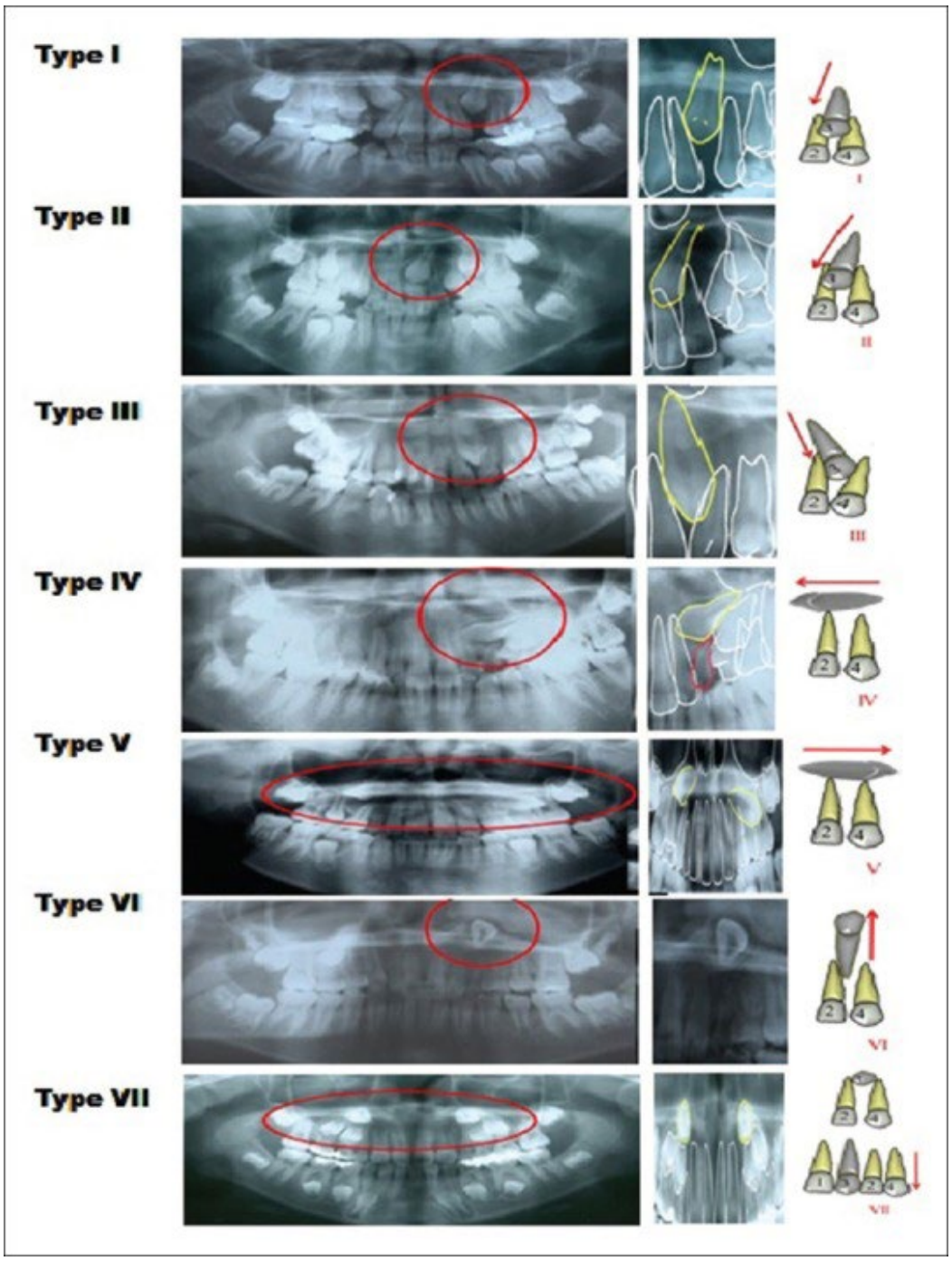

Figure1

Maxillary canine impaction classification. Type I (canine embedded between lateral incisor and first premolar); Type II (crown is mesially tipped overlapping, pressing lateral incisor tooth to provide a distal tipping of the lateral); Type III (distally tipped canine with an overlapped canine crown and the root of the first premolar); Type IV/V (canine long axis is orientated horizontally); Type VI (canine crown is directed up toward orbitale fossae); Type VII (canine long axis in horizontal direction with its crown placed buccally or interchanging with adjacent teeth).***(Yamamoto G et al , 2003)***.

Canine impaction type	Frequency (%)
I	44 (12.5)
II	181 (51.6)
III	17 (4.8)
IV	99 (28.2)
V	0
VI	2 (0.6)
VII	8 (2.3)
Total	351 (100)

Table 1: Occurrence of various types of impacted canines classified using proposed classification***(Hassan Al-Zoubi et al,2017)***.

4. Diagnosis of canine impaction

The diagnosis of canine impaction is based on both clinical and radiographic examinations.

4.1 Clinical assessment

It has been suggested that the following clinical signs might be indicative of canine impaction: **(Bishara SE ,1992)**

Delayed eruption of the permanent canine or prolonged retention of the deciduous canine beyond 14–15 years of age,

1. Absence of a normal labial canine bulge,
2. Presence of a palatal bulge, and
3. Delayed eruption, distal tipping, or migration (splaying) of the lateral incisor.

According to **Ericson and Kurol**, the absence of the "canine bulge" at earlier ages should not be considered as indicative of canine impaction. In their evaluation of 505 schoolchildren between 10 and 12 years of age, they found that 29% of the children had nonpalpable canines at 10 years, but only 5% had it at 11 years, whereas at later ages only 3% had nonpalpable canines. Therefore, for an accurate diagnosis, the clinical examination should be supplemented with a radiographic evaluation.

4.2 Radiological assessments

There are various radiological techniques that the dentist can use to accurately identify the position of an impacted maxillary canine. The location of the unerupted canines and the determination of their relationship with adjacent teeth and the neighboring anatomical structures can initially be obtained from conventional two-dimensional (2D) radiographs (periapical and occlusal radiographs, OPT and cephalograms). Accurate, 3D localization of impacted maxillary canines is now possible with CBCT ***(Ştefania Dinu et al,2022)***.

4.2.1 Periapical radiography

It is the simplest and most informative of all X-rays***(Cejudo JE et al , 2021)***. This is generally done perpendicular to an imaginary plane that intersects the angle between the long axis of an erupted tooth and the plane of the film, to produce minimal distortion. The periapical X-ray is designed to visualize the tooth itself from the most advantageous angle, without reporting its position on buccolingual plane ***(Poornima R et al , 2018)***

. This periapical X-ray will reveal if there is an included tooth, also if its stage of development is similar to that of the counterpart. The presence and size of a dental follicle will be highlighted, and it will be confirmed if there is coronal or root resorption, as well as the root pattern and integrity of the included tooth. Also, any

obstruction present in the eruption path, supernumerary teeth, cysts, or different types of odontomas can be identified ***(Mori M,2022).***

Figure2: Periapical radiographs indicating two impacted canines at different levels and angulations. (A) The maxillary right canine crown is positioned in the middle of the edentulous ridge. (B) The left canine crown is located near the apex of the maxillary left central incisor ***(Yi– Chun Lin et al , 2013).***

4.2.2 Occlusal Radiographs

Occlusal radiography is an intraoral radiographic investigation in which the image receptor is located in the occlusal plane, and which uses a dental radiograph of a larger size (5.7×7.6 cm) that includes the entire maxillary arch. The arm containing the X-ray tube will be positioned close to the forehead and nose, the role of which is to transmit the X-rays at a correct angle to the sensor located in the patient's oral cavity. This is how it is obtained an occlusal image of the teeth in the maxillary anterior region, which is probably best described as a periapical image taken from a much more oblique angle and at a much higher height than usual. The image will "shorten" the actual root length, but it will be a considerable distance from the cross-section so easily achieved at the level of the maxillary arch. Because the central ray traverses less bone thickness, detail is usually good, although not as sharp as in a periapical radiograph. If the cusp of

impacted canine is located in front of the arbitrary line joining the apexes of the lateral incisors, the position will be buccally ***(Kumar S,et al,2015).***

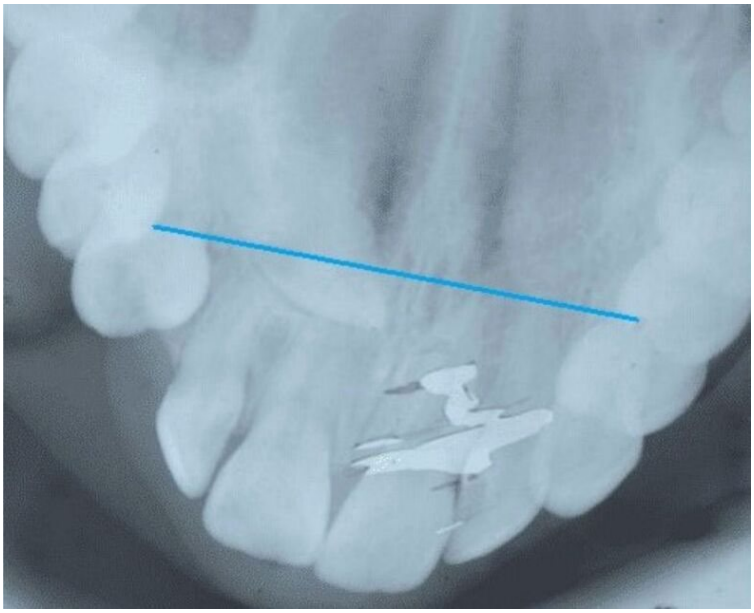

Figure 3 : Upper occlusal radiograph of a buccally impacted canine***(Surej Kumar et al,2018)***

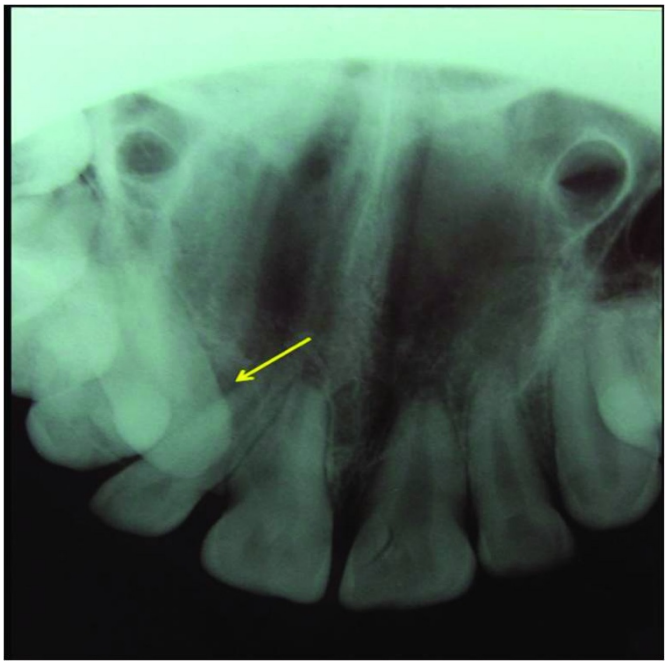

Figure 4 : Occlusal radiograph showing labially impacted canine ***(PW Goatz and SC White,1986)***

4.2.3 Clark's Rule or Parallax Method or Tube Shift Method

Parallax is the apparent displacement of an image relative to the image of a reference object and is caused by an actual change in the angulation of the x-ray beam. The change in angulation of the beam is caused by a change in the x-ray tube position. The reference object is normally the root of an adjacent tooth. Two radiographs of the object are taken. First using the proper technique and angulation as prescribed and the second, radiograph is taken keeping all the parameters constant and equivalent of those of the first radiograph, only changing the direction of the central ray either with a different horizontal angulation or vertical angulation. A tube shift may be carried out in either the horizontal or the vertical plane. If the tooth shifts in the same direction as the tube then the tooth is lingually placed and if it moves in the opposite direction then it is buccally placed (SLOB- same lingual opposite buccal)***(CF Clark,1910).***

Horizontal tube shift

The most used periapical radiographic method is "the buccal object rule" introduced by Clark, in 1909. On a tooth located adjacent to the affected maxillary canine area, two periapical radiographs are performed with the change of the horizontal angle of the X-ray beam. The palatally impacted maxillary canine moves in the direction of the tube, and the buccally impacted in the opposite direction ***(Varghese G,2021).***

If three objects are aligned on the center beam axis, their images will be superimposed on the X-ray. If the X-ray source is moved laterally but remains pointed at the three objects, individual images of each will appear on the X-ray. The object closest to the film will appear displaced in the same direction as the X-ray source***(Gutmann JL et al , 2011)***. According to the principles of binocular vision, two periapical radiographs of

the same tooth, with slightly different angulation, can provide information about its position in the jawbone **(Figure 5A, 5B , 5C)**

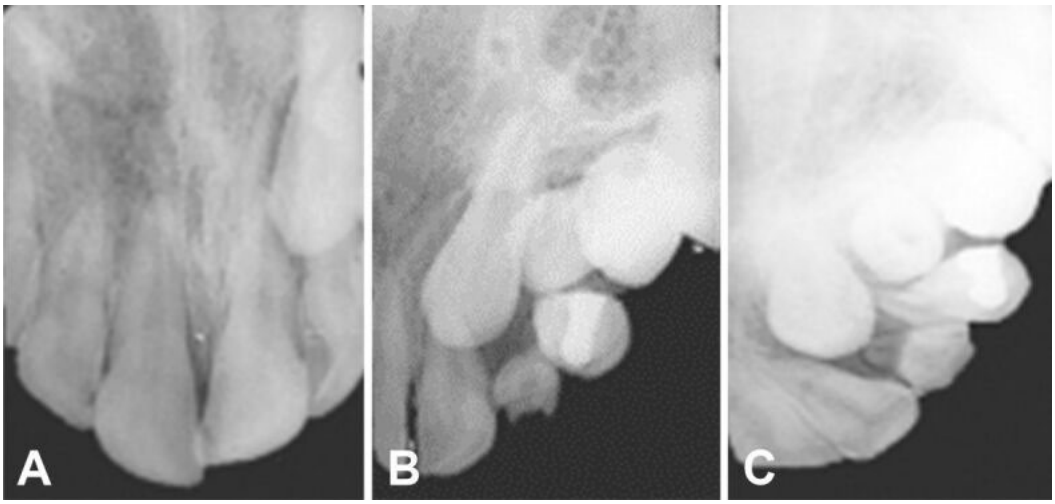

Figure 5 : (A) Periapical radiograph of the central incisors, highlighting the crown of the included canine over the distal half of the root of the left incisor; **(B)** Rotated X-ray 30° to the left shows the overlap of the canine only on the root of the central incisor; **(C)** Rotating the X-rays more than 30°, the palatal inclusion of the canine is observed, without any overlap***(Yadav R & Shrestha BK, 2013).***

This technique helps distinguish between lingual and buccal displacement of the canine. The procedure is performed as follows: a periapical X-ray of a certain size is placed intraorally, with the patient holding the finger against the palatal area where the maxillary canine should be located. The X-ray tube is directed at right angles to a tangent to the line of the maxillary arch, as for any periapical radiograph, and at an appropriate angle to the horizontal plane***(Figure 6A)(Becker A & Chaushu S, 2012)***. A second X-ray is placed in the oral cavity, in the same position, but this time the X-ray tube is moved (rotated) mesially or distally around the arch but kept at the same angle to the horizontal plane and oriented towards the adjacent mesial or distal tooth. To achieve this, the tube

should describe between 30° and 45° of an arc of a circle whose center is somewhere in the middle of the palate **(Figure 6B)** ***(Becker A & Chaushu S, 2012).***

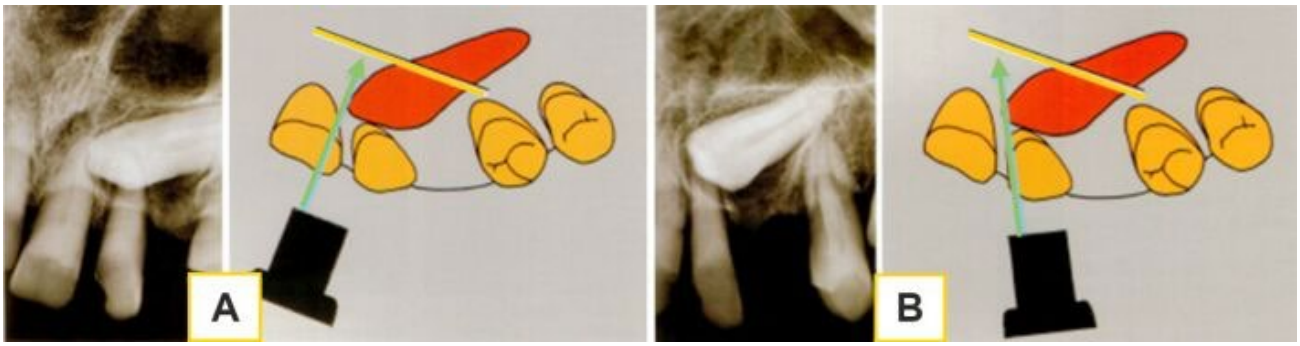

Figure 6 : (A) The first periapical film taken from a correct angle to the crown highlights the overlap of the right maxillary canine over the root of the incisor; (B) The second radiograph is placed in the same position, except that the X-ray beam is moved distally, 20°, and the crown of the canine appears to move with it, as it is found closer to the film than the other teeth ***(Becker A & Chaushu S, 2012).***

If an impacted canine is placed palatally **(Figure 7A,7B)**, then it will be almost in the middle of the image of the two radiographs***(Becker A & Chaushu S, 2012).*** However, in the first image **(Figure7A)**, if the tube was oriented over the area indicated by the canine, the root of the lateral incisor will be on the right. If the canine is positioned forward of the lateral, there will be some overlap of the crown of the canine and the root of the lateral incisor. In the second image **(Figure7B)**, taken from the front, the root of the right lateral incisor and the crown of the palatally impacted canine will be in the middle of the radiographic image, superimposed on each other to a much greater degree. This method is very useful in cases where there is a minimal discrepancy between the height of the erupted tooth and the adjacent unerupted one.

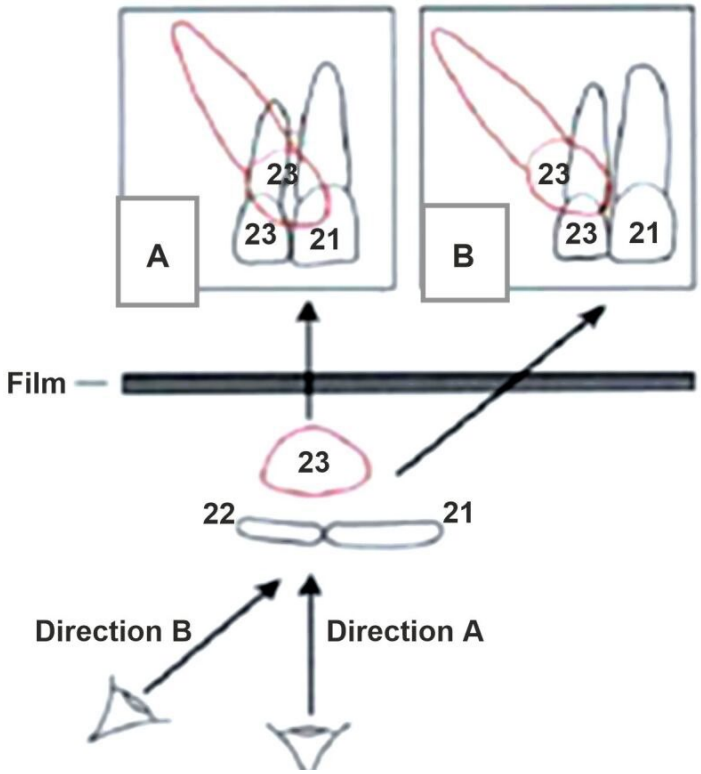

Figure 7 : (A and B) Graphic representation of the "parallax" method. If the observer's eye looks along the axis of the X-ray beam, in each case, the image on the film can be easily reconstructed***(Yadav R, Shrestha BK , 2013) (Becker A & Chaushu S, 2012)***.

Vertical parallax method

The principal of this method is same as that of horizontal parallax, but the change of angle is made in the vertical direction ***(Armstrong C , 2003)***. Vertical displacement of the tube was described by Keur, in 1986, using one occlusal radiograph and one panoramic. The occlusal radiograph is obtained by placing the tube at an angle of 60–65° to the occlusal plane. The panoramic tube being located anterior to the patient's head at an angle of 7°, the direction in which the palatally impacted canine will move is the same as that of the tube in the occlusal radiograph **(Figure 8)*(Jacobs SG , 1994) (Mason C et al , 2001) (Keur JJ , 1986).***

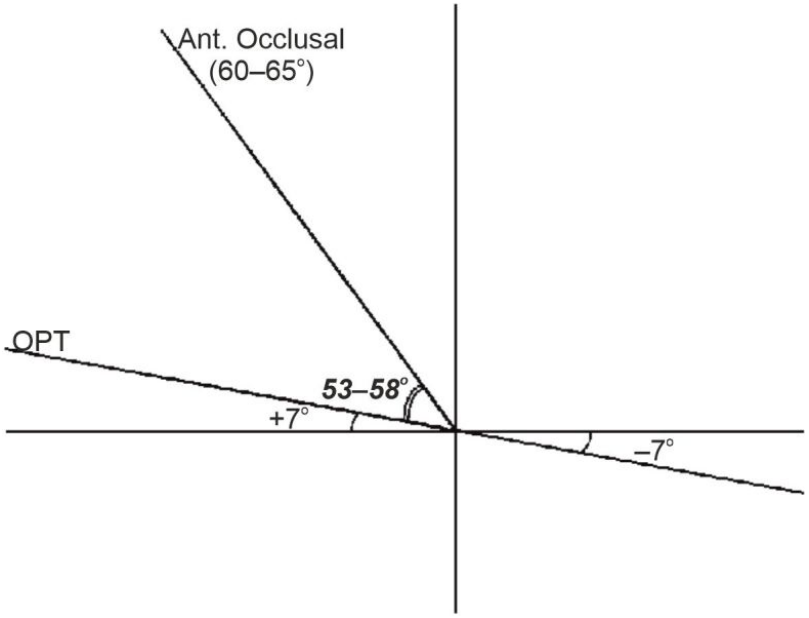

Figure 8 : Vertical angulation between orthopantomogram (OPT) and maxillary anterior occlusal ***(Ştefania Dinu et al , 2022)***.

4.2.4 cephalograms

Lateral and frontal cephalograms can provide additional information on upper canine displacement and possibly for the prediction of canine impact. Lateral cephalograms of patients between eight and nine years of age show the height of the impacted canine and the anteroposterior position of its cusp relative to the apexes of the incisors. The evaluation of the impacted canine is done by analyzing the angle between its axis and the perpendicular to the Frankfurt plane **(Figure9)**. This technique can indicate whether the canine is in palatal or labial position ***(Kumar S et al 2015)***, Lateral and frontal cephalograms can be useful in determining the position of the impacted canine relatively to the maxillary sinus and the floor of the nasal cavity ***(Becker A & Chaushu S , 2012).***

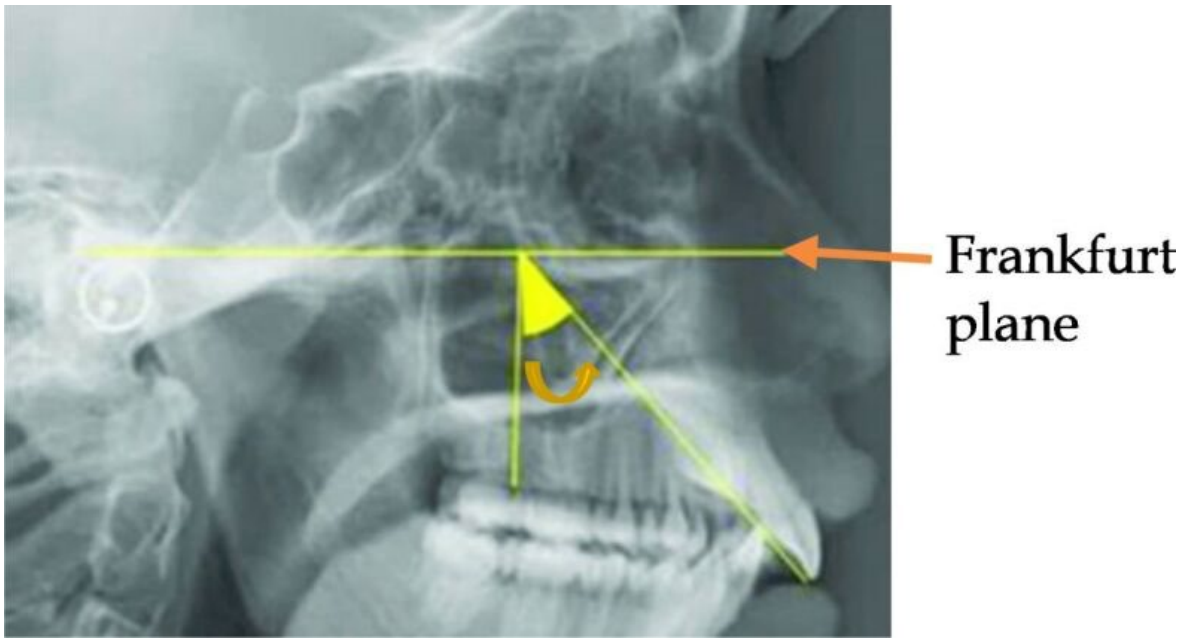

Figure 9 : Canine direction on the lateral cephalogram versus perpendicular to the Frankfurt plane ***(Kumar S et al , 2015)***

Figure 10 : Lateral cephalogram with impacted upper canine **(Marcelo Aires Vilarinho ,2010)**

4.2.5 Panoramic radiography

The panoramic radiograph, although it does not have the same level of detail as a periapical film, has the advantage of being simple and fast, offering a good scan of the teeth and jaws, from one joint to another **(Figure 11)**

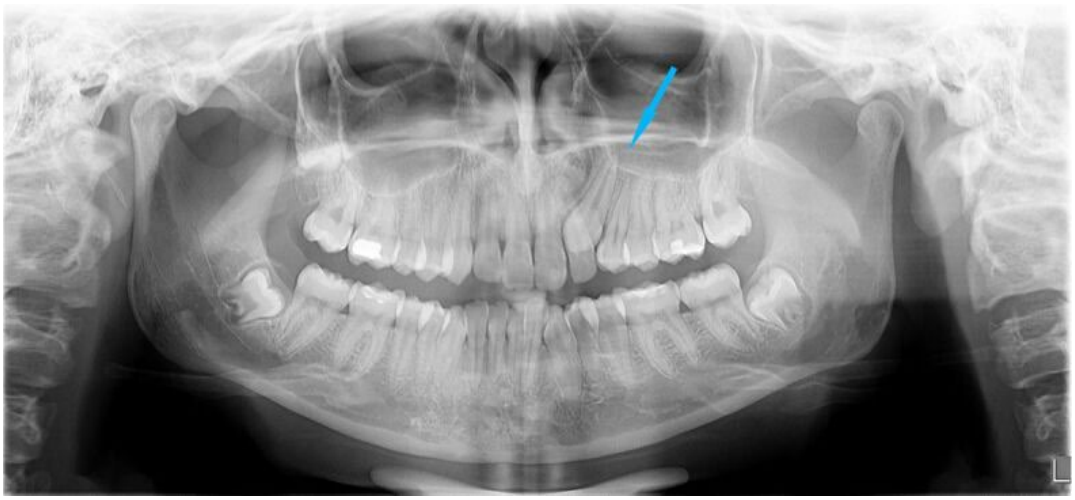

Figure 11

Panoramic radiograph showing the impaction of the left maxillary canine ***(Warford JH et al , 2003)***

Chaushu et al,1999. conducted studies to determine the position of impacted maxillary canines using a single panoramic radiograph. The magnification technique **(Figure 12)**applied to an OPT is based on the idea that when the teeth move away from the film, they will be larger compared to the teeth on the other hemiarcade.Panoramic radiography is widely used in dental medicine and is the preferred primary radiographic imaging technique for orthodontic patients **(Figure 13A,13B)*(Jung YH et al , 2012).***The procedure was developed in 1946 by Prof. Paatero and is based on the principles of tomography. If a canine is relatively magnified in comparison to the neighboring teeth or the contralateral canine, it is found closer to the tube (palatal) and if it is relatively diminished it is found further away from the tube (buccal) ***(Fox NA et al , 1995)***.

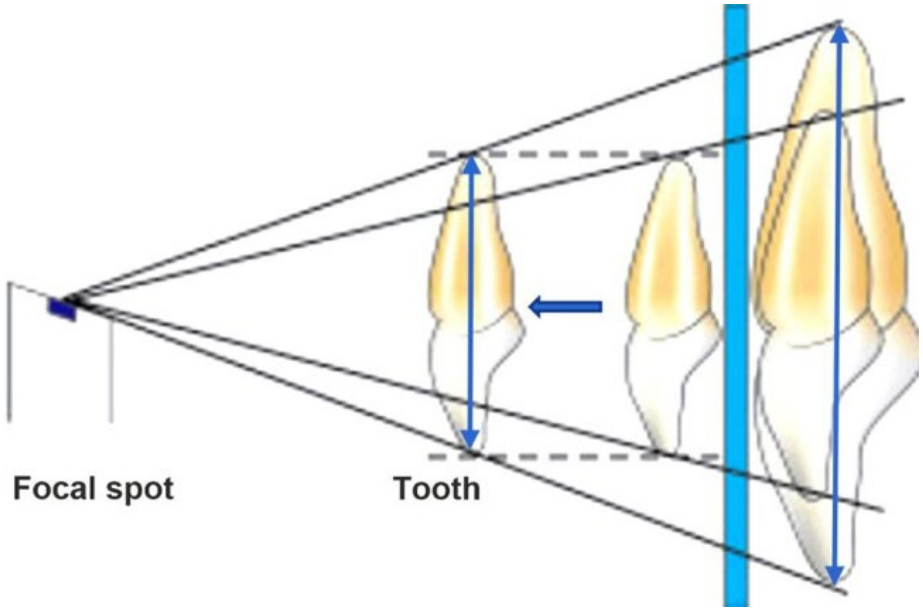

Figure 12 :

Increasing the distance between the tooth and the film increases the magnification ***(Surej Kumar et al , 2018).***

Figure 13: (A) Canines begin eruption with their long axis aligned with the distal surface of the lateral incisor as they descend from the floor of the nasal orifice (yellow line). Bony crypt of the left maxillary canine (blue arrow); (B) The panoramic radiograph shows an apparent mesial inclination of the maxillary canine (yellow arrows), requiring caution because the panoramic is not a frontal view, but an average of radiographic images of lateral and frontal projections. (Modified image) **(Jung YH et al , 2012) .**

Napgal et al, 2009 . analyzed OPT of 50 patients with a total of 68 impacted canines, correct prediction of the palatal position of impacted canines by magnification on a panoramic radiograph was possible in 77% of cases . ***Fox et al.,1995*** after examining 139 ectopic canines on panoramic radiographs, were able to accurately predict the position of a palatally displaced crown in approximately 80% of cases. An et al. reviewed and evaluated panoramic radiographs of 94 patients, respectively 102 impacted maxillary canines, using magnification, angulation, and superimposition methods. The study concluded that magnification and angulation methods using a single OPT did not provide accurate results for locating the impacted canine. The method correctly located 68% of buccal canines and 69.57% of palatal canines***(An S et al , 2013)***. These studies concluded that panoramic radiography cannot be used alone to reliably locate impacted maxillary canines.

4.2.6Computed tomography

Conventional CT was introduced in 1990 as an alternative for determining the position of impacted canines and areas of root resorption of neighboring teeth, due to the contrast between tissues and the precise 3D images provided by this technique ***(Ericson S & Kurol PJ , 2000) (Abdel-Salam E et al , 2012).*** CT, also known as computed axial tomography (CAT), is a radiographic method in which a 3D image of the inside of a jaw is obtained using a 2D X-ray beam around a single axis of rotation **(Figure 14)** ***(Grisar K et al, 2019)***. At the same time, this technique allows the elimination of the overlap of different structures that would mask the image of the impacted canine, in an attempt to visualize it in traditional radiography.

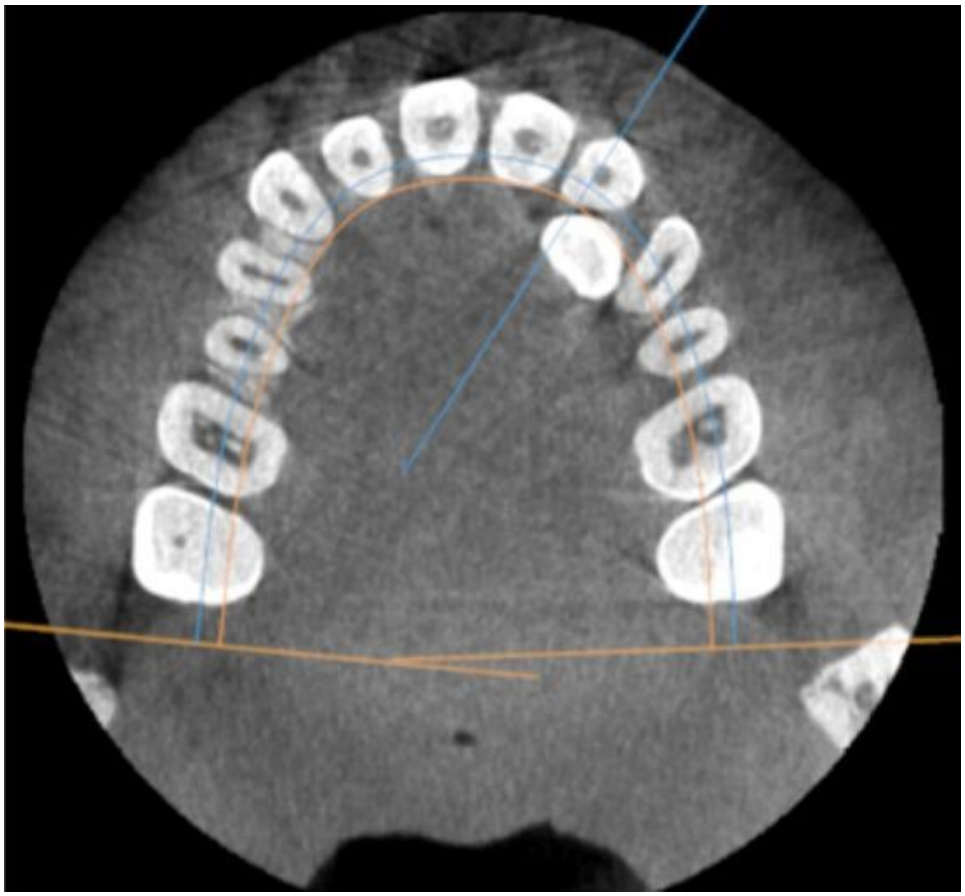

Figure 14 Palatal position of the impacted maxillary canine cusp ***(Grisar K et al, 2019).***

By visualizing the radiographic series in "slices" of the jaw, the relationship between the included canine and the adjacent teeth, in all three planes of space, can be correctly evaluated, as well as the coronal, apex positions and the inclination of the long axis of the tooth **(Figure 15)**. The method can also provide correct information regarding early root resorption, especially of the buccal and palatal surfaces ***(Grisar K et al, 2019).***

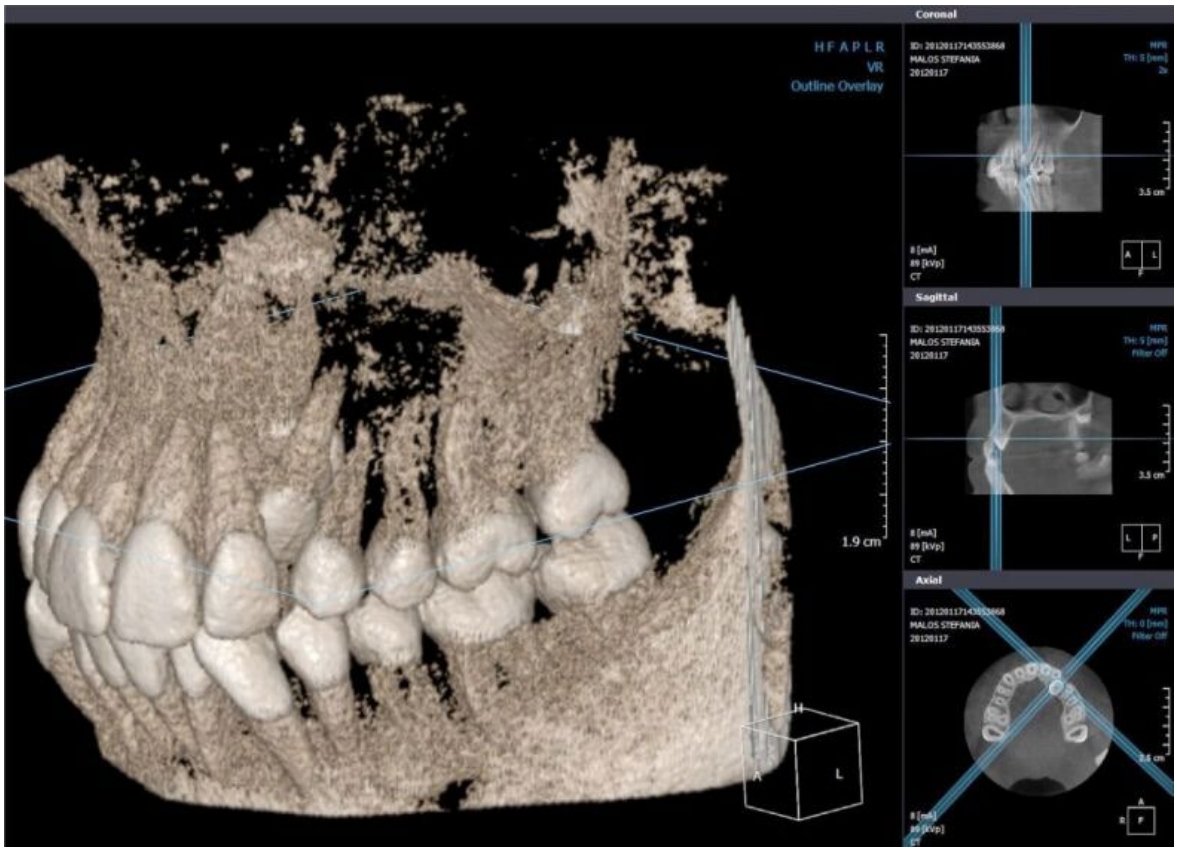

Figure 15 : 3D CT scan: coronal, sagittal and axial section. (Personal case). ***(Rom J Morphol Embryol,2022)***

Conventional CT would be the most suitable method of investigation to find out the exact position of the impacted canine. The restriction of its use is given by the high cost and high radiation dose ***(Mah JK & Alexandroni S , 2010)(Abdelkarim A , 2019).***

4.2.7Cone-beam computed tomography

A new method, used more and more in the diagnosis and therapy of dental impaction is a variant of CT, called CBCT, cone-beam volumetric tomography (CBVT). 3D reconstructions are useful for a better visualization of the position of the impacted canines, their relationship with the adjacent structures, as well as the possible complications caused by them ***(Farcaşiu C et al , 2021) (Andrei OC , 2021)***. CBCT uses a conical beam (the radiation wave propagates conically), and a single scan of a short duration is sufficient to cover the entire investigation area. The images are quickly reconstructed, using special software, providing an image with a very high resolution, in a single plane, the one of interest to the doctor.It presents the advantage that the anatomical planes do not overlap, providing great accuracy in assessing the position and proximity ratios of the included canine. It also allows 3D reconstruction on the image in space, the doctor precisely locating the impacted tooth **(Figure 16A, 16B)**

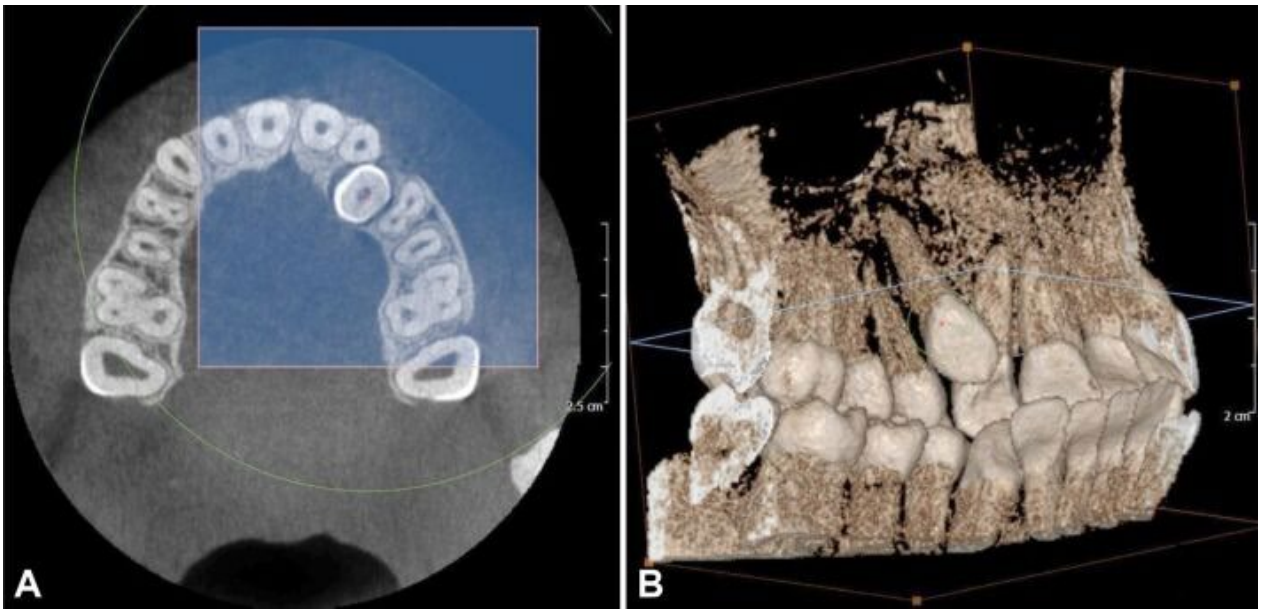

Figure 16: (A) CBCT aspect of the palatal impacted maxillary left canine, axial section; (B) The left upper maxilla, palatal view: 3D reconstruction on CBCT. (Personal case) ***(Jacobs R , 2011).***

To determining the position of the impacted maxillary canine CBCT is used, the degree of irradiation of the patient being much lower: 50 μSv for both jaws, compared to 17.6–656.9 μSv for CT of the jaw ***(Ericson S & Kurol PJ , 2000)***. However, CBCT determines a higher radiation dose than intraoral and panoramic radiographs, thus optimizing the CBCT field-of-view (FOV), is necessary to reduce radiation dose.

Chapter Two

Previous study

Botticelli et al. included in a study 27 patients (17 females and 10 males, mean age 11.8 years) undergoing orthodontic treatment with 39 impacted or retained maxillary canines. They used a comparative study to see differences in diagnostic provided by conventional 2D images (panoramic radiograph, lateral cephalograms and periapical radiographs with different projections for each patient) and a 3D image (CBCT), for each canine. Canine inclination measured from the midline did not differ significantly using the two methods. The significant difference given by the two methods was the mesiodistal location of the apex. Clinical crown level varied significantly with a trend toward a higher position in the vertical plane based on 2D images. Regarding the labial or palatal location of the crown and apex, the 3D method revealed a significantly higher labial position. The direction of overlap of the canine with the lateral incisor was the same for the two methods in 70% of cases. Statistically, the 3D method revealed a greater overlap. 3D images reveal more pronounced root resorption.

Haney et al. performed a prospective study in which they compared the diagnosis and treatment planning of affected maxillary canines between two imaging methods, the evaluation being performed by seven doctors. One method included 2D images: a panoramic X-ray to establish the direction from the vertical, an occlusal radiograph to determine the distance to adjacent teeth, and two periapical radiographs to assess the labio-palatal position. The second method used CBCT, using anterior, posterior, caudal–rostral, rostral–caudal, palatal, and labial view. Depending on the X-ray method used, different decisions were made regarding the location of the impacted canine. The results showed that the radiographic method used (2D or 3D) can lead to different diagnoses and treatment plans.

Wriedt et al. performed a crossover study to evaluate the diagnostic differences in 21 patients with 29 impacted maxillary canines, by using panoramic radiographs (2D) and CBCT (3D), analyzed by 26 dentists. Impacted canine position was concordantly determined in 2D and 3D images, for 64% of all

patients. The 3D evaluations provided more accurate data regarding the identification of the apical regions of the canines and root resorption of the lateral incisors. The authors concluded that partial CBCT may be justified as an adjunct to a panoramic radiograph when the canine inclination exceeds 30°, when the apex is not clearly visible, or when root resorption of adjacent teeth is suspected.

Lai et al., in a retrospective study of 113 patients with 134 impacted canines, showed that CBCT presents accurate information on the location of the impacted canine, as well as on the degree of root resorption of the neighboring teeth.

Alqerban et al., in a prospective study, compared the impact of using panoramic radiographs and CBCT for surgical treatment planning of impacted maxillary canines. Evaluations at the level of 2D and 3D radiological investigations showed differences in the position of the impacted canine as well as the root resorption of the lateral incisors. Other studies have also concluded that 3D imaging is more sensitive than 2D, both for locating the impacted canine and for identifying root resorption of adjacent teeth.

Pico et al. performed a study to compare maxillary canine impaction when analyzing a panoramic image versus analyzing a set of CBCT reconstructions, for 20 patients with a total of 28 impacted canines. The results of this study indicate that the differences between 2D and 3D radiological techniques are related not only to the position of the apex in the mesio-distal plane and the position of the labio-palatal cusp, but also to the assessment of root resorption.

Tsolakis et al., in a study conducted on 20 patients with the range of ages from 10–17 years old, with unilateral or bilateral impaction of the maxillary canines, evaluated the reliability of images obtained by conventional radiographic techniques (periapical, occlusal, panoramic) compared to those provided by CBCT. The study concluded that 2D methods demonstrate a more subjective diagnostic procedure compared to CBCT. Root resorption of lateral incisors induced by impacted maxillary canines cannot be accurately diagnosed on 2D radiographs.

Chapter three

Conclusion

Conclusion

Each radiological method present advantages and disadvantages. Panoramic radiography remains the most commonly used diagnostic aid in clinical cases where there is a suspicion of dental impaction of permanent canines, because of its ease of interpretation, low cost, and low radiation. Clinical examination and ectopic positioning on a panoramic radiograph warrant further radiographic investigations. CBCT technology is increasingly accessible in dental practice. It enormously expands the fields of diagnosis and treatment possibilities for patients. However, CBCT should only be used after careful consideration, especially regarding patient exposure, where conventional 2D imaging techniques are not sufficient. Further studies are needed to determine in which cases the CBCT examination has a clear advantage over conventional 2D examinations, justifying its use.

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