RADIOGRAPHIC METHODS FOR LOCATING & EVALUATING IMPACTED MAXILLARY CANINES USING KUFTINEC, CHAUSHU AND ERICSON & KUROL METHODS

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Abstract

A canine impaction is a very common phenomenon in the everyday dental practice. For the orthodontist to be able to successfully treat an impacted maxillary canine a deep and thorough radiographic evaluation needs to be made almost imminently after the first visit.
The various modern methods are an imperative and must therefore be fully reviewed by the orthodontist before the beginning of treatment.
This paper aims to review cases of bilateral and unilateral canine impaction, their exact location through the most used diagnostic methods in modern orthodontics.

Introduction

Radiographic evaluation

Orthodontic-surgical treatment of impacted teeth is very complex, which is why radiological diagnostics play an important role in therapy, showing their exact localization. Based on the obtained images, the methods for treating the impacted tooth are decided. Several different radiological techniques can be used in diagnostics. The appearance of impacted teeth can be proven through orthopantomogram images, laterolateral and posteroanterior and occlusal and periapical images. It is important to show the position of the tooth, its direction, placement in the bone and relationship to the roots of neighboring teeth. Such images are two-dimensional. They diagnose the presence of impacted teeth, but any analysis is due to distortion, superposition and the appearance of artifacts.
Details such as the exact location of the tooth, the impact on neighboring teeth and structures, and the root anatomy are difficult to distinguish. For this reason, cone beam computed tomography (CBCT) has been used more frequently in recent years, which shows the jaw in three dimensions with the exact position of the impacted tooth, the hard and soft tissues surrounding it (Katalinić et al., 2012), (Jeremias et al., 2016). Radiography is a diagnostic procedure for detection and diagnosis. According to Severin, the X-ray examination contains three moments:
1. Visualization of the impacted tooth.
2. Analysis of the morphology of the impacted maxillary canine, inclination of the impacted maxillary canine and position towards adjacent structures.
3. Assessment of the risk of complications.
The X-ray examination should meet certain criteria: - complete contour of the impacted maxillary canine; - contour of the follicular sac; - contours of bone tissue, as well as of the root of the impacted tooth.
Various radiographic examinations (orthopaedic, lateral, PA, teleradiography, occlusal, computed tomography) have their advantages and disadvantages. The methods differ in the radiation dose, the speed and quality of obtaining information, as well as in the cost-benefit ratio (price). The assessment of which and how many of them will be used depends on the decision of the therapist, individually for each patient. All of these examinations reveal the

position of the canine in relation to the surrounding structures, but also the inclination of the longitudinal axis of the impacted tooth in relation to the reference plane.

Orthopantomogram (OPG)

The use of orthopantomogram examination to localize impacted maxillary canines is the most commonly recommended method, given its relatively low radiation exposure, simple performance, economic acceptability, and wide distribution (Chaushu et al., 1999), (Fox et al.,1995). In case of impactions, orthopantomogram can be used to monitor:
• tooth position (deep or shallow);
• general orientation, horizontal or inclined mesial or distal;
• relationship to neighboring teeth;
• risk of transposition;
• presence or absence of apical resorption of the roots of neighboring teeth.
Lateral radiography
This radiograph allows visualization of the sagittal and vertical position of the canines and their relationship to the floor of the nasal cavity.
The longitudinal axis of the canine should be almost parallel to the longitudinal axis of the incisors.

Frontal radiograph

This radiograph provides a transverse view of the situation. This radiograph can measure the intercanine distance, visualize the abnormal position of the canine tooth bud (germ), and assess the likelihood of impaction. Canines that are about to erupt should be inclined mesially, with their crowns lying below the level of the tips of the lateral incisors and the lateral border of the nasal cavity.

Periapical Radiographs

By using two or more periapical films of the same region with different angulations of the central beam and a conical technique that allows parallelism between the tooth and the film, the orthodontist can determine the exact position of the tooth. Using Clark's rule, it is determined whether the tooth is impacted labially, lingually, or palatally.

Occlusal radiographs

Orthodontists use these radiographs very often, as they are a useful adjunct to other radiological examinations, providing a third horizontal dimension.
Ericson and Kurol sector method

Vertical Parallax

To facilitate the use of vertical parallax with the orthopantomography, the tube should be increased to 70-75 degrees.
a – axial angulation of the canine to the central sagittal plane or medial line.
OL – occlusal line, connects the center point between the two mandibular central incisors with the tip of the buccal tubercle of the first mandibular molar.
Sector 1 – the tip of the maxillary canine is located distal to the root of the lateral incisor

Sector 2 – the tip of the maxillary canine is located in the distal half of the root of the lateral incisor
Sector 3 – the tip of the maxillary canine is located in the mesial half of the root of the lateral incisor
Sector 4 – the tip of the maxillary canine covers the distal half of the root of the central incisor
Sector 5 – the tip of the maxillary canine covers the mesial half of the root of the central incisor.

Kuftinec Method

If the tip of the canine covers the distal half of the root of the lateral incisor, then it is located buccally is more mesial to the root of the lateral incisor then it is located palatal.

Chaushu Method

Canine-Incisor Index, CII; Canine-Canine Index, CCI; Buccal < 1.15 > Palatal.
Aim

The aim of this study is to determine the methods used for location and evaluation of impacted maxillary canines, as well as to determine a detailed position using Chaushu, Kuftinec and Ericson and Kurol sector method.

Materials & Methods

0 patients with impacted maxillary canines were included in this study. For the evaluation and location method OPG was used. Out of patients 5 were males and 5 were females, out of which 8 had a mixed dentition and 2 had permanent dentition. Their age varied from 9-18 years.

Results

6 patients had buccally impacted maxillary canines, out of which 4 were bilateral and 2 unilateral.
4 patients showed palatal impaction out of which only one patient had a bilateral impaction.

Impacted Maxillary Canine			**Unilateral Impacted Maxillary Canine**		
	Number	%		Number	%
13	8	53	13	3	20
23	7	47	23	2	13,33
Bilaterally Impacted Maxillary Canines					
13 & 23		Број		%	
		10		66,6	

Using the Kuftinec method to determine the canine location, it was determined that, in total 10 buccally impacted canines and 5 palatal impacted canines were analyzed.
50% of the patients showed a bilateral impaction out of which 80% were buccal impactions and only 20% palatal.
50 % of the rest showed a unilateral impaction out of which 40% were buccally placed and 60% palatal.

Impaction	Buccally	Palatal	Total
Unilateral	10	5	15
Bilateral	8	2	10
Total	18	7	25

Using the Ericson & Kurol sector method the following was determined:
Out of 10 buccally impacted canines 8 were placed in sector 1, and 2 into sector 2.
Out of 5 palatal impacted maxillary canines 3 were placed into sector 4, and 2 into sector 3.

Sectors	13		23		Total	
1	4	50%	4	57,14%	8	53,33%
2	1	12,5%	1	14,28%	2	13,33%
3	0	0	2	28,57%	2	13,33
4	3	37,5%	0	0	3	20%
5	0	0	0	0	0	0
Total	8	53%	7	47%	15	100%

According to Chaushu method, IKI (Canine-Incisor Index, CII) was used for 7 cases, out of which 5 had a buccal impaction and only 2 showed a palatal impaction, for the rest of 3 an IKK (Canine-Canine Index, CCI) was used, and it showed that 2 had a palatal impaction and only one showed a buccal impaction.

Kuftinec Method				
Position	13		23	
	Nr.	%	Nr	%
Buccal	5	62,5%	5	71,42%
Palatal	3	37,5%	2	28,58%
Total	8	100%	7	100%
Chaushu Method				
Position	13		23	
	Nr.	%	Nr.	%
Buccal	5	62,5%	5	71,42%
Palatal	3	37,5%	2	28,58%
Total	8	100%	7	100%

For us to determine the canine position in relation with midline, measuring alpha angle that is formed between longitudinal central axis and medial sagittal line method was used, we determine whether the position is vertical or horizontal.
We concluded that 5 of the right impacted maxillary canines showed a favorable prognosis, compared to 4 from the left. 3 out of the 8 impacted on the right side showed an average prognosis whereas 3 from the left side showed an average prognosis. We conclude that not a single impacted maxillary canines showed a poor prognosis.

Degree	13	23	Total			
	Nr	%	Nr	%	Nr	%
First 0-15 degrees	5	62,5	4	57,2	9	60
Second 16-30	3	37,5	3	42,8	6	40

Third >31	0	0	0	0	0	0
Total	8	100	7	100	15	100

Conclusion

Panoramic radiography remains the most 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.
The methods used for determining the exact and precise canine locations all correspond and match 100%.
The Chaushu, Clack and Ericson Kurol methods remain a wide field of study and clinical evidence for both locating and evaluating maxillary canine treatment., however for more complicated cases a cbct is preferred.

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