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Research Article

CORRELATION BETWEEN PANORAMIC RADIOGRAPHIC SECTORS AND LABIOPALATAL POSITIONS OF IMPACTED MAXILLARY CANINES: A CBCT ANALYSIS OF ROOT RESORPTION IN PERMANENT INCISORS.

Dr. Taheerkhan Tadakod*

Associate Professor, Department of Radiology, Sree Balaji Medical College and Hospital, Chromepet, Chennai – 600044, Tamilnadu, India.

ABSTRACT

The position of the labiopalatal canines on panoramic radiographs was correlated with the root resorption of permanent incisors when impacted maxillary canines were analyzed. A radiographic analysis was conducted on 63 maxillary canines affected by 63 individuals. A total of 73 mesiodistal cusp impacted canines were classified based on 63 panoramic radiographs. We evaluated the amount of root resorption in impacted canines and permanent incisors using CBCT. A comparison was made between sector locations on panoramic radiographs and labiopalatal positions in CBCT for impacted maxillary canines. To investigate the correlation between panoramic and CBCT images, we used two-fold t-tests and Fisher's exact tests. Abrasions of the labial bone are significantly more common in Panorama Sectors 1 and 2 than in Panorama Sectors 4, and Abrasions of the midalveolus are more prevalent in Panorama Sector 5. A correlation between the canine panoramic sector and labiopalatal position was statistically significant ($p<0.001$). Root resorption was significantly affected by sector 3, 4, and 5 location ($p <0.001$). A panoramic radiograph analysis allowed us to predict the resorption of permanent incisors based on the location of each sector.

Keywords:-CT scans, CT radiographs, impacted cuspids.

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INTRODUCTION

Although maxillary canines are only second to third molars in terms of impacted teeth, they tend to interfere with eruption because they develop over a longer period of time [1]. Since canines are located in the upper portion of the oral cavity, they have the greatest difficulty erupting. The lateral incisor roots are capable of resorbing, shifting, degenerating, and even losing their roots if they are impacted [2]. Panoramic radiographs can confirm these impacts early based on how the lateral incisor resorbs or shifts. Panorama radiography provides valuable diagnostic information for tooth eruption and treatment outcomes [3]. It is impossible to determine the labiopalatal position of impacted canines with panoramic X-rays or multidetector CT scans (MDCT). Cone beam CTs (CBCT) decrease radiation dose and provide a more accurate assessment of tooth impaction than MDCTs, since they do not produce the typical overlap between dental structures on panoramic radiographs [4]. A CBCT scan allows identifying and accurately locating impacted canines, as well as assessing damage to adjacent teeth and bone near them [5].

Corresponding Author:- **Dr. Taheerkhan Tadakod**

It was not possible to find any previous study comparing panoramic radiography with CBCT for impacted maxillary canines, despite the use of panoramic radiography and CBCT in the evaluation of impacted canines. Maxillary canines with impacted mesiodistal positions are correlated in panoramic radiographs and CBCT scans.

MATERIALS AND METHODS

An examination was conducted on 72 maxillary canines with impacted teeth. CBCTs were ordered for 76 patients with impacted maxillary canines following panoramic radiographs and clinical examinations. When maxillary canines are delayed or impacted, CBCT scans are recommended. The study excluded 13 patients who had odontogenic tumours or cysts around impacted canines. Among the patients, there were 10–56 of varying ages between 10.4 and 56. Among ten patients with bilaterally impacted teeth in Table 1, ten have impacted canines on both sides. 13 patients with maxillary canine roots matured between the ages of 13 and 15 were divided into two groups based on their age.

A Planmeca Proline XC radiography unit was used to obtain panoramic radiographs. About 20 by 19 cm was the CBCT scan field of view, and scans were taken at 90 kVp, 24 seconds, 4 mA. A CBCT image and a panoramic radiograph were analyzed. The position of the mesiodistal tip of 63 impacted canines was classified within a panoramic sector classification in 73 panoramic radiographs. This study reconstructed CBCT data volumes using Vatech's Ez3D2009 software to assess impacted canines' positioning and incisors' resorption. In order to reformat the CBCT images, each examiner reviewed the CBCT study volumes. Canines were classified as labial, mid-alveolus, and palatal based on the position of their dental crowns relative to their adjacent teeth. Resorption patterns of permanent incisors were used to categorize whether they resorb or not. Resorption did not affect the root surface. CBCT images of impacted canines and incisors show an association between sectors on panoramic radiographs. Two panoramic radiographs and CBCT volumes were reviewed by one oral and maxillofacial radiologist in a month. One independent oral and maxillofacial radiologist rated both the CBCT and panoramic images. Patients' identities were masked before panoramic radiographs and CBCT images were shown as random sequences. In this study, the kappa statistic was used to evaluate intraobserver and interobserver agreement. Intraobserver reliability could only be established by one examiner in this study. A CBCT scan indicated sector locations of 0.84, labiopalatal locations of 0.89, and root resorptions of 0.86 ($p<0.01$). Interobserver location reliability was also high: 0.794 for lingual location, 0.876 for root resorption, and 0.825 for sector location. A statistical significance level of 0.001 was found for each of these scores. In cases where the two observers' assessments differed, they discussed their differences. Fisher's exact test and correlation test showed a correlation between CBCT's findings and Pixar's order 2. Statistical significance was determined by p 0.05. SPSS version 14.0, by IBM Corporation, Armonk, NY, was used to carry out all analyses.

RESULTS

Sectors 1, 2 and 3 were most prevalent in 15-year-olds with labially impacted canines. Sector 5 primarily affected people over 15 years of age. The mid-alveus contained 23 maxillary canines (315%), 23 (27.3%), and 23 (41.1%). A majority of the canines in sectors 1, 2, and 3 were labially impacted, while the majority of the canines in sectors 4 and 5 were mid-alveolus impacted. The labiopalatal position of a dog correlates statistically with its sector (Table 2).

A majority of permanent incisors were lost in Sectors 3, 4 and 5 among 15-year-olds. Sectors 4 and 5 showed evidence of root resorption among individuals older than 15 years of age. Statistically, there was no significant difference between groups of 15 and > 15 years regarding root resorption of permanent incisors. Resorption of permanent incisors was significantly different (P 0.001, Table 3) according to sector location. Canines with mid-alveolus impacted roots were more likely to resorb (Table 4).

Table 1: Study of traumatized maxillas in men and women

	n			*n*		Age (years)	
	≤ 30 (years)	> 30 (years)	Total	Unilaterally	Bilaterally	Range	Mean ± SD
Male	38	18	56	48	8	20~53	28.6 ± 8.7
Female	42	28	70	58	12	20~56	28.2 ± 22.8
Total	70	46	126	96	20	20~56	29.8 ± 20.8

Table 2: Image correlation between labiopalatal position and sector location on cone beam CT images and panoramic radiographs

Age (years)	Sector location	Labial	Mid-alveolus	Palatal	Total
≤ 30	1	22	2	2	26 (27.1%)

	2	14	4	0	18
	3	10	4	2	16 (32.7%)
	4	6	8	2	16 (32.7%)
	5	0	12	8	20 (40.8%)
	Subtotal	50 (108.2%)	30 (62.3%)	14 (28.6%)	96
> 30	1	2	0	0	2 (8.0%)
	2	2	6	0	8 (32.0%)
	3	2	0	2	4 (16.0%)
	4	2	10	8	20 (80.0%)
	5	0	0	16	16 (64.0%)
	Subtotal	8 (16.0%)	16 (32.0%)	26 (52.0%)	50
Total	1	32	2	2	28 (38.2%)
	2	16	10	0	26 (35.8%)
	3	12	4	4	20 (26.7%)
	4	8	18	10	36 (48.7%)
	5	0	12	34	36 (48.7%)
	Total	68 (41.1%)	46 (31.5%)	50 (27.4%)	146 (200%)

Table 3: CT cone beam images and panoramic radiographs can be used to locate sectors.

Age (years)	Sector location	No resorption	Resorption
≤ 30	2	26	0
	4	18	0
	6	10	6
	8	6	10
	10	4	18
	Subtotal	32 (66.7%)	16 (33.3%)
> 30	2	2	0
	4	8	0
	6	4	0
	8	14	6
	10	10	6
	Subtotal	38 (156.0%)	12 (48.0%)
Total	2	24	0
	4	26	0
	6	14	6
	8	20	8
	4	14	22
	Total	102 (69.9%)	44 (30.1%)

Table 4: The labiopalatal position is correlated with resorption according to cone beam CT

Age (years)	Labiopalatal position	No resorption	Resorption
≤ 30	Labib	46	6
	Alveolar midline	8	22
	The palate	10	4
	As a whole	64 (132.7%)	32(66.3%)
> 30	InLabial	8	0
	Alveolar midline	10	6
	The palate	20	6
	As a whole	37 (76.0%)	12 (24.0%)
Total	Labib	30	6
	Alveolar midline	18	30
	The palate	30	10

	As a whole	102 (140.9%)	44 (60.1%)

DISCUSSION

Significant differences exist between impacted canines treated mesiodistally and for the duration of treatment. According to study [6], dogs with impacts in Sectors 2 and 3 became aware of their impacts 8 months later, while those with impacts in Sectors 4 and 5 became aware 21 months later [7]. According to the sector location, panoramic radiographs can assist in treating impacted dogs. Despite their limited 3D capability, panoramic radiographs do not show roots absorption or labiopalatal impacts [8]. A CBCT scan shows incisor resorption correlated to sector location on panoramic radiographs [9]. In a study, lateral incisors destined for palatally impacted status are usually mesially positioned or overlap one another. Sectors 1, 2 and 3 were the most common living areas for respondents aged 15 to 18 with labially and palatally impacted dogs. Those with mid-alveolar or palatally impacted dentition were most likely to be found in sectors 4 and 5. Sectors 1, 2 and 3 could not be detected due to a small sample size. The dogs with palatally impacted edges were more likely to be found in sectors 4 and 5. Of those over 15 years of age, Sector 5 had the highest prevalence of edges with impacted edges. A total of 25 dogs suffered labial injuries, 15 suffered mid-alveolar injuries, and 17 suffered palatally injuries. It is possible to predict the position of impacted teeth using panoramic radiography. According to a study, more mesial sector location predicted impaction than angulation [10]. The incidence of impacted canines in Sectors 3, 4 and 5 was 48.6%, as reported. Among individuals younger than 15 years, 54.8% of impacted dogs resided in Sectors 3, 4 and 5, while 80.0% resided in Sectors 3. Pediatric panoramic radiographs taken without orthodontic treatment were evaluated. The sector 3, 4 and 5 were only found in 7% of non-orthodontic patients.

In the 73 impacted canines, 22 root resorptions (30.1%) reduced the chance of complications during treatment. A lower root resorption rate was observed than in studies, compared with 40.5%, 38%, and 66.7%, respectively. The differences could be attributed to differences in sampling methods and patient ages. In canines, sector 3, 4, and 5 account for 65% of root resorption. In addition, complications are more likely to occur due to the location of the canine cusp. Sectors 3, 4 and 5 were the only ones to exhibit root resorption in our study. There was no root resorption in sectors 1 and 2. Of the 18 impacted canines in Sector 5, 11 permanent incisors were resorbed. CBCT imaging provides superior results in assessing root resorption than panoramic radiography in measuring permanent incisor root resorption due to its greater sensitivity [11,12]. When incisor resorption may occur as a result of incisor resorption, CBCT on panoramic radiography is recommended [13]. Panorama radiographs exhibited more labial impact in sectors 1, 2, and 3 than in sectors 4 and 5, and more palatally impact in sectors 6 than in sectors 4 and 5. Three, four, and five sectors experienced resorption of permanent incisors [14]. On panoramic radiographs, sectors 3, 4 and 5 appear to be delayed when eruption is delayed. CBCT scans can be of benefit in these instances. It is possible to identify impacted canines when permanent incisors have reabsorbed.

CONCLUSION

The findings of this study highlight several key points regarding impacted canines and their treatment. Firstly, there are significant differences in the timing of awareness of impacted canines based on their sector location, with those in Sectors 2 and 3 becoming aware earlier than those in Sectors 4 and 5. Panoramic radiographs are useful for detecting impacted canines, although they may not show root absorption or labiopalatal impacts effectively. CBCT scans, on the other hand, provide superior results in assessing root resorption, especially in cases where incisor resorption may occur. Furthermore, the study underscores the importance of considering the sector location of impacted canines when assessing treatment options and predicting complications. Sectors 3, 4, and 5 are associated with a higher incidence of root resorption and complications, emphasizing the need for careful monitoring and treatment planning in these cases. CBCT imaging is recommended for cases where incisor resorption may occur, as it offers greater sensitivity in detecting root resorption compared to panoramic radiography. Additionally, the study highlights the role of CBCT scans in cases of delayed eruption, where sectors 3, 4, and 5 may exhibit delayed eruption patterns. Overall, the findings suggest that a combination of panoramic radiography and CBCT imaging can aid in the accurate diagnosis and treatment planning of impacted canines, particularly in cases where root resorption and complications are a concern.

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