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Location of External Root Resorption of Upper Permanent Incisors Adjacent To Impacted Maxillary Canines: Assessment By Cone Beam Computed Tomography

*Dr. Mohamad Aslam Baidar Gull[1], Prof. (Dr.) Mohammad Mushtaq[2]
[1,2](*Department of Orthodontics & Dentofacial Orthopaedics, Govt. Dental College & Hospital, Srinagar, J&K, India)*
**Corresponding author: Dr. Mohamad Aslam Baidar Gull*

***Abstract*:** *Impacted maxillary canines are common in orthodontic practice. Untreated impacted maxillary canines interfere with the alignment of adjacent teeth and can cause irreversible damage of external root resorption of adjacent teeth especially incisors. The purpose of the study was to investigate the location of root resorption associated with ectopic eruption of maxillary canines. CBCT scans were taken using NewTom GiANO cone beam computed tomography machine (CBCT). Location of the root resorption was taken in relation to the long axis of the involved tooth. In this study, a total of 53 impacted canines were investigated and it was found that 18 incisors were resorbed, which included 16 lateral incisors and 2 central incisors. Root resorption on permanent lateral incisors was located primarily in the middle third of the root (50.0 per cent), followed by the apical third of the root (25 per cent), cervical third of the root (18.7 per cent) and apical tip (6.3 per cent). In central incisor resorptions, it was found in the middle third (50 per cent) and apical third (50 per cent). The main location of root resorption on lateral incisors was primarily on lingual side (62.5 per cent) followed by buccal (25 per cent), distal (6.25 per cent) and apical (6.25 per cent). In case of central incisors, the main location was lingual (50 per cent) and distal (50 per cent).Thus CBCT provides accurate information regarding location of root resorption on incisors associated with impacted canines which is very beneficial and important before treatment plan .*

Keywords: *Impacted maxillary canine, root resorption, central incisor, lateral incisor*

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I. Introduction

Impacted maxillary canines are a common entity in orthodontic practice. Maxillary canines are the frequently impacted permanent teeth than other teeth, except for third molars with a prevalence of approximately 1-5 percent.[1,2] Impaction is defined as failure of eruption of tooth at its appropriate site in the dental arch, within its normal growth period.[3] Eruption disturbance is commonly found during the stages of transition from primary dentition to mixed dentition, through to permanent dentition. Eruption disturbances of the maxillary canine often result in its impaction because of its position and eruption sequence.[4] Untreated impacted maxillary canines interfere with the alignment of adjacent teeth, shorten the dental arches, increase the chances of follicular cyst formation and more importantly can cause irreversible damage of external root resorption of adjacent teeth.[5] On using two-dimensional radiographic techniques, the appearance of relationship of impacted canines with the neighboring bony and dental structures are often inaccurate because of overlap in maxillofacial region. So many authors have used computed tomography (CT) for evaluation of resorption of incisors, because of excellent contrast. Recently cone beam computed tomography (CBCT) units have been developed which improves accuracy of the diagnosis of root resorption and significantly reduced the radiation doses.[6,7,8] The objective of this study was to investigate the location of incisor root resorption adjacent to impacted maxillary canines.

II. Materials And Methods

The study was carried out on the patients visiting the out-patient section of the Department of Orthodontics and Dentofacial Orthopaedics, Government Dental College & Hospital, Srinagar. CBCT scans were taken for orthodontic reasons and to investigate the root resorption associated with ectopic eruption of maxillary canines. Patients with combined incisor and canine impactions, craniofacial anomalies, cleft lip and cleft palate were not included in this study. A total of 53 impacted canines were studied in which 11 were bilateral impactions. Data was obtained using the NewTom GiANO NNT Scanner with the patient in upright position. All the scans were taken using the same machine by the same operator. The operating parameters were

set at 3mA and 90kV, dose of 80-100 µSv and the scan time of 9 seconds. All CBCT images were taken using a limited dentoalveolar field of view (FOV: 5cm×8cm, 8cm×8cm and 8cm ×11cm). Imaging data was analyzed with the software provided by the manufacturer (NewTom 9000 Version 3. 10). The data was reconstructed in slices, and examined slice by slice in all three dimensions (sagittal, coronal and axial) on 1:1 scaled images using the provided software. The following variables were analysed:

2.1 Location of the root resorption in relation to the long axis of the involved tooth: It was classified as the ***cervical third, middle third, apical third*** and ***apical tip*** of the root (Fig. 1).

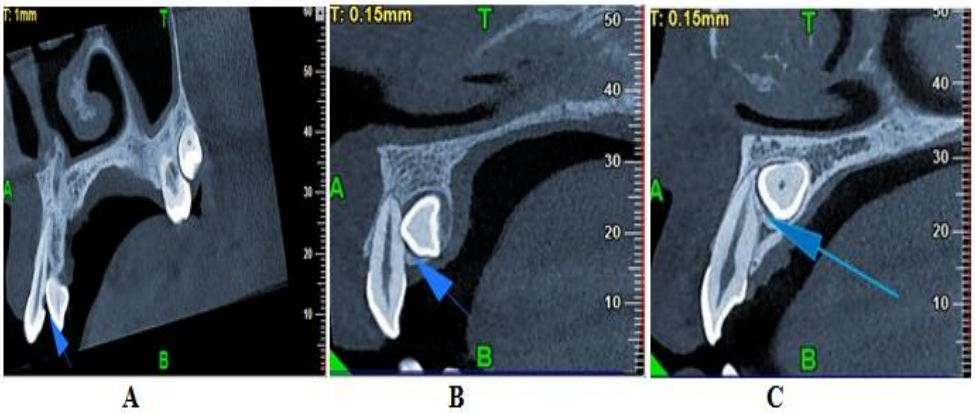

Figure 1. Representative example of different locations of root resorption: (A) root resorption at cervical third of lateral incisor; (B) root resorption at middle third of lateral incisor; (C) root resorption at apical third of lateral incisor.

2.2 Main location of the root resorption of lateral/central incisor: It was classified as ***Buccal, Lingual, Distal*** and ***Apical*** **(Fig. 2).**

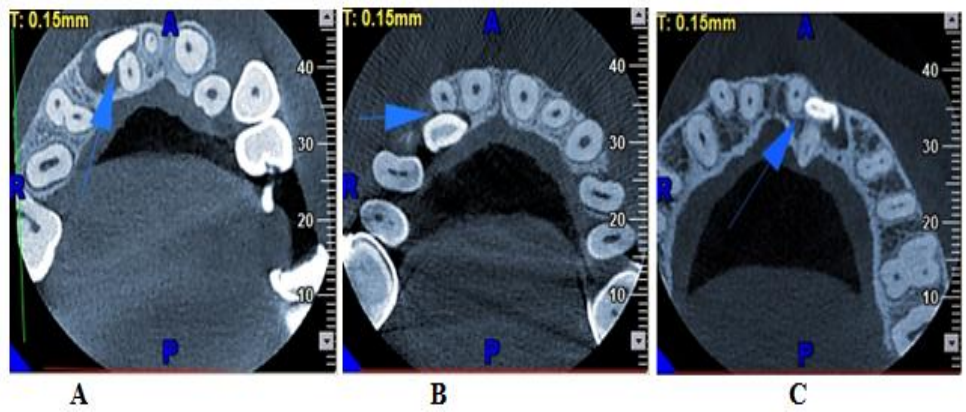

Figure 2. Representative examples of main locations of root resorption: (A) root resorption on buccal side of lateral incisor; (B) root resorption on lingual side of lateral incisor; (C) root resorption on distal side of central incisor**.**

III. Results

3.1 Statistical Analysis

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were summarized in the form of mean and standard deviations and categorical variables were summarized as percentages. A P-value of less than 0.05 was considered statistically significant.

In this study, a total of 42 patients with CBCT scans were enrolled, and 53 impacted canines were analysed. The mean age of the patients was 21.2 years with majority of subjects being 14-19 years. Of the 42 included patients, 15 (35.7 percent) were male and 27 (64.3 percent) were females. A total of 18 incisors were resorbed, which included 16 lateral incisors and 2 central incisors.

Root resorption on permanent lateral incisors was located primarily in the middle third of the root (50.0 per cent), followed by the apical third of the root (25 per cent), cervical third of the root (18.7 per cent) and

apical tip (6.3 per cent). In central incisors, the resorption was found in the middle third (50 per cent) and apical third (50 per cent) (Table 1). The main location of root resorption on lateral incisors was primarily on lingual side (62.5 per cent) followed by buccal (25 per cent), distal (6.25 per cent) and apical (6.25 per cent) while in case of central incisors, the main location was lingual (50 per cent) and distal (50 per cent). The distribution of the resorption on the roots of the incisors was in agreement with the positions of the crowns of the ectopic canines.

Table 1: Location of the root resorptions relative to the root height

Location of Root Resorption	Lateral Incisor		Central Incisor	
	No.	%age	No.	%age
Cervical Third	3	18.7	0	0.0
Middle Third	8	50.0	1	50.0
Apical Third	4	25.0	1	50.0
Apical Tip	1	6.3	0	0.0
Total	16	100	2	100

Table 2: Main location of the resorption on the roots of the maxillary incisors

Main Location of Root Resorption	Laterals		Centrals	
	No.	%age	No.	%age
Buccal	4	25.0	0	0.0
Distal	1	6.25	1	50.0
Lingual	10	62.5	1	50.0
Apical	1	6.25	0	0.0
Total	16	100	2	100

IV. Discussion

The CBCT method has been proven to be most effective in revealing the presence or absence and location of root resorptions on teeth adjacent to impacted maxillary canines.[9] The technique facilitates observations of even minor loss of tooth structure on the roots of the teeth.[10] Most of the root resorptions were without clinical signs or symptoms when diagnosed, which is in agreement with other studies.[11,12] The findings underline the importance of early supervision of the maxillary canine germ and the eruption path of the canine to avoid complications in cases with problems in eruption. As the eruption process goes on, the unerupted canine frequently moves more mesially, increasing the risk of resorption. Early extraction of the deciduous canine has been effective in reducing the incidence of unerupted displaced canines provided that normal space conditions are present. In 78% of cases, the palatally displaced maxillary canine changed its deviant eruptive path to a normal eruptive path within 12 months after extraction of the adjacent deciduous canine.[13] The resorptive cavities were mainly located on the middle and apical thirds of the root and mostly lingually (62.5%) which is in accordance with earlier findings and may lead to diagnostic mistakes due to overlapping when ordinary radiographic methods are used. The mechanism of the root resorption following maleruption and the factors involved in the process are not clear.[14] The resorptions may be caused by physical pressure due to the migration of the misplaced, erupting canine.[15]

V. Conclusion

Diagnosis and assessment of root resorption associated with impacted maxillary canines is of utmost importance prior to making an interdisciplinary treatment plan. CBCT imaging provides invaluable information about resorption of incisors associated with impacted canines to better understand and treat these cases orthodontically or surgically or interdisciplinary orthodontic-surgical management.

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