RESEARCH ARTICLE

Frequency and association of maxillary ectopic canine with incisor root resorption and dental agenesis

Nasreen Iqball Nagani,[1] Imtiaz Ahmed,[2] Sadia Rizwan,[3] Hana Pervez,[4] Taskeen Khan,[5] Tahira Arif[6]

Abstract

Objective: To assess the frequency of maxillary ectopic canine both buccally and palatally displaced with incisor root resorption and dental agenesis.

Methods: The cross-sectional study was conducted from April 8 to June 29, 2019, at the Department of Orthodontics, Dr. Ishrat Ul Ebad Khan Institute of Oral Health Sciences, and Dow Dental College, Dow University Of Health Sciences, Karachi, and comprised orthodontic patients diagnosed with maxillary ectopic canine eruption. Root resorption and agenesis were diagnosed on panoramic films. Root resorption was further confirmed by periapical radiographs. Data was analysed using SPSS 21.

Results: Of the 98 subjects, 86(87.8%) had buccally displaced canines of which 38(44.2%) were associated with root resorption, while 12(12.2%) patients had palatally displaced canines of which 10(83.3%) had root resorption (p=0.011). Overall, 30(30.6%) lateral incisors were resorbed, 7(7.1%) both central and lateral incisors, 5(5.1%) premolars, and 6(6.1%) both lateral incisors and premolars were resorbed. Agenesis was detected in 10 (10.2%) subjects (p=0.62).

Conclusion: There was found to be no association of maxillary ectopic canines with incisor root resorption and dental agenesis.

Keywords: Root resorption, Agenesis, Ectopic canine, Buccally displaced canine, Palatally displaced canine.
(JPMA 71: 277; 2021)
DOI: https://doi.org/10.47391/JPMA.782

Introduction

Canines are considered to be the longest teeth and the cornerstones of the dental arch. Ectopic tooth is defined as deviation of a tooth from its normal path of eruption. Deviation in the erupting path of maxillary permanent canine is common compared to any other tooth in the arch because they travel the longest distance and develop deep in the maxilla. They play a major role in dental aesthetics, facial appearance, arch development and functional occlusion. The prevalence of ectopic canine eruption in the general population is 1-2%.[1] Palatally displaced canines (PDCs) occur as frequently as buccally displaced canines (BDC).[2] However, in clinical practice BDCs are more commonly found compared to PDCs. It can be diagnosed by X-ray analysis as early as age 10 years.

There are numerous aetiological factors involved, but both BDCs and PDCs are characterised by different aetiopathogenesis. Most common reason for BDCs is severe crowding i.e. insufficient space in the maxillary arch which provides no space for the eruption of canines, ultimately resulting in ectopic eruption or impaction.[3] On the other hand, PDCs are often found in patients with no crowding; in fact, when there is excess space present in the canine area. The aetiology of PDC is still unclear. Some have believed that lack of lateral incisor guidance (guidance theory) could result in palatal displacement of canines by allowing the canine to cross back from the buccal to the palatal side.[4]

The most common sequel of maxillary ectopic canines is root resorption. PDCs most commonly cause the root resorption of maxillary anterior teeth compared to BDCs. If the condition is not detected and diagnosed at an early stage, it may lead to the resorption of the roots.[5] Severely resorbed incisors lead to extraction due to poor long-term prognosis.[6]

PDCs are commonly associated with dental anomalies as microdontia / peg-shaped maxillary lateral incisors, enamel hypoplasia, infraocclusion of deciduous molars, tooth size reduction, delayed tooth development and eruption, transposition and tooth agenesis (hypodontia).[7] Three types of permanent teeth account for over 95% of cases of tooth agenesis: third molars (M3), second premolars (PM2) and lateral incisors (I2).[8] The prevalence of PDCs ranges from 5.2% to 12.6% with the occurrence of at least one missing lateral incisor, and 8.1% with the occurrence of at least one missing second premolar.[9] The

[1-3,5,6]Department of Orthodontics, DIKIOHS, Dow University of Health Sciences, Karachi, [4]Department of Orthodontics, Jinnah Medical and Dental College, Karachi, Pakistan.
Correspondence: Nasreen Iqbal. Email: nasreen.iqbal@duhs.edu.pk

frequency of absent tooth site in European population was found to be third molar>second premolar>lateral incisor. It is reported that simultaneous occurrence of PDC with tooth agenesis has a strong genetic component.[10,11]

General dental practitioners and orthodontists frequently encounter this problem and should be fully aware of how to manage it. Failure to diagnose and manage the ectopic canine can result in a complex treatment strategy which would be costly in terms of clinical time for both the patient and the clinician. Early detection and diagnosis of ectopic canine and to assess the level of root resorption is of fundamental importance so that timely preventive measures can be taken in order to prevent the later complications and the risk of damaging the adjacent teeth.

Few studies have been conducted regarding ectopic canine and its relation to incisor root resorption and congenital anomalies.[12,13] In our population, no such study has been conducted in which both incisor root resorption and agenesis is detected together in patients presenting with ectopic canines. The current study was planned to fill the gap by evaluating the association of maxillary ectopic canines, both PDCs and BDCs, with the anterior teeth root resorption and agenesis.

Material and Methods

The cross-sectional study was conducted from April 8 to June 29, 2019, at the Department of Orthodontics, Dr. Ishrat Ul Ebad Khan Institute of Oral Health Sciences, and Dow Dental College, Dow University of Health Sciences, Karachi, and comprised orthodontic patients diagnosed with maxillary ectopic canine eruption. After approval from institutional ethics review board, the sample size was calculated using Power Analysis and Sample Size (PASS) version 11,[5] with two sample proportion, 95% confidence interval and 80% power of test, and an estimated population size of 1200 per month. The sample was raised using non-probability sampling technique from among orthodontic patients visiting the outpatient department (OPD).

Those included were patients of either gender with unilateral or bilateral ectopic canine in the maxillary arch. Patients with syndrome and craniofacial deformities were excluded.

After taking consent from each patient, data was collected from direct observation of dental casts, intraoral pictures and biodata of the cases. Radiographic examination was carried out for all patients on the initial visit. Panoramic radiographic films were used to evaluate incisor root resorption and agenesis. Further root resorption was confirmed by evaluating periapical radiographs. These intraoral radiographs were taken by using a modified parallel technique. Three to five intraoral films (Kodak Ultraspeed) were exposed from right to left lateral incisor and the teeth were imaged orthoradially, mesially with mesiocentric projection and distally with distocentric projection. Two independent observers, specialists in the field, analysed the radiographs. In case of disagreements, consensus was reached through discussion.

Data was analysed using SPSS 21. Relationship of variables was analysed using chi-square test with $p<0.05$ as significant.

Results

Of the 3,500 orthodontic patients, 98(2.8%) were included; 31(31.6%) males and 67(68.4%) females. The overall age range was 10-30 years. There were 60(61.2%) unilateral and 38(38.8%) bilateral cases (Table-1). Of the total, 86(87.8%) subjects had BDCs of which 38(44.2%) were associated with root resorption, while 12(12.2%) had PDCs of which 10(83.3%) were diagnosed with root

Figure-1: Periapical radiograph of a patient showing root resorption of lateral incisor caused by ectopic canine.

Table-1: Frequency of maxillary ectopic canines positioned unilaterally or bilaterally as seen in radiographic images.

Gender	Frequency of ectopic canines	Unilateral	Bilateral	Significance (p-value)*
Male	31 (31.6%)	20 (33.3%)	11 (28.9%)	
Female	67 (68.36%)	40 (66.6%)	27 (71%)	0.649
Total	98	60 (61.2%)	38 (38.8%)	

*Significant at 0.05 (Chi-square test).

Table-2: Frequency of root resorption of teeth due to ectopic canine as seen in radiographic images.

Teeth type	Frequency of Root Resorption	Significance (p-value)*
Lateral incisors	30 (62.5%)	
Central & lateral incisors	07 (14.5%)	
Premolars	05 (10.4%)	0.078
Lateral incisors & premolars	06 (12.5%)	
Total	48	

*Significant at 0.05 (Chi-square test).

resorption (p=0.011). The lateral incisors were the teeth mostly affected and were more resorbed than any other tooth (Figure-1), but the difference was non-significant (p=0.078). Of the 98 ectopically positioned maxillary canines, 30(30.6%) lateral incisors were resorbed, 7(7.1%) both central and lateral incisors, 5(5.1%) premolars and 6(6.1%) both lateral incisors and premolars were resorbed (Table-2).

Overall, agenesis was detected in 10(10.2%) subjects (p=0.62). Hypodontia was seen in third molars in 8(8.2%) cases, while 2(2%) had lateral incisors. Of the 10, 9(90%) had BDCs and 1(10%) had PDC.

Discussion

The current study assessed the possible associations of maxillary ectopic canine with incisor root resorption and agenesis. The subjects selected were not strictly randomised but had been referred by the oral diagnosis department for orthodontic treatment.

Maxillary ectopic canines were diagnosed consistently in both genders which was contrary to the findings reported in other studies.[14,15] No statistically significant gender association was found which was consistent with literature.[16,17] There was a higher frequency of unilateral ectopic cases compared to bilateral cases, as reported in other studies as well.[4,16]

It was reported previously that the prevalence of PDCs are higher compared to BDCs[18.19] but the current study's findings were not in agreement.

Displacement of canines lead to the resorption of teeth,[5,20] and ectopic eruption of maxillary canines most commonly causes root resorption of lateral incisors.[20,21] However, in the current study, ectopic eruption of the canine was not significantly associated with root resorption of neighbouring teeth. Resorption of lateral incisor was more common than central incisor. The first premolar was rarely resorbed. There were higher chances of root resorption with PDCs compared to BDCs which is evident from other studies as well.[14,22]

Studies showed that agenesis is mostly associated with PDCs,[10,14,17] but in the current study, agenesis was diagnosed in only 10% cases. It is reported that hypodontia is most commonly seen in third molars.[10] The sequence of developmentally absent tooth types is: maxillary or mandibular third molars > mandibular second premolars > maxillary lateral incisors.[23] In the current study, hypodontia was seen in third molars and then in lateral incisors, possibly based on the theory which emphasises that the most distal tooth is most likely to be unstable and absent genetically compared to the most mesial tooth.[10] Other causes are smaller dental arches and narrow intermaxillary complex.[17]

The current study has limitations. It used two-dimensional orthopantomagram (OPG) and periapical radiographs instead of three-dimensional (3D) images through computed tomography (CT) scan and cone beam computed tomography (CBCT). It is costly and the study site did not have this facility. To ensure more informative diagnosis, 3D images should be used as they are very helpful in determining the amount of damage to the neighbouring teeth.[23] Their major disadvantage, however, is increased radiation exposure which is at least four times higher than the panoramic radiographs. Therefore, orthodontists and general clinicians should consider these adverse effects and cost-benefit outcomes before prescribing these radiographs.[24,25]

It is recommended that similar studies should be conducted in future in conjunction with advance 3D techniques, but effective dose should be maintained to minimise the adverse effects. Furthermore, studies should also be conducted to assess the amount of root resorption.

Conclusion

BDCs were more commonly found than PDCs, while unilateral maxillary ectopic canines were more prevalent than bilateral ectopic canines. Besides, maxillary ectopic canines were not associated with root resorption of the adjacent teeth. Finally, tooth agenesis was not commonly associated with maxillary ectopic canines.

Disclaimer: None.

Conflict of Interest: None.

Source of Funding: None.

References

1. Majumder P, Singh A, Sharma M, Chokotiya H, Gupta MD. Case report on orthodontic treatment of a unique case of bilateral maxillary canine impaction, one buccal and another palatal. Int Dent J Stud Res. 2018;6:31-4.
2. Fleming P, Scott P, Heidari N, Dibiase A. Influence of radiographic position of ectopic canines on the duration of orthodontic treatment. Angle Orthod. 2009;79:442–6.
3. Ferreira JB, Silveira GS, Mucha JN. A simple approach to correct ectopic eruption of maxillary canines. Am J Orthod Dentofacial Orthop. 2019;155:871-80.
4. Al-Nimri KS, Bsoul E. Maxillary palatal canine impaction displacement in subjects with congenitally missing maxillary lateral incisors. Am J Orthod Dentofacial Orthop. 2011;140:81–6.
5. Rafflenbeul F, Gros C-I, Lefebvre F, Bahi-Gross S, Maizeray R, Bolender Y. Prevalence and risk factors of root resorption of adjacent teeth in maxillary canine impaction, among untreated children and adolescents. Eur J Orthod. 2019;41:447-53.
6. Savage RR, Kokich VG Sr. Restoration and retention of maxillary anteriors with severe root resorption. J Am Dent Assoc. 2002;133:67–71.
7. Lempesi E, Karamolegkou M, Pandis N, Mavragani M. Maxillary canine impaction in orthodontic patients with and without agenesis. Angle Orthod. 2014;84:11-17.
8. Garib DG, Alencar BM, Lauris JR, Baccetti T. Agenesis of maxillary lateral incisors and associated dental anomalies. Am J Orthod Dentofacial Orthop. 2010;137:732.e1–6.
9. Peck S, Peck L, Kataja M. Concomitant occurrence of canine malposition and tooth agenesis: evidence of orofacial genetic fields. Am J Orthod Dentofacial Orthop. 2002;122:657 60.
10. Becktor KB, Steiniche K, Kjaer I. Association between ectopic eruption of maxillary canines and first molars. Eur J Orthod. 2005;27:186–9.
11. Sacerdoti R, Baccetti T. Dentoskeletal features associated with unilateral or bilateral palatal displacement of maxillary canines. Angle Orthod. 2004;74:723–30.
12. Alqerban A, Jacobs R, Lambrechts P, Loozen G, Willems G. Root resorption of the maxillary lateral incisor caused by impacted canine: a literature review. Clin oral invest. 2009;13:247-55.
13. Alhaija ESA, Wazwaz FT. Third molar tooth agenesis and pattern of impaction in patients with palatally displaced canines. Angle Orthod. 2018;89:64-70.
14. Mercuri E, Cassetta M, Cavallini C, Vicari D, Leonardi R, Barbato E. Dental anomalies and clinical features in patients with maxillary canine impaction. Angle Orthod. 2013;83:22-8.
15. Mossey PA, Campbell HM, Luffingham IK. The palatal canine and the adjacent lateral incisor: a study of west Scotland population. Br J Orthod. 1994;21:169–74.
16. Schindel RH, Duffy SL. Maxillary transverse discrepancies and potentially impacted maxillary canines in mixed-dentition patients. Angle Orthod. 2007;77:430-5.
17. Bedoya MM, Park JH. A review of the diagnosis and management of impacted maxillary canines. J Am Dent Assoc. 2009;140:1485-93.
18. Ericson S, Kurol J. Resorption of incisors after ectopic eruption of maxillary canines. Angle Orthod. 2000;70:415-23.
19. Hameedullah J, Ayesha A, Sadia N. Frequency of impacted canines in orthodontic patients presenting to armed forces institute of dentistry. Pak Armed Forces Med J. 2009; 59: 363-6.
20. Abdulraheem S, Alqabandi F, Abdulreheim M, Bjerklin K. Palatally displaced canine diagnosis and interceptive treatment. Orthod Craniofac Res. 2019;1:1-11.
21. Schroder AGD, Guariza-Filho O, de Araujo CM, Ruellas AC, Tanaka OM, Porporatti AL. To what extent are impacted canines associated with root resorption of the adjacent tooth: A systematic review with meta-analysis. J Am Dent Assoc. 2018;149:765-77. e8.
22. Nagpal A, Pai KM, Sharma G. Palatal and labially impacted maxillary canine-associated dental anomalies: a comparative study. J Contemp Dent Pract. 2009;4:1–10.
23. Anic-Milosevic A, Varga S, Mestrovic S, Lepter-Varga M, Slaj M. Dental and occlusal features in patient with palatally displaced maxillary canines. Eur J Orthod. 2009;31:367–373.
24. Jacobs R. Dental cone beam CT and its justified use in oral health care. JBR-BTR. 2011;94:254-65.
25. Smith BR, Park JH, Cederberg RA. An evaluation of cone-beam computed tomography use in postgraduate orthodontic programs in the United State and Canada. J Dent Educ. 2011;75:98-106.