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Prevalence of Ectopic Maxillary Canine and Its Association With Other Dental Anomalies In Children: An Observational Study

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ABSTRACT

Ectopic eruption of canines can lead to further dental problems and discomfort for the patients. In this study, it was aimed to investigate the prevalence of ectopic eruption of maxillary canine and its association with other dental anomalies in children.

In this cross-sectional study, we included children aged 9-13 year old who were referred to specialized radiology clinics in Babol and Babol Dental School affiliated to Babol University of Medical Sciences between 2016-2020. The prevalence of ectopic eruption of maxillary canine and its association with other dental anomalies was evaluated.

Of 472 children, 218 (46.1%) were male and others were female. Fourteen children (3.0%) had at least one ectopic canine in the maxilla, of whom nine (64.3%) were male and five (35.7%) were female (p=0.168). The ectopic canine was unilateral in 12 cases (85.7%) and bilateral in two cases (14.3%). Of 14 children with an ectopic eruption of canine in the maxilla, 12 cases (85.7%) had unilateral, and two cases (14.3%) had bilateral ectopic canines. Of 16 ectopic canines in maxilla, 81.3% (13 teeth) had palatal direction and 18.7% (three teeth) had buccal direction. According to the chi-squared test, a direct association was found between the ectopic eruption of maxillary canines and over-retained deciduous teeth (p<0.001).

The frequency of unilateral ectopic canines was higher than bilateral, and frequency of maxillary palatal ectopic canines was higher than buccal ectopic canines. Over-retained deciduous teeth in individuals with maxillary ectopic canines were found to be more frequent.

Keywords: Prevalence, tooth eruption, ectopic, maxilla

Introduction

Ectopic canine, as a tooth eruption disorder, can cause the resorption of all or part of the adjacent tooth root or be superimposed on it (1). Mechanisms of ectopic canine eruption include unknown local pathological processes, trauma, mechanical interference, the odontoma, cysts and tumors in the eruption path of permanent teeth, and over-retained deciduous teeth. In addition, displacement of the dental lamina to an abnormal position early in life can cause an abnormal path of eruption (2, 3).

Canine is one of the most common teeth involved in ectopic eruption in the anterior jaw area (4). The prevalence of ectopic eruption of canines has been reported in different studies between 1.1%-9.5% (5-8). Diagnosis of ectopic eruption of canine is primarily based on radiographic examination, and an panoramic radiograph is preferable to lateral and frontal cephalograms (9).

If the buccal bulge of the maxillary canine is not touched at the age of 10-11 years, radiographic examinations should be used to find the cause (10). If diagnosed, extraction and surgical exposure with force eruption are the main treatments for the ectopic eruption of canines (11). The etiology of ectopic eruption of canines is still controversial. Lack of maxillary arch space is

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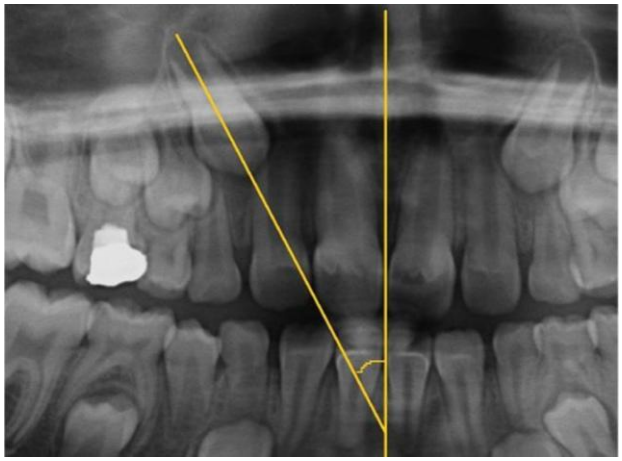

Fig.1. Diagrammatic Representation of The Measurement of The Angulation Between The Longitudinal Axis of Canine And Maxillary Midline

a local mechanical cause of ectopic eruption and impaction of canines (12, 13).

Ectopic eruption of canines can cause dental impaction, loss of arch length, root resorption of adjacent teeth, creation of dentigerous cysts, pain and discomfort, and neuralgic symptoms in the patient. Therefore, early diagnosis of this anomaly in childhood and timely surgical and orthodontic interventions protect the teeth, playing an important role in the aesthetic and function of a person's dentition (11). Considering that no study has been carried out on this topic in Babol city, northern Iran, and also given the importance of early diagnosis of this anomaly and other possible anomalies in childhood, the aim of this study was to investigate the prevalence of ectopic eruption of canine and its relationship with other dental anomalies in children aged 9-13 years in Babol. It was assumed that the prevalence of ectopic eruption of maxillary canines is almost comparable with previous studies.

Materials and Methods

In this cross-sectional study, we included children aged 9-13 years who were referred to specialized radiology clinics in Babol and Babol Dental School affiliated with Babol University of Medical Sciences between 2016-2020. Panoramic radiographs were obtained from the children. The radiographs were then examined by a maxillofacial radiologist and pedodontist, and data were recorded in a checklist. Panoramic images were saved digitally in JPEG format and examined on a monitor in a dark room. In these radiographs, an ectopic eruption of canine was examined according to the type of jaw involved, gender, symmetry, and eruption direction. High-quality

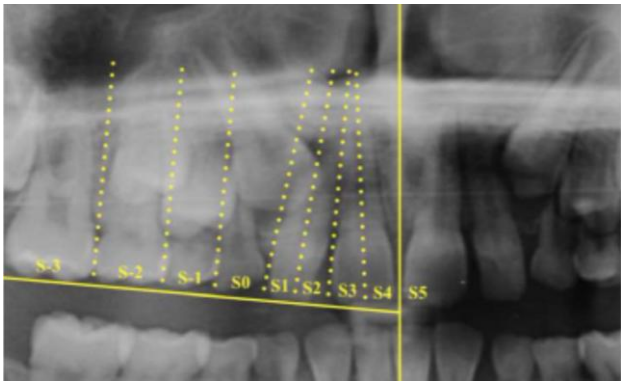

Fig. 2. Ericson Vertical Sectors

panoramic radiographs were included in the study. On the other hand, radiographs of patients with lip and palate cleft, jaw surgery and trauma, horizontal canines, severe skeletal malocclusion, children who underwent orthodontic treatment, and distorted radiographs were excluded from the study.

Two criteria for diagnosing ectopic eruption of maxillary canine in this study included (9):

A) The angle between the longitudinal axis of the canine and maxillary midline be greater than 30 degrees (Figure 1); B) Based on the Ericson vertical sectors, the maxillary canine crown be located in a sector other than the zero sector (Figure 2) (14).

The buccal and palatal eruption direction of maxillary canines was determined using the following three criteria:

A) Canine-Incisor Index: If the ratio of the maximum mesiodistal width of the ectopic canine to the maximum mesiodistal width of the central incisor in the same quadrant was greater than or equal to 1.16, the direction of the ectopic canine was palatal; otherwise, it was buccal (Figure 3) (15).

B) Bicondylar index: If the ratio of the distance from the most prominent point of the incisal edge of the central incisor to the bicondylar line to the distance from the tip of the canine crown of the same quadrant to the bicondylar line was greater than 1.5, the direction of the ectopic canine was palatal; otherwise, it was considered to be buccal (Figure 4) (16).

C) If the angle between the longitudinal axis of the canine and maxillary occlusal plane was greater than 65 degrees, the direction of the ectopic canine was buccal; otherwise, it was considered palatal. The maxillary occlusal plane was determined by connecting the tips of the mesiobuccal cusp of the maxillary first molars (Figure 5) (17).

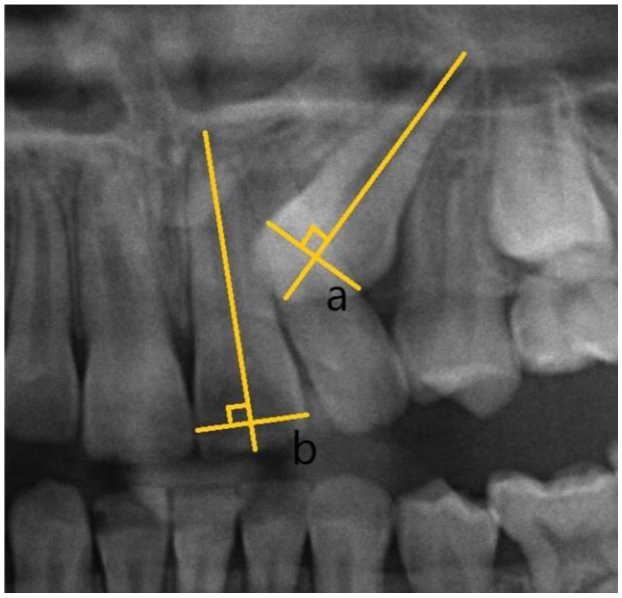

Fig. 3. Canine-Incisor Index. A Represents the Maximum Mesiodistal Width of the Ectopic Canine. B Represents the Maximum Mesiodistal Width of Central Incisor

In order to determine the buccal and palatal eruption direction of maxillary canines using the above criteria, it is necessary that the central incisors and upper first molars have fully erupted and that the central incisors and canines do not have anomalies in size, shape, and position.

A priori G-power analysis was performed to determine the sample size with effect size = 0.10, type I error = 0.05, and power = 80%. The dental anomalies in this study included extra teeth, impacted teeth, premature loss of deciduous teeth, over-retained deciduous teeth, odontogenic cysts, and odontoma. A descriptive statistical index was presented as percentages and ratios, and the relationship between ectopic eruption and other anomalies was analyzed using the chi-squared test, and a p-value less than 0.05 was considered significant. Statistical analyses were performed using SPSS v22 software.

The children' consent was obtained from their parents or legal guardians. The study protocol was approved by the ethics committee of Babol University of Medical Sciences (code: IR.MUBABOL.HRI.REC.1398.073).

Results

A total of 472 children were included in the study, of whom 218 (46.1%) were male and 254 (53.8%) were female. Fourteen children (3.0%) had at least one ectopic canine in the maxilla, of whom 9 (64.3%) were male and 5 (35.7%) were female

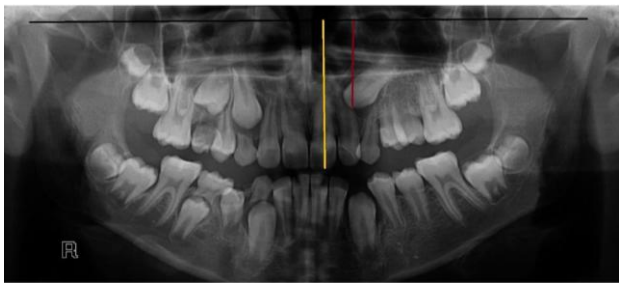

Fig. 4. Bicondylar Index. Black Line Represents the Bicondylar Line. Red Line Represents the Distance Between the Bicondylar Line and the Crown tip of the Ectopic Canine. Yellow Line Represents the Distance Between the Bicondylar Line and Crown Tip of the Lateral Incisor

Fig. 5. The Angle Between The Longitudinal Axis of Canine and Maxillary Occlusal Plane

(p=0.168). The ectopic canine was unilateral in 12 cases (85.7%) and bilateral in 2 cases (14.3%).

Among 14 children with an ectopic eruption of canine in the maxilla, it was unilateral in 12 cases (85.7%) and bilateral in 2 cases (14.3%). Out of 16 ectopic canines in the maxilla, 81.3% (13 teeth) had palatal direction, and 18.7% (3 teeth) had buccal direction.

Table 1 shows the distribution of ectopic eruption of maxillary canines by dental anomalies. In this regard, over-retained deciduous teeth were observed in three children with canine ectopic eruption. Also, one case with canine ectopic eruption had tooth agenesis. According to the analysis, a significant association was found between the ectopic eruption of maxillary canines and over-retained deciduous teeth ($p<0.001$) (Table 1).

Discussion

In the present study, the prevalence of ectopic eruption of maxillary canine and its association with other dental anomalies was investigated. In this regard, the prevalence of maxillary ectopic canines was 3.0%. Ibtesam et al. (18) in Saudi Arabia reported the prevalence of ectopic eruption of maxillary canine as 9.5%. In Ibtesam et al.'s study, the criteria for determining maxillary

Table 1. Prevalence and Association of Dental Anomalies With Ectopic Eruption of Maxillary Canine

Dental anomalies	Presence of canine ectopic eruption (N=14)		Lack of canine ectopic eruption (N=458)		P-value
	N	%	N	%	
Extra teeth					0.861
Yes	0	0.0	1	0.2	
No	14	100.0	457	99.8	
Impacted teeth					0.761
Yes	0	0.0	3	0.6	
No	14	100.0	455	99.4	
Early loss of deciduous teeth					0.331
Yes	0	0	29	6.3	
No	14	100.0	429	93.7	
Over-retained deciduous teeth					<0.001
Yes	3	21.4	5	1.1	
No	11	78.6	453	98.9	
Tooth agenesis					0.584
Yes	1	7.1	19	4.1	
No	13	92.9	439	95.9	
Odontogenic cysts					-
Yes	0	0.0	0	0.0	
No	0	0.0	0	0.0	
Odontoma					-
Yes	0	0.0	0	0.0	
No	0	0.0	0	0.0	

ectopic canine included 30-degree angulation of the canine, its overlap on the adjacent permanent lateral and the horizontal position of the canine above the premolar. Among these three criteria, the third one was different from the criteria of the Ericson method used in the present study. According to the regression model, the criteria of the Ericsson method are the strongest predictors of ectopic eruption and impaction of maxillary canine. In a study on 11-14-year-old children in Ireland in 2016, Daly et al. (5) reported a rate of 1.1%. Due to the indirect path of eruption of the maxillary canines, fewer cases of ectopic eruption of this tooth are found in older ages due to the more vertical angle of the canine. Also, in the mentioned study, only palatal ectopic canines were classified as ectopic canines, and buccal ectopic canines were not included in this classification. They stated that buccal ectopic canines would finally erupt, albeit with a delay in a buccal position.

The prevalence of ectopic eruption of maxillary canine in males was about two times higher than that in females; however, the difference was not significant. In a study by Ericson et al. in the United States (19), the ectopic eruption of maxillary canine was more common in females than in males. In Ericson's study, the sample size was 3000 and more than that of our study, and the age of the study population was 10-15 years. In the study conducted by Salem et al. (20) in Iran, the ectopic eruption of maxillary canine was higher in females. In Salem's study, the sample size was 1023 and more than that of our study. Thus, it seems that a study with a higher sample size is needed to achieve more accurate results in this regard.

The unilateral maxillary ectopic canine frequency was six times higher than bilateral, which was

consistent with other studies (21, 22). Also, the frequency of palatal ectopic canines was about four times higher than buccal ectopic canines. The buccal eruption direction of the maxillary canine is due to a lack of eruption space, and its palatal eruption path has a genetic basis (23). In the studies by Katsnelson et al. (24) and Ericson et al. (19) in the United States, the prevalence of maxillary ectopic canines with the palatal path of eruption was greater than that of the buccal eruption direction. However, in the study by Adersh et al. in India (25) and Haghnegahdar et al. in Iran (15), the prevalence of maxillary impacted canines with the buccal direction was higher than that of palatal direction. In Adersh's study (25), only the bicondylar index was used to determine the position of the maxillary impacted canines, and in Haghnegahdar's study (15), only the canine-incisor index was used.

In this study, over-retained deciduous teeth were found more often in individuals with ectopic maxillary canine than in those without. Over-retained deciduous teeth can cause displacements in the follicles of permanent teeth, resulting in ectopic eruption in the same tooth or adjacent permanent teeth. In the study conducted by Baccetti et al. (26), no association was found between maxillary palatal ectopic canines and extra teeth. In the study conducted by Garib et al. (27), there was no association between ectopic canines and lateral and second premolar agenesis in the maxilla. In a study conducted by Peck et al. (28), second premolar and third molar agenesis were significantly higher in individuals with maxillary palatal ectopic canines. In Peck et al.'s study (28), 85 patients with at least one maxillary palatal ectopic canine were examined. Besides, in that study, only palatal ectopic canines were examined.

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Conflict of interest: The authors report no conflicts of interest related to this study.

References

1. Chaushu S, Kaczor-Urbanowicz K, Zadurska M, Becker A. Predisposing factors for severe incisor root resorption associated with impacted maxillary canines. Am J Orthod Dentofacial Orthop. 2015;147(1):52-60.
2. Juuri E, Balic A. The biology underlying abnormalities of tooth number in humans. J Dent Res. 2017;96(11):1248-56.
3. Ozdemir DS, Hato E, Kuyucu YE, Altan H. Prevalence and complications of ectopic eruption in 6-12-year-old children based on radiographic evaluation. J Oral Health Oral Epidemiol. 2022;11(1):25-31.
4. Ferreira JB, Silveira GS, Mucha JN. A simple approach to correct ectopic eruption of maxillary canines. Am J Orthod Dentofacial Orthop. 2019;155(6):871-80.
5. Daly KT. Clinical and radiographic assessment of maxillary canine eruption status in a group of 11- to 14-year-old Irish children. J Ir Dent Assoc. 2016;62(3):162-6.
6. Sachan A, Chaturvedi TP. Orthodontic management of buccally erupted ectopic canine with two case reports. Contemp Clin Dent. 2012;3(1):123-8.
7. Margareta L, Rune H, Olafur PJ. Dental abnormalities and ectopic eruption in patients with isolated cleft palate. Scand J Plast Reconstr Surg Hand Surg. 1998;32(2):203-12.
8. Güven Y. Prevalence of ectopic eruption of first permanent molars in a Turkish population. Eur Oral Res. 2018;52(1):1-5.
9. Cacciatore G, Poletti L, Sforza C. Early diagnosed impacted maxillary canines and the morphology of the maxilla: a three-dimensional study. Prog Orthod. 2018;19(1):20.
10. Naoumova J, Kjellberg H. The use of panoramic radiographs to decide when interceptive extraction is beneficial in children with palatally displaced canines based on a randomized clinical trial. Eur J Orthod. 2018;40(6):565-74.
11. Aileni KR, Rachala MR, Prathima CR, Naveen PK, Soujanya D. Management of an unusual ectopic eruption of maxillary canine. J Clin Diagn Res. 2017;11(5):ZD03.
12. Cruz RM. Orthodontic traction of impacted canines: Concepts and clinical application. Dental Press J Orthod. 2019;24:74-87.
13. Aslan I, Üçüncü N. Clinical consideration and management of impacted maxillary canine teeth. In: Virdi MS, editor. Emerging trends in oral health sciences and dentistry. London: Intech Open; 2015. p. 465–501.
14. Alejos-Montante K, Martínez-Zumarán A, Torre-Delgadillo G, Rosales-Berber M, Garrocho-Rangel A, Pozos-Guillén A. Early identification of permanent maxillary canine impaction: A radiographic comparative study in a Mexican population. Journal of clinical and experimental dentistry. 2019;11(3):e282-e6.
15. Haghnegahdar A, Najafi HZ, Abdollahi S. Prevalence and localization of impacted canine teeth in both jaws using panoramic radiograph in

a selected Iranian population, Shiraz, 2012. Galen Medical Journal. 2014;3(1):24-8.

16. Adersh G, Salim S, Nair V, Sebastian A. Localisation of impacted maxillary canines using panoramic radiographs; Anovel technique that uses bicondylar line as reference. International Journal of Medical and Biomedical Studies. 2019;3:71-5.
17. An S, Wang J, Li J, Cheng Q, Jiang C, Wang Y, et al. Comparison of methods for localization of impacted maxillary canines by panoramic radiographs. Dentomaxillofacial Radiology. 2013;42(8):20130129.
18. Alzain I, Batwa W, Kamrani A, Bawazir R. Early assessment of ectopic maxillary canine. EC Dental Science. 2017;10:125-31.
19. Ericson S, Kurol J. Radiographic examination of ectopically erupting maxillary canines. Am J Orthod Dentofacial Orthop. 1987;91(6):483-92.
20. Salem K, Mirzaee B. Infraocclusion of Primary Molars and Associated Dental Anomalies. Research Journal of Biological Sciences. 2009;4(12):1217-20.
21. Anoush K, Valizadeh Haghi H, Vahedi H, Nemati R, Mikaeeli Khyiavi H. A study on the Frequency of Ectopic Eruption of Permanent First Molar and Canine in Patients Presenting to the university of Ardabil School of Dentistry, 2016-2018. Journal of Ardabil University of Medical Sciences. 2019;18(4):497-505.
22. Batwa W, Alzain I. Association between ectopic mandibular and maxillary canines. J Contemp Dent Pract. 2018;19(7):830-5.
23. Becker A, Chaushu S. Etiology of maxillary canine impaction: a review. Am J Orthod Dentofacial Orthop. 2015;148(4):557-67.
24. Katsnelson A, Flick WG, Susarla S, Tartakovsky JV, Miloro M. Use of panoramic x-ray to determine position of impacted maxillary canines. J Oral Maxillofac Surg. 2010;68(5):996-1000.
25. Adersh G, Salim S, Nair V, Sebastian A. Localisation of impacted maxillary canines using panoramic radiographs; a novel technique that uses bicondylar line as reference. International Journal of Medical and Biomedical Studies. 2019;3:71-5.
26. Baccetti T. A controlled study of associated dental anomalies. Angle Orthod. 1998;68(3):267-74.
27. Garib DG, Lancia M, Kato RM, Oliveira TM, Neves LTd. Risk of developing palatally displaced canines in patients with early detectable dental anomalies: a retrospective cohort study. J Appl Oral Sci. 2016;24:549-54.
28. Peck S, Peck L, Kataja M. Prevalence of tooth agenesis and peg-shaped maxillary lateral incisor associated with palatally displaced canine (PDC) anomaly. Am J Orthod Dentofacial Orthop. 1996;110(4):441-3.