Saudi Dental Journal (2020) 32, 300–305

King Saud University

Saudi Dental Journal

www.ksu.edu.sa
www.sciencedirect.com

ORIGINAL ARTICLE

Prevalence and pattern of impacted canines in Najran, South Western Saudi Arabian population

Bandar Alyami [a,*], **Ramat Braimah** [b], **Saeed Alharieth** [c]

[a] *Department of Preventive Dentistry, Faculty of Dentistry, Najran University, PO Box 1988, Najran, Saudi Arabia*
[b] *Consultant, Oral and Maxillofacial Surgeon, Department of Oral and Maxillofacial Surgery, Specialty Regional Dental Center, New Medical City, Najran, Saudi Arabia*
[c] *Psychiatry Hospital, New Medical City, Shurfa, Najran, Saudi Arabia*

Received 11 July 2019; revised 27 September 2019; accepted 3 October 2019
Available online 15 October 2019

KEYWORDS

Canine;
Cone beam CT;
Impaction;
Prevalence;
Panorama

Abstract *Background:* The canine plays an important role in dentofacial aesthetics and function. It supports the base of the alar and upper lip, which are necessary for smile aesthetics. When impacted, these functions are lost, leading to low self-esteem and overall poor health-related quality of life. This study was designed to determine the prevalence and pattern of impacted canines in the southwestern region, Kingdom of Saudi Arabia.

Materials and methods: This was a retrospective study carried out in a dental center in the southwestern region of Saudi Arabia. A total of 2000 panoramic radiographs were screened, and all patients with impacted canines were further screened both clinically and radiologically (cone beam CT). Demographics, position, laterality, and relationships to the midline were retrieved and recorded. Cone beam CT was used to diagnose palatal or labial impactions. The data were analyzed using IBM SPSS Statistics for IOS Version 25 (Armonk, NY: IBM Corp).

Results: A total of 2000 panoramic radiographs were screened, out of which 107 cases were found to have impacted canines, giving a prevalence of 5.35%. There were 38 males and 69 females with a M:F ratio of 1:1.8. Their age ranged from 15 to 75 years with a mean ± SD age of 20.4 ± 11.1. There were more affected maxillary canines (99 (92.5%)) compared with mandibular canines (8 (7.5%)). Palatal impaction positions were more frequent than labial impactions.

Conclusion: The prevalence of canine impaction in the southwestern region of Saudi Arabia was 5.35%, with a female preponderance and more palatal positions. The impactions occurred more unilaterally on the left side than on both sides.

* Corresponding author.
E-mail address: bsalyami@nu.edu.sa (B. Alyami).
Peer review under responsibility of King Saud University.

Production and hosting by Elsevier

1. Introduction

Canines, also known as cuspids, play fundamental roles in the aesthetics and function of patients. Canines are crucial for biting and tearing food, as well as directing the jaw into the proper orientation. The upper canines are the second most

https://doi.org/10.1016/j.sdentj.2019.10.002

common teeth to become impacted following the wisdom teeth. The etiology of the impaction of canines includes genetic causes, lateral incisor anomalies and crowding (Peck et al., 1994; Vastardis, 2000). The genetic and guidance theories are the two main theories associated with displaced canines (Litsas & Acar, 2011). While the genetic theory considers genetic factors as the main etiology of palatally displaced canines, the guidance theory suggests that the roots of the lateral incisors guide the canine into proper occlusion. Any abnormality in the root of the lateral will lead to the canine missing its path of eruption, and therefore, it becomes displaced (Peck et al., 1994). Evidence for genetic and hereditary factors have been reported to be convincing and strong, and therefore, the prevalence of the condition in the local population is crucial (Pirinen, Arte, & Apajalahti, 1996). Such data on the pattern and prevalence of this health condition will enable the health planning office and officials to appropriately deploy human and material resources to address it (Haralur et al., 2017).

Data on dental anomalies in patients are important for treatment planning. Ethnic background may modify the prevalence rates of some of these anomalies, including teeth impaction. Awareness by dental practitioners of ethnic differences in the occurrence of dental anomalies will allow them to keep an eye out for them in certain communities, thereby allowing for timely clinical intervention to avert complications (Stecker et al., 2007). When impacted canines are not managed appropriately, they can lead to the root resorption of adjoining teeth, transposition of canines, a reduction in arch length, and the development of cystic masses triggering infection and pain (Bedoya and Park, 2009; Lindauer et al., 1992).

To diagnose impacted canines, both clinical and radiographic assessment are very important. The most sensitive and specific imaging technique for the location of an impacted canine is cone-beam CT (CBCT) (Al-Homsi and Hajeer, 2015; Patil et al., 2018). This imaging technique can give details about the precise anatomy and the location of the crown and root apex with its orientation along the long axis (Patil et al., 2017).

Several studies have reported the prevalence of canine impaction to be between 0.8 and 8.8% (Aydin et al., 2004; Chu et al., 2003; Fardi et al., 2011; Zahrani, 1993). In Saudi Arabia, some studies have reported prevalences in different parts of the kingdom (Abdul Bagi Mustafa, 2014; Alhammadi et al., 2018; Haralur et al., 2017; Zahrani, 1993); however, none has been conducted in the current study location. The aim of this study was therefore to determine the prevalence and pattern of impacted canines in the southwestern region of the Kingdom of Saudi Arabia.

2. Materials and methods

This was a retrospective study carried out in a dental center in a city in the southwestern region of Saudi Arabia. All patients were screened both clinically and radiologically for impacted canines. All panoramic radiographs obtained were taken with standardized equipment and specifications (Carestream Dosimetry of the 9500 3D Cone Beam System, Carestream Dental LLC, 3625, Cumberland Blvd. Ste. 700, Atlanta, GA 30339). Incomplete data were excluded from the study. Demographics, position, angulation, relationships to midline, and laterality were retrieved. Those patients with a panorama suggesting impacted canines were further investigated with a cone beam CT scan machine (Carestream Dosimetry of the 9500 3D Cone Beam System, Carestream Dental LLC, 3625, Cumberland Blvd. Ste. 700, Atlanta, GA 30339) to determine whether it was palatal or labially located.

Required sample size was determined by using the prevalence of 4.3% from a similar comparative study on impacted canines in Saudi Arabia (Alrwuili et al., 2016) and a formula for a prevalence study (Sofoluwe et al., 1996) ($n = (1.96)^2P(100 - P)/d^2$) applied with a confidence level preset at 95%. This formula gave a minimum sample size of 63 cases. However, all identified cases of impacted canines from the reviewed panoramic radiographs were included.

2.1. Statistical analysis

The data were analyzed using IBM SPSS Statistics for IOS Version 25 (Armonk, NY: IBM Corp.), and the results are presented as simple frequencies and descriptive statistics. Pearson's chi-square test was used to assess the association and level of significance among categorical variables such as age group of patients, sex and position of the impacted canine with $p \leq 0.05$ considered as statistically significant.

3. Results

A total of 2000 panoramic radiographs were screened, and 107 cases of impacted canines were found, giving a prevalence of 5.35%. There were 38 males and 69 females with an M:F ratio of 1:1.8. Their age ranged from 15 to 75 years with a mean ± SD age of 20.4 ± 11.1 (Table 1). The majority of the patients fell within the age groups 11–20 (29 (27.1%)) and 21–30 (40 (37.4%)). There were more impacted maxillary canines (99 (92.5%)) compared with mandibular canines (8 (7.5%)) (Fig. 1).

With respect to the sex of the patients, the majority of the impacted upper canines in labial and palatal positions (30 (28.0%) and 39 (36.5), respectively) were seen in the females, although this observation did not attain any statistical significance ($\chi^2 = 0.016$, df = 1, p value = 0.900) (Table 2). Table 3 shows the distribution of positions according to age groups where the majority of the palatal positions were observed in

Table 1 Distribution of sex of patients according to age groups.

	Sex		
	Male (%)	Female (%)	Total (%)
11–20	8 (7.5)	21(19.6)	29 (27.1)
21–30	14 (13.1)	26 (24.3)	40 (37.4)
31–40	13 (12.1)	12 (11.2)	25 (23.3)
41–50	2 (1.9)	6 (5.6)	8 (7.5)
51–60	1 (0.9)	2 (1.9)	3 (2.8)
61–70	0 (0.0)	1 (0.9)	1 (0.9)
71–80	0 (0.0)	1 (0.9)	1 (0.9)
Total	38 (35.5)	69 (64.5)	107 (100.0)

$X^2 = 5.261$, df = 6, p value = 0.511.

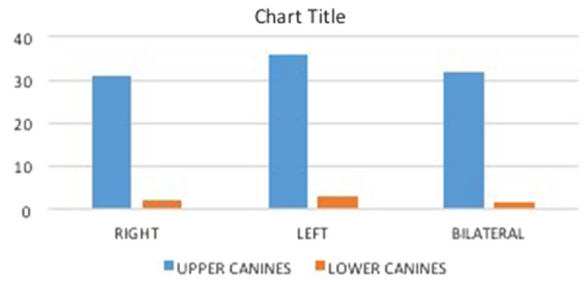

Fig. 1 Bar chart depicting the laterality of the impacted canines.

Table 2 Distribution of the position of the impacted canine according to the sex of the patients.

	Sex		
	Male (%)	Female (%)	Total (%)
Labial	17 (15.9)	30 (28.0)	47 (43.9)
Palatal/lingual	21 (19.6)	39 (36.5)	60 (56.1)
Total	38 (35.5)	69 (64.5)	107 (100.0)

$\chi^2 = 0.016$, df = 1, p value = 0.900.

Table 3 Distribution of the position of the impacted canine according to the age group of the patients.

	Position		
	Labial (%)	Palatal/lingual (%)	Total (%)
11–20	12 (11.2)	17 (15.9)	29 (27.1)
21–30	13 (12.1)	27 (25.2)	40 (37.4)
31–40	12 (11.2)	13 (12.1)	25 (23.3)
41–50	6 (5.6)	2 (1.9)	8 (7.5)
51–60	2 (1.9)	1 (0.9)	3 (2.8)
61–70	1 (0.9)	0 (0.0)	1 (0.9)
71–80	1 (0.9)	0 (0.0)	1 (0.9)
Total	47 (43.9)	60 (56.1)	107 (100.0)

$\chi^2 = 8.684$, df = 6, p value = 0.192.

the age group 21–30; this observation, however, did not attain any statistical significance ($\chi^2 = 8.684$, df = 6, p value = 0.192) (Table 3).

4. Discussion

The presence of maxillary canines supports the base of the alar and upper lip that are necessary for smiles and aesthetics (Sajnani, 2015). Furthermore, it provides canine guidance for mandibular movements (Sajnani, 2015). An impacted tooth has been defined as a tooth that is thwarted from completely erupting into a natural functional position within the expected time frame, usually due to a lack of space, physical obstruction by another tooth, or a deviant eruption path (Chu et al., 2003). Some studies have reported the maxillary canines as the most frequently impacted teeth (Halıcıoğlu et al., 2012); however, others have reported it as the second after the third molars (Litsas and Acar, 2011). This high rate of impaction of canines has been attributed to the fact that they are the last tooth to develop and therefore travel long and tortuous paths before coming into functional occlusion. Through this long journey, they are frequently prone to displacements and mechanical obstructions from adjacent teeth and the process of pneumatization in the maxilla (Becker and Chaushu, 2015).

Several studies have reported the prevalence of impacted canines in different populations (Chu et al., 2003; Fardi et al., 2011; Sajnani, 2015). In Saudi Arabia, the prevalence of impacted canines has been reported for various regions (Abdul Bagi Mustafa, 2014; Alhammadi et al., 2018; Haralur et al., 2017; Zahrani, 1993). This study has reported a prevalence of 5.35% with higher rates among females (69 (64.5%)) than those among males (38 (35.5%)).

In Saudi Arabia, the prevalence of canine impaction has been reported for the eastern, central and northern regions with different figures. In Riyadh, Melha et al. (2017) reported a prevalence of 3.65%; while in the eastern region, a prevalence of 3.30% was reported (Afify and Zawawi, 2012). In the northern region, a prevalence of 3.03% was reported (Patil and Maheshwari, 2014). Similar values have been reported for India (Patil and Maheshwari, 2014) and Turkey (Aktan et al., 2010). In the Asir province of the southern region, a hospital-based study reported a prevalence of 1.14%, far below the reported values in the eastern, central and northern parts of the country (Mustafa, 2014). The current study in a city within the southern region reported a prevalence of 5.35%. This rate is much higher than that from the Asir region and those of the east, north and central regions of the kingdom. The reason for this difference still needs further investigation. However, we suspect that genetic background may be a very strong factor. The linkage of genetic reasons with palatally displaced canines (Litsas and Acar, 2011) is a strong supporting factor for this hypothesis, as most of the cases in the current study were palatally impacted canines. Outside the kingdom, higher incidences have been reported, with 9.9% in Australia and 8.8% in Greece (Fardi et al., 2011; Tassara, Lopez, Hanke, Tumanyan, & F., 2015). In contrast, a much lower prevalence of 0.27% has been reported in Japan (Fardi et al., 2011; Tassara et al., 2015).

Consistent with the previous literature (Bishara, 1992; Cooke and Wang, 2006), upper canine impaction occurred more often than the impaction of the lower canine (99 (92.5%)) and 8 (7.5%), respectively), with a much higher percentage of impaction in females. This sex difference could be a result of sex-related differences in growth patterns (Melha et al., 2017).

Some previous literature has reported that the unilateral impaction of canines is more common than bilateral impactions (Fardi et al., 2011; Melha et al., 2017). Others have reported a contrary view where bilateral canine impaction was more common (Fardi et al., 2011). In this study, we found more unilateral impactions than bilateral impactions. With unilateral impactions, the previous literature has reported higher frequencies for the left than the right canine (Al-Zoubi et al., 2017). The present study also found a higher prevalence of impacted maxillary canines on the left side (n = 36) compared to the right side (n = 31). This outcome is in agreement with that from Al-Zoubi et al. (Al-Zoubi et al., 2017), where more left-sided impacted canines were reported. Presently, there is no scientific explanation for the

Fig. 2 Cone beam CT showing labial canine impaction.

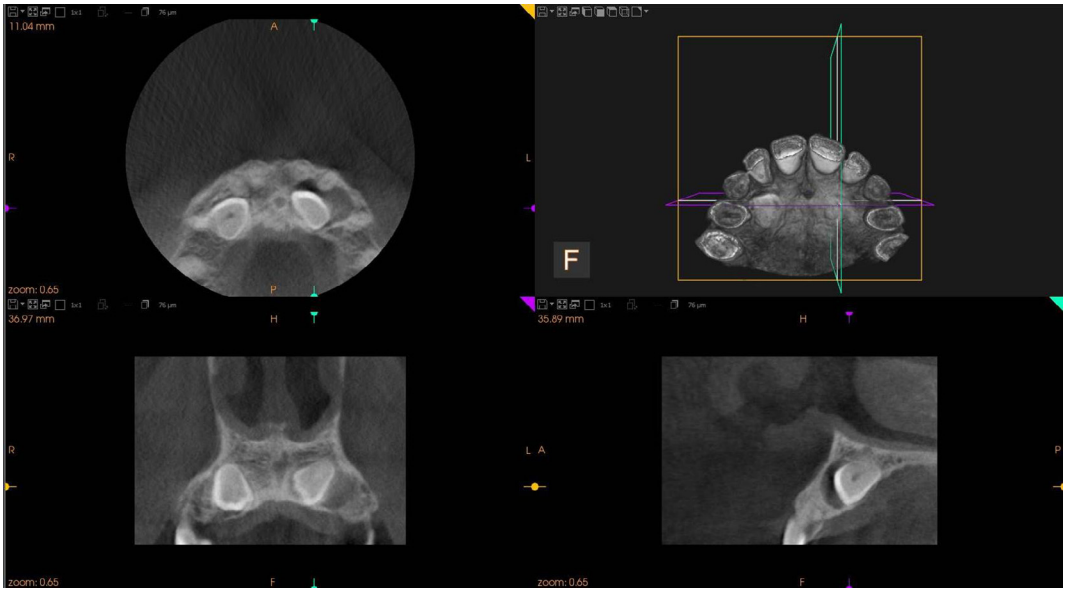

Fig. 3 Cone beam CT showing palatal canine impaction.

left-side preponderance (Al-Zoubi et al., 2017). Other studies have reported equal distributions of unilaterally impacted maxillary canines between the left and right sides (Prskalo et al., 2008; Sajnani and King, 2014).

The prevalence of labial or palatal locations of impacted canines has been reviewed in several populations, and it has been established that palatal impaction is more common and occurs in 50% to 92.6% of cases (Alkadhi, Alfuraih and Ajwa, 2017; Stivaros and Mandall, 2000). We found a prevalence of 56.1% of palatal/lingual impactions compared to labial impactions of 43.9%, which fell within the previously reported range of cases. Other studies have reported a contrary finding, wherein labial impactions were predominant (Kifayatullah et al., 2015). Several methods have been used to locate the exact position of the impacted canine, but cone beam CT has been found to be the most suitable (Ericson

Fig. 4 Panoramic x ray showing both maxillary and mandibular canine impaction.

and Kurol, 2000). In the current study, cone beam CT was used to categorize the impacted canines into palatal or labial positions (Figs. 2 and 3). Other imaging techniques to locate impacted canines include panoramic views of the jaws (Fig. 4).

5. Conclusion

The prevalence of canine impaction in a southwestern city of Saudi Arabia was 5.35%, with a female preponderance. The impaction occurred more frequently unilaterally on the left side than it did on the right side or on both sides. We also observed that palatal impacted canines were more common than labial impactions.

Declaration of Competing Interest

The authors declare that there is no conflict of interest.

References

Abdul Bagi Mustafa, A.B., 2014. Prevalence of impacted canine teeth in college of dentistry, King Khalid University – A Retrospective Study. Int. J. Health Sci. Res. 4 (12), 211–214.

Afify, A.R., Zawawi, K.H., 2012. The prevalence of dental anomalies in the Western region of Saudi Arabia. ISRN Dent. 2012, 837270.

Aktan, A.M., Kara, S., Akgünlü, F., Malkoç, S., 2010. The incidence of canine transmigration and tooth impaction in a Turkish subpopulation. Eur. J. Orthod. 32, 575–581.

Al-Homsi, H.K., Hajeer, M.Y., 2015. An evaluation of inter- and intraobserver reliability of cone-beam computed tomography- and two dimensional-based interpretations of maxillary canine impactions using a panel of orthodontically trained observers. J. Contemp. Dent. Pract. 16 (8), 648–656.

Al-Zoubi, H., Alharbi, A.A., Ferguson, D.J., Zafar, M.S., 2017. Frequency of impacted teeth and categorization of impacted canines: a retrospective radiographic study using orthopantomograms. Eur J Dent 11, 117–121.

Alhammadi, M.S., Asiri, H.A., Almashraqi, A.A., 2018. Incidence, severity and orthodontic treatment difficulty index of impacted canines in Saudi population. J. Clin. Exp. Dent. 10 (4), 327–334.

Alkadhi, O.H., Alfuraih, A.A., Ajwa, N.M., 2017. Prevalence of different impacted maxillary canine locations in a saudi population in Riyadh City. EC Dental Sci. 13, 261–265.

Alrwuili, M.R., Alanazi, Y.M., Alenzi, N.A., Latif, K., Aljabab, M.A., Sabsabi, M.M., 2016. Prevalece and localization of impacted canine among Al-Qurayyat orthodontic patients: A study conducted over 4 years. Pakistan Oral Dental J. 36 (1), 75–78.

Aydin, U., Yilmaz, H.H., Yildirim, D., 2004. Incidence of canine impaction and transmigration in a patient population. Dentomaxillofac Radiol. 33 (3), 164–169.

Becker, A., Chaushu, S., 2015. Etiology of maxillary canine impaction: a review. Am. J. Orthod Dentofacial Orthop. 148, 557–567.

Bedoya, M.M., Park, J.H., 2009. A review of the diagnosis and management of impacted maxillary canines. J. Am. Dent. Assoc. 140 (12), 1485–1493.

Bishara, S.E., 1992. Impacted maxillary canines: a review. American J. Orthodont. Dentofac. Orthoped. 101 (2), 159–171.

Chu, F.C., Li, T.K., Lui, V.K., Newsome, P.R., Chow, R.L., Cheung, L.K., 2003. Prevalence of impacted teeth and associated pathologies–a radiographic study of the Hong Kong Chinese population. Hong Kong Med J 9 (3), 158–163.

Cooke, J., Wang, H.L., 2006. Canine impactions: Incidence and management. Int. J. Periodontics Restorative Dent. 26, 483–491.

Ericson, S., Kurol, J., 2000. Resorption of incisors after ectopic eruption of maxillary canines: a CT study. Angle Orthodontist 70 (6), 415–423.

Fardi, A., Kondylidou-Sidira, A., Bachour, Z., Parisis, N., Tsirlis, A., 2011. Incidence of impacted and supernumerary teeth–a radiographic study in a North Greek population. Med. Oral Patol. Oral Cir. Bucal. 16 (1), 56–61.

Halıcıoğlu, K., Çörekçi, B., Irgın, C., 2012. Incidence of impacted teeth and transmigrated canines—A radiographic study in turkish dental patients. Clin. Res. Dental 36, 42–50.

Haralur, S.B., Al Shahrani, S., Alqahtani, F., Nusair, Y., Alshammari, O., Alshenqety, O., 2017. Incidence of impacted maxillary canine teeth in Saudi Arabian subpopulation at central Saudi Arabian region. Ann. Trop. Med. Public Health 10, 558–562.

Kifayatullah, J., Bangash, T.H., Ayub, A., Khan, D.B., 2015. Prevalance and patterns of impacted maxillary canine in a peshawer sample. Pak. Oral Dental J. 35 (1), 57–60.

Lindauer, S.J., Rubenstein, L.K., Hang, W.M., Andersen, W.C., Isaacson, R.J., 1992. Canine impaction identified early with panoramic rasdiographs. J. Am. Dent. Assoc. 123, 91–97.

Litsas, G., Acar, A., 2011. A review of early displaced maxillary canines: etiology, diagnosis and interceptive treatment. Open Dent J 5, 39–47.

Melha, S.B., Alturki, S., Aldawasri, G., Almeshari, N., Almeshari, S. K.A., 2017. Canine impaction among riyadh population: A single center experience. Int. J. Oral Health Sci. 7, 93–95.

Mustafa, A., 2014. Prevalence of impacted canine teeth in college of dentistry, King Khalid University – A retrospective study. Int. J. Health Sci. Res. 4, 211–214.

Patil, S., Maheshwari, S., 2014. Prevalence of impacted and supernumerary teeth in the North Indian population. J. Clin. Exp. Dent. 6, 116–120.

Patil, S.R., Gudipaneni, R., Kuraym Alenazi, K.K., Al-Zoubi, I.A., Rao, K.A., Ravi, J., Iqbal, A., 2017. Cone beam computed tomographic evaluation of impacted mesiodens and central incisor as sequelae of trauma: A short case report. Int. J. Health Allied. Sci. 6, 237–239.

Patil, S.R., Gudipaneni, R.K., Alam, F., Al-Zoubi, I.A., Arun, P.S., Alam, M.K., 2018. CBCT evaluation of the prevalence of impacted maxillary canines in a Saudi Arabian population: a preliminary study. Int. J. Human Health Sci. 2 (1), 31–34.

Peck, S., Peck, L., Kataja, M., 1994. The palatally displaced canine as a dental anomaly of genetic origin. Angle Orthod. 64, 249–256.

Pirinen, S., Arte, S., Apajalahti, S., 1996. Palatal displacement of canine is genetic and related to congenital absence of teeth. J. Dent. Res. 75, 1742–1746.

Prskalo, K., Zjaca, K., Skaric-Juric, T., Nikolic, I., Anic-Milosevic, S., Lauc, T., 2008. The prevalence of lateral incisor hypodontia and canine impaction in croatian population. Collegium Antropologicum 32, 1105–1109.

Sajnani, A.K., 2015. Permanent maxillary canines—review of eruption pattern and local etiological factors leading to impaction. J. Invest. Clin. Dentist. 6, 1–7.

Sajnani, A.K., King, N.M., 2014. Prevalence and characteristics of impacted maxillary canines in Southern Chinese children and adolescents. J. Invest. Clin. Dentist. 5, 38–44.

Sofoluwe, G.O., Schram, R., Ogunmekan, D.A., 1996. Principles and practice of public health in Africa 1996. Nigeria: University Press PLC.

Stecker, S.S., Beiraghi, S., Hodges, J.S., Peterson, V.S., Myers, S.L., 2007. Prevalence of dental anomalies in a South-East Asian population in the Minneapolis/Saint Paul metropolitan area. Northwest Dent 86, 25–28.

Stivaros, N., Mandall, N., 2000. Radiographic factors affecting the management of impacted upper permanent canines. J. Orthod. 27 (2), 169–1113.

Tassara, G., Lopez, L., Hanke, R., Tumanyan, S., Picon, F., 2015. Prevalence of impacted maxillary canines in Puerto Rican adolescents. Int. J. Health Sci. 3, 135–138.

Vastardis, H., 2000. The genetics of human tooth agenesis: New discoveries for understanding dental anomalies. Am. J. Orthod. Dentofacial. Orthop. 117, 650–656.

Zahrani, A.A., 1993. Impacted cuspids in a Saudi population: prevalence, etiology and complications. Egypt Dent. J. 39 (1), 367–374.