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Original research

RADIOGRAPHIC FEATURES AND TREATMENT STRATEGIES OF IMPACTED MAXILLARY CANINES

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ABSTRACT

Objective: Treatment of impacted maxillary canines is essential, both aesthetically and functionally. This study aims to define the radiographic features of maxillary impacted canines, evaluate treatment options, and to detect related pathologies.

Materials and Methods: In this retrospective study, orthopantomographs, treatment options, and demographic features of the patients were analyzed. Impacted maxillary canines were classified according to the study of Yamamoto *et al.* According to this classification, maxillary canines are evaluated under seven types according to the occlusal plane and their relative location to adjacent teeth. Moreover, the pathologies around impacted canines were detected via panoramic radiographies.

Results: 323 impacted maxillary canines of 270 patients were analyzed. Two hundred fifteen of these teeth (66.6%) belonged to females, while the rest 108 (33.4%) belonged to males. It was observed that impacted maxillary canines were bilateral in 53 patients and unilateral in 217 patients. In the classification based on direction and position of impacted maxillary canines, the highest rates was Type 2 (55.42%) which was followed by Type 4 (26.93%), Type 1 (12.38%), Type 7 (2.79%), Type 3 (1.86%) and Type 5 (0.62%), respectively. Twenty-eight patients with cystic lesion related to impacted maxillary canines were detected. Impacted maxillary canines concomitant with odontoma was detected in 4 patients. In 52 of the patients, it was detected that maxilla was edentulous except for the impacted canines, and the extractions of impacted canine teeth were due to prosthetic reasons. Thirty impacted maxillary canines of 24 patients (n=30, 9.28%) were placed buttons for orthodontic maintenance, while surgical tooth extraction was preferred as a treatment option in other patients.

Conclusions: Orthodontic, surgical treatments or combinations may be preferred depending on the impact level of the canine. Early diagnosis and correct orientation of the patient is essential for the success of the treatment.

Keywords: Impacted, maxilla, tooth, tooth extraction.

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INTRODUCTION

Description of impacted teeth comprises teeth that could not take its place on dental arch and impacted partially or wholly in bone or soft tissue.[1] Despite the differences observed among people, third molar teeth are the most impacted teeth in general, and they are followed by canine teeth.[2-4] The impact incidence of maxillary canines varies between 0.8% and 3.6%.[5] Impact incidence of mandibular canines is more rare than maxillary canines and it was reported that this incidence is 20 times lower than of maxillary canines.[6]

Despite some cases where an impacted tooth migrates from its development area to another distance, the tooth stays on the same side of the middle line in general. The rare phenomena in which the tooth passes the middle line is called as "tooth transmigration". Although various terminologies have been used to define this case, the "transmigration" term is widely used to define this phenomenon. Transmigration is more widely observed in mandibular canines than in maxillary canines.[7] Specific etiology of this anomaly has not been known yet; however, causal factors may be traumatic factors, genetic factors, long eruption line of canines, the early loss of deciduous teeth, incompatibility between tooth sizes, inadequate length of dental arch and odontomas.[8, 9]

Treatment of impacted teeth is essential, both aesthetically and functionally.[10] Among the treatment options for impacted canines, surgical, and orthodontic treatment options may be evaluated separately or as a combination. In the surgical option, the spontaneous eruption of the tooth may be planned by opening the eruption line. Spontaneus eruption of the tooth may be provided by removing the odontoma or similar pathologies lying on the eruption line. The impacted tooth may be drawn to the dental arch by placing a button on the crown of an impacted tooth and applying orthodontic force. In cases where orthodontic treatment cannot be applied, tooth extraction is evaluated as a general treatment option.[11] In cases where the impacted canines cannot be treated, some phenomena as transmigration between adjacent teeth, loss of vitality in adjacent teeth, contraction in dental arch, cystic pathologies based on dental follicles, ankylosis, internal and external resorption, recurrent infections, pain and combination of these may be observed.[12, 13]

This study aims to define the radiographic features of maxillary impacted canines, evaluate treatment options, and detecting related pathologies.

MATERIAL AND METHODS

Ethical committee approval was obtained from Ethical Committee of Clinical Researches of Tokat Gaziosmanpaşa University (Project no: 18-KAEK-285). In this retrospective study, orthopantomographs, treatment options, and demographic features of the 270 patients who had admitted to the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry in Tokat Gaziosmanpaşa University due to impacted maxillary canine between March 2013 and January 2019 were analyzed. The study includes the patients above 13 years of age who had no developmental or systemic diseases and whose impacted maxillary canine was placed an extraction indication or who underwent a button application for orthodontic treatment after clinical and radiologic treatment in Department of Oral and Maxillofacial Surgery. The patients who have a genetic disorder causing developmental and eruption problems in the development and eruption of teeth and whose demographic features could not be accessed were excluded from the study. Impacted maxillary canines were classified according to the study of Yamamoto *et al.*[14] According to this classification, maxillary canines are evaluated under seven types according to the occlusal plane and their relative location to adjacent teeth (Figure 1).

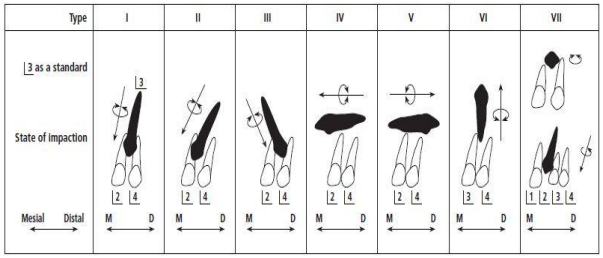

Figure 1. According to Yamamoto *et al.*[14] classification of impacted maxillary canines

Moreover, the pathologies around impacted canines were detected via panoramic radiographies.

SPSS 19 (IBM SPSS Statistics 19, SPSS inc., an IBM Co., Somers, NY) program was used in the statistical analysis of study data Variables were recorded and analyzed by descriptive statistics.

RESULTS

In this study, 323 impacted maxillary canines of 270 patients (173 females and 97 males) were analyzed. Two hundred fifteen of these teeth (66.6%) belonged to females, while the rest 108 (33.4%) belonged to males. The age of the patients varied between 13-77 (average: 38.74 ± 18.12). It was observed that impacted maxillary canines were bilateral in 53 patients (42 female, 11 male) and unilateral in 217 patients. In the classification based on direction and position of impacted maxillary canines, the highest rates was Type 2 (55.42%) which was followed by Type 4 (26.93%), Type 1 (12.38%), Type 7 (2.79%), Type 3 (1.86%) and Type 5 (0.62%) respectively. There were no cases classified in Type 6. Impacted maxillary canines were mostly localized at left side (n=171, % 52.94) (Table-1).

Table1. Distribution of impacted maxillary canines by gender and the type of impaction.

Type	**Localization**		**Gender**		**Total**	
	Right (#13)	**Left (#23)**	**Female**	**Male**	**n**	**%**
Type 1	25	15	28	12	40	12.38
Type 2	83	96	118	61	179	55.42
Type 3	4	2	5	1	6	1.86
Type 4	36	51	56	31	87	26.93
Type 5	0	2	2	0	2	0.62
Type 6	0	0	0	0	0	0
Type 7	4	5	6	3	9	2.79
Total	152 (47.06 %)	171 (52.94%)	215 (66.56%)	108 (33.44%)	323	100

The age distribution of patients showed that a significant number of patients with impacted maxillary canines are between 13-20 of ages (Table-2).

Table 2. Age distribution of patients with impacted maxillary canines.

	Number of impacted teeth	
Age (years)	**n**	**%**
13-20	94	29.1
21-30	45	13.93
31-40	33	10.22
41-50	45	13.93
51-60	63	19.51
>60	43	13.31
Total	323	100

Twenty-eight patients (10.4%) with cystic lesion related to impacted maxillary canines were detected (Figure-2). Impacted maxillary canines concomitant with odontoma was detected in 4 patients (1.5%) (Figure-3). In 52 of the patients (19.3%), it was detected that maxilla was edentulous except for the impacted canines, and the extractions of impacted canine teeth were due to prosthetic reasons. Thirty impacted maxillary canines of 24 patients (n=30, 9.28%) were placed buttons for orthodontic

maintenance, while surgical tooth extraction was preferred as a treatment option in other patients.

Figure 2. Impacted canine tooth associated with cystic lesion

Figure 3. Impacted canine tooth associated with odontoma

DISCUSSION

Maxillary canines play an important role in both aesthetically and functionally. Although the bilateral impact of maxillary canine is a frequent phenomenon, unilateral ectopic eruptions are more frequent.[14,15] In this study, the unilateral impact was more frequently observed. When the localization of impacted maxillary canines are analyzed, it is observed that the impacted maxillary canines are frequently located on the left side.[1,16] Despite the lack of any scientific evidence to show the high prevalence of left-sided impacted maxillary canines, it has been accepted as a general malformation. In this study, too, the left-sided impacted maxillary canine was more frequently observed.

Yamamoto *et al.*[14] were reported that impacted canines were more frequently observed in females. Similarly, in this study, 215 of 270 impacted canines were observed in females. Despite the lack of any literature about jawbone sizes of people with an impacted tooth, we believe that gender differences as the fact that females have smaller cranium, maxilla, and mandible than of males, may have an effect on this situation. Al-Zoubi*et al*[1] reported that Type 2 was more frequent among other types of impacted maxillary canines. However, in the study of Yamamoto *et al.*[14], Type 1 of impact is more frequent. In this study, Type 2 was the most frequently observed type of impact.

Patients are generally not aware of their impacted canines. They do not consult dentists unless they have problems like pain or swelling. The impacted tooth or persistent deciduous tooth is generally explored during the examination and confirmed via radiographies. Clinical examination includes inspection and palpation.[17] From the age of 8 years, the alveolar process on the distal side of the lateral incisor can palpate the buccal surface and open the position of the maxillary canine teeth, and this was offered as a diagnostic tool by Kettle.[18] Radiographic evaluation of jaws is an important diagnostic tool in the diagnosis and localization of impacted teeth. A radiograph is required for 3D (vertical, mesiodistal, and buccopalatal) imaging of the impacted canines, observing the relations with the middle line and neighboring teeth, and evaluating any resorption.[19] In the evaluation of impacted canine; Panoramic, periapical, cephalometric, lateral skull and maxillary occlusal, CT, and CBCT are widely used.[17] CBCT is the most sensitive radiographic localization method, which maximizes diagnostic efficiency and reduces radiation exposure. Total radiation is about 20% of conventional CTs.[20,21] CBCT eliminates problems such as magnification and superimposition in conventional radiographs. In orthodontics and pedodontics, underestimating the degree of resorption in maxillary canine is a common problem. CBCT increases resorption detection by 50%.[22] For these reasons, the use of three-dimensional imaging methods for the maxillofacial region has become more common than traditional radiographs.[23]

The demands of the patient should also be taken into account while deciding on treatment. Long-term follow of a tooth, extraction of the tooth, re-drawn of the tooth to its position on the dental arch by orthodontic movement, autotransplantation of the tooth, simultaneous dental implant placement after the extraction of the impacted tooth may be evaluated as treatment options for impacted canines.[24,25] Cyst formation

between possible sequels of impacted canines, internal resorption of an impacted tooth, external resorption of impacted or adjacent teeth, ankylosis, infection, and migration of neighboring teeth may also be included.[26] For this study, the surgical extraction reasons for impacted teeth may be evaluated as pathological formations as cyst and tumor-related to the impacted tooth, malposition of especially lateral teeth, and prosthetic reasons in edentulous patients.

Besides traditional surgical applications, Bensaha *et al*.[27] also suppose ultrasonic surgery for the treatment of impacted canines. The main advantages of ultrasonic surgery are facing no bleeding or no tissue necrosis and the chance of placing the brackets during the same visit. Baccetti *et al*.[28] suggest transpalatal arch therapy to be used as a treatment for impacted maxillary canine teeth. This option helps to control the movement of maxillary first molar teeth. Thus, the location of permanent maxillary canines is preserved, and spontaneous eruption can be induced. Moreover, mini-screws can be used when extrusion of impacted maxillary canine teeth is needed. Roth *et al*.[29] successfully performed a case where the maxillary canine was extruded via a mini-screw.

CONCLUSIONS

Impacted maxillary canine teeth are usually diagnosed using panoramic imaging or cone-beam computed tomography. Cone-beam computed tomography is one of the most accurate diagnostic methods to identify the localization of affected maxillary canines. Orthodontic, surgical treatments or combinations may be preferred depending on the impact level of the canine. Early diagnosis and correct orientation of the patient is important for the success of the treatment.

Gömülü Maksillar Kanin Dişlerin Radyografik Özellikleri ve Tedavi Stratejileri

ÖZ

Amaç: *Gömülü kanin dişlerinin tedavisi estetik ve fonksiyon açısından önem taşımaktadır. Bu çalışmanın amacı; maksillar gömülü kanin dişlerin, radyografik özelliklerini belirlemek, tedavi seçeneklerini değerlendirmek ve ilgili patolojileri tespit etmektir.* ***Gereç ve Yöntem:*** *Bu retrospektif çalışmada,hastaların ortopantomograf radyografileri, tedavi seçenekleri ve demografik özellikleri analiz edildi. Gömülü maksillar kaninler; Yamamoto ve arkadaşları tarafından yapılan sınıflamaya göre gruplara ayrıldı. Bu sınıflamaya göre maksillar kaninler oklüzal düzleme ve komşu dişlere konumlarına göre 7 tipe ayrılmıştır. Ayrıca; panaromik radyografilerden gömülü kanin dişler etrafındaki patolojiler tespit edildi.* ***Bulgular:*** *Çalışmada, 270 hastaya (173 kadın, 97 erkek) ait 323 gömülü maksillar kanin diş analiz edildi. Bu dişlerin 215'i (%66,6) kadınlarda, 108'si (%33,4) erkeklerde görüldü. Maksillar gömülü kanin dişler 53 hastada (42 kadın, 11 erkek) bilateral, 217 hastada unilateral olarak tespit edildi. Maksillar kaninlerin yönü ve pozisyonuna göre yapılan sınıflamada en yüksek oran Tip 2 (%55,42)'de onu takiben sırasıyla, Tip 4 (%26,93), Tip 1 (%12,38), Tip 7 (%2,79), Tip 3 (%1,86), Tip 5 (%0,62) idi. 28 hastada gömülü maksillar kanin dişlerle ilişkili kistik lezyon tespit edildi. 4 hastada ise gömülü maksillar kanin dişe odontoma eşlik ediyordu. Hastaların 52'sinde gömülü kanin dişler haricinde maksillanın total dişsiz olduğu ve protetik amaçlarla çekim gerçekleştirildiği belirlendi. 24 hastada 30 gömülü maksillar kanin dişe ortodontik olarak sürdürülme amacıyla buton yerleştirildi, diğer hastalarda ise tercih edilen tedavi yöntemi cerrahi çekimdi.* ***Sonuçlar:*** *Kanin dişin gömülülük derecesine bağlı olarak; tedavide ortodontik, cerrahi ya da kombinasyonları tercih edilebilir. Tedavinin başarısında erken tanı ve hastanın doğru yönlendirilmesi önemlidir.* ***Anahtar Kelimeler:*** *Gömülü, maksilla, diş, diş çekimi.*

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