

RESEARCH

An evaluation of mesiodentes: A retrospective study with cone-beam computed tomography

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ABSTRACT

An evaluation of mesiodentes: A retrospective study with cone-beam computed tomography

Background: The mesiodens, located in the palatal midline between the two maxillary central incisors, is the most common type of supernumerary tooth. The aim of this study was to evaluate the distribution of mesiodentes according to shape, position, and complications using cone-beam computed tomography (CBCT) images.

Methods: This study was carried out retrospectively on the CBCT images of cases. The following data were recorded: age, gender, number, shape (conical, incisor, tuberculate, round), size (less than 8 mm, 8-16 mm, and over 16 mm), direction (vertical, semi-vertical, horizontal, inverted), position (impacted or erupted) of the mesiodens, any pathologies or complications (delayed eruption of adjacent tooth, root resorption, cystic formation, diastema, displacement of adjacent tooth) and relation with neighboring anatomical structures (nasal cavity, nasopalatine canal).

Results: The age distribution of the patients ranged from 7 to 61 years; mean 16.8 ± 14.2 years. In total, 65 mesiodens were seen in 50 patients. The results showed that; mesiodentes were observed in the form of an incisor tooth (38.5%) mostly, followed conical shape (33.8%). A majority of the mesiodentes were in vertical direction (38.5%) and impacted (92.3%) in the CBCT images. Thirty-six patients (72%) had one mesiodens, 13 patients (26%) had two, and one patient (2%) had three mesiodentes. The most common complication was delayed eruption (29.2%). No complications were found in 49.2% of the cases. Sixteen cases (24.1%) were associated with the nasal cavity, while 43 cases (66.1%) were associated with the nasopalatine canal.

Conclusion: Radiographic examination, especially with CBCT images, is important for an exact diagnosis, evaluation, and management of mesiodens.

KEYWORDS

Cone-beam computed tomography, mesiodens; supernumerary teeth

ÖZ

Meziodenslerin değerlendirilmesi: Konik ışınli bilgisayarli tomografi ile retrospektif bir çalıřma

Amaç: Meziodens, süpernümerer dişlerin en yaygın türüdür ve iki maksiller orta kesici diş arasındaki palatal orta hatta yerleşmiştir. Bu çalışmanın amacı, meziodenslerin karakteristik özelliklerini konik ışınli bilgisayarli tomografi (KIBT) görüntüleri ile değerlendirmektir.

Gereç ve Yöntemler: Bu çalışma, olguların KIBT görüntülerinin retrospektif olarak incelenmesi ile yapıldı. Belirtilen veriler kaydedildi: Yaş, cinsiyet, meziodenslerin sayısı, şekli (konik, kesici diş, tüberküllü, yuvarlak), boyutu (8 mm'den küçük, 8-16 mm arasında ve 16 mm'den büyük), yönü (vertikal, semi-vertikal, horizontal, ters), pozisyonu (gömülü ya da sürmüş), herhangi bir patoloji veya komplikasyon oluşturup oluşturumaması (komşu dişin sürmesinde gecikme, kök rezorpsiyonu, kistik oluşum, diastema, komşu dişin yer deęiřtirmesi) ve komşu anatomik yapılarla (burun boşluğu, nasopalatin kanal) iliřkisi.

Bulgular: Hastaların yaş dağılımı 7 ila 61 yıl arasında olup ortalama yaş 16.8 ± 14.2 'dir. Toplamda 50 hastada 65 adet meziodens görüldü. Elde edilen sonuçlara göre; meziodenslerin çoğunlukla kesici diş (% 38.5) ve konik şekilli (% 33.8) olduęu tespit edildi. Meziodenslerin en sık görülen yönünün vertikal yön (% 38.5) olduęu ve büyük çoğunluğunun gömülü (% 92.3) kaldıęı belirlendi. Otuz altı hastada (% 72) bir meziodens, 13 hastada (% 26) iki tane, bir vakada ise üç meziodens (% 2) vardı. En sık görülen komplikasyon sürme gecikmesi (% 29.2) idi. Olguların % 49.2'sinde herhangi bir komplikasyon görülmeydi. On altı olgu (% 24.1) burun boşluğu, 43 olguda (% 66.1) ise nazopalatin kanalla iliřkiliydi.

Sonuç: Radyografik inceleme, özellikle KIBT görüntüleri, meziodenslerin kesin tanısı, deęerlendirmesi ve tedavisi için önemlidir.

ANAHTAR KELİMELEER

Konik ışını bilgisayarli tomografi, meziodens, süpernümerer dişler

Supernumerary teeth are a development anomaly characterized by an excess number of teeth.¹ Supernumerary teeth that present among the maxillary central teeth are called mesiodens.² Although several theories have been presented to

explain the development of supernumerary teeth, the etiology has not been clearly understood. The most widely accepted theory is that mesiodentes develop as a result of horizontal proliferation or hyperactivity of dental lamina.³ Mesiodentes are the most

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common type of supernumerary teeth, and they are more common in males than in females.⁴ Mesiodentes are usually seen as asymptomatic impacted, with a conical crown and a single root.^{5,6} Frequently, they are in an inverted position in which the crown is located towards the nasal cavity and the root is located towards the oral cavity.⁷ One or two mesiodentes frequently occur while three or more mesiodentes are rarely found.^{4,8}

In general, an asymptomatic impacted mesiodens is detected incidentally during a routine radiographic examination; only 25% of maxillary anterior supernumerary teeth erupt.^{1,4} However, mesiodentes may cause complications in the anterior maxilla, such as impaction of adjacent teeth, delayed eruption of the permanent central teeth, ectopic eruption, median diastema, displacement of permanent teeth, root resorptions, and dentigerous cysts.⁹⁻¹¹ Therefore, early diagnosis and treatment may be helpful in preventing such complications. However, the optimal age for extraction of mesiodentes is a controversial issue because of the difficulty with the co-operation of pediatric patients, occlusal complications, and the technical difficulty of extraction.¹²

Although the panoramic radiograph is an important imaging method for diagnosis, it provides only two-dimensional information. Occlusal and periapical radiographs are necessary to assess the maxillary anterior region because panoramic radiographs are not detailed enough to determine the exact position of the mesiodentes.¹³ Cone beam computed tomography (CBCT) is a helpful diagnostic tool to identify the accurate location and the shape of mesiodentes without superimpositions.¹²

The aim of this study was to evaluate the characteristics of the mesiodentes revealed via CBCT images.

MATERIALS AND METHODS

This retrospective study was approved by the Ethical Review Board of Gazi University (No: 2017-129). Informed consent was routinely obtained from all patients before CBCT examinations. Patients who admitted to our clinic between 2013 and 2016, with the request of mesiodentes were included in this study. The images were evaluated retrospectively in Department of Dentomaxillofacial Radiology, Faculty of Dentistry, Gazi University. Patients who underwent orthodontic treatment or premaxillary surgery and patients with a history of traumatic tooth loss were not included in the study.

CBCT images were obtained using a Promax 3D unit (Planmeca Oy, Helsinki, Finland), operating at 90 kVp, 9-14 mA, with a 0.2 or 0.4 mm voxel size, exposure time of 6 seconds and a field of view of 8x5 cm. The imaging was performed under routine radiation protection rules. The images were examined by two experienced oral radiologists (GA, MO). The CBCT images were analyzed, and lengths of the mesiodentes were measured with the software of the CBCT device (Romexis Viewer 2.7.0) on a 24-inch Nvidia Quadro FX 380 screen with 1280x1024 resolution in a quiet room with subdued ambient lighting. The axial, sagittal, and cross-sectional slices (thickness: 1 mm) of CBCT images were used. All observers were blinded to the gender and age of the patients. Following radiographical examination, demographic variables including age and sex were recorded for each patient. The characteristics of the mesiodentes including number, shape (conical, incisor, tuberculate, round), size (less than 8 mm, 8-16 mm, and over 16 mm), direction (vertical, semi-vertical, horizontal, inverted), position (impacted or erupted), any pathologies or complications (delayed eruption of adjacent tooth, root resorption, cystic formation, diastema, displacement of adjacent tooth), and relation with the neighboring anatomical structures (nasal cavity, nasopalatine canal) were examined. Descriptive analyses were used to evaluate the data.

RESULTS

Age and gender

In the present study, the age distribution of the patients ranged from 7 to 61 years, mean 16.8 ± 14.2 years. A total of 65 mesiodentes were found in 50 patients. Forty-two patients were in the pediatric group (younger than age 16) while eight of the patients were adults. Regarding gender, mesiodentes were more common in males (n: 37, 74%) than in females (n: 13, 26%) (Table 1). Most of the mesiodentes were observed in patients between 9 and 11 years of age (n: 18, 36%).

Table 1.

The frequency of the patients who had mesiodentes, according to gender

Gender	n	Percentage (%)
Male	37	74
Female	13	26
Total	50	100

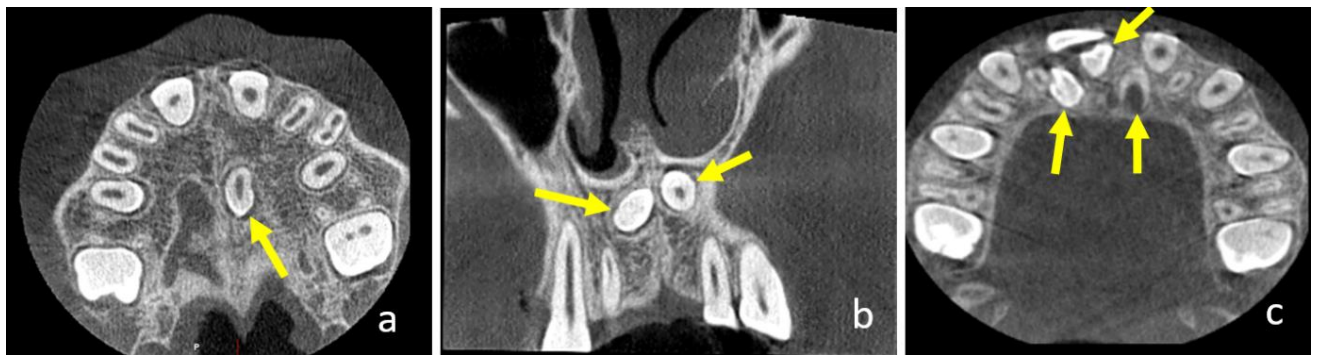


Figure 1.

Number of the mesiodentes (arrows) in CBCT images; one mesiodens (a), double mesiodentes (b), triple mesiodentes (c)

Number, shape, size, direction, and position

Thirty-six patients (72%) had one mesiodens, 13 patients (26%) had two midline bilateral, and only one case (2%) had three mesiodentes (Figure 1).

Mesiodentes with conical, incisor, round, and tuberculate shapes were observed in our study. Most of them were found in the form of incisor teeth (n: 25, 38.5%) followed by conical shape (33.8%), round shape (16.9%), and tuberculate shape (10.8%) (Figure 2).

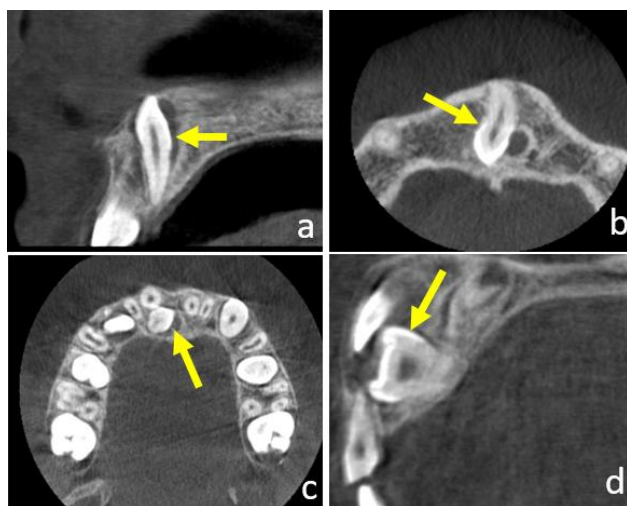


Figure 2.

Shapes of mesiodens in CBCT images; incisor shape (a), conical shape (b), round shape (c), tuberculate shape (d)

The size of mesiodentes were classified as less than 8 mm, 8-16 mm, and over 16 mm. Most of them were 8-16 mm (84.6%), followed by less than 8 mm (9.2%), and more than 16 mm (7.2%).

Considering direction, 25 teeth (38.5%) were in vertical position, 21 teeth (32.3%) were inverted, 15 teeth (23.1%) were in horizontal position, and 4 teeth (6.1%) were in semi-vertical position (Figure 3).

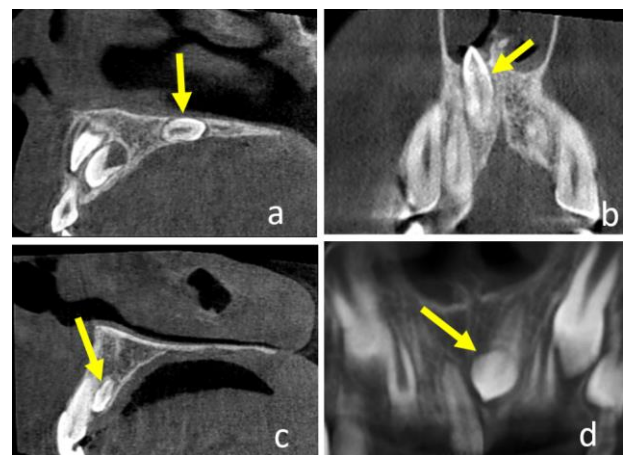


Figure 3.

Directions of the mesiodentes (arrows) in CBCT images; horizontal position (a), inverted position (b), vertical position (c), and semi-vertical position (d)

In terms of position, most of the mesiodentes (n: 60, 92.3%) were impacted (Table 2).

Table 2.
Radiographic characteristics of the mesiodentes

The characteristics of the mesiodentes		n	Percentage (%)
Number	One	36	0.72
	Two	13	0.26
	Three	1	0.02
Shape	Incisor	25	0.385
	Conical	22	0.338
	Round	11	0.169
	Tuberculate	7	0.108
Direction	Vertical	25	0.385
	Inverted	21	0.323
	Horizontal	15	0.231
	Semi-vertical	4	0.061
Position	Impacted	60	0.923
	Erupted	5	0.077

Complications

The most common complication was delayed eruption (n: 19, 29.2%) (Figure 4). Diastema was observed in 12 cases (18.5%), followed by root resorption of the adjacent tooth in five cases (7.7%), and cyst formation in four cases (6.2%). No complications were found in 49.2% of the cases (Table 3).

Table 3.
Complications caused by the mesiodentes

		Number of the cases	Percentage* (%)
Complications	Diastema	12	18.5%
	Delayed eruption	19	29.2%
	Root resorption	5	7.7%
	Cyst formation	4	6.2%
	None	32	49.2%

Relation with the anatomic structures

When we evaluated the relationship between anatomic structures and mesiodentes; 16 mesiodentes were associated with the nasal cavity (24.6%) while 43 cases (66.1%) were associated with the nasopalatine canal (Table 4) (Figure 5).

Table 4.
Mesiodentes' relations with the surrounding anatomical structures

	n	Percentage (%)
Eruption to the nasal cavity	16	24.6%
Relation with the nasopalatine canal	43	66.1%

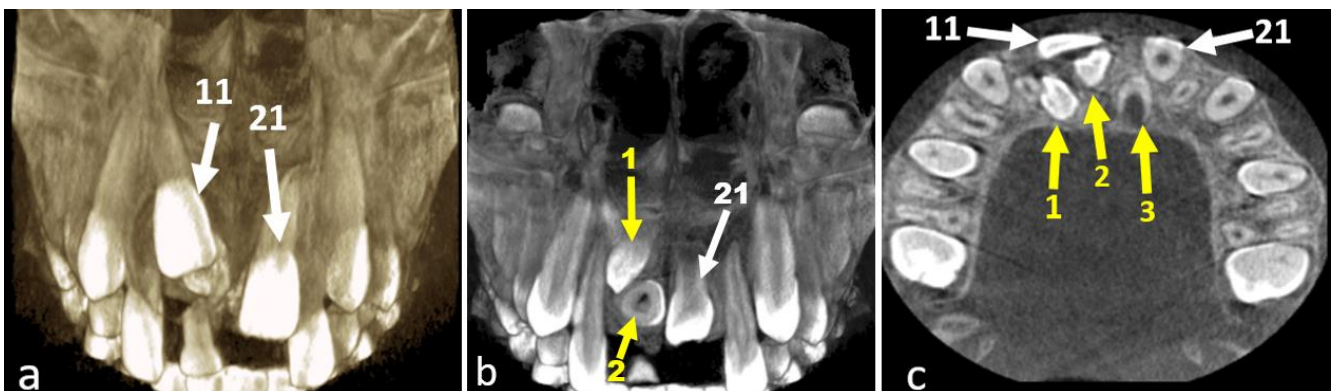


Figure 4.
Impacted triple mesiodentes and failure of eruption of maxillary incisors can be seen in 3D reconstruction images (a, b) and axial slice (c) of CBCT in an 9-year-old boy. Yellow arrows show the three mesiodentes, white arrows show right maxillary central incisor (11) and left maxillary central incisor (21)

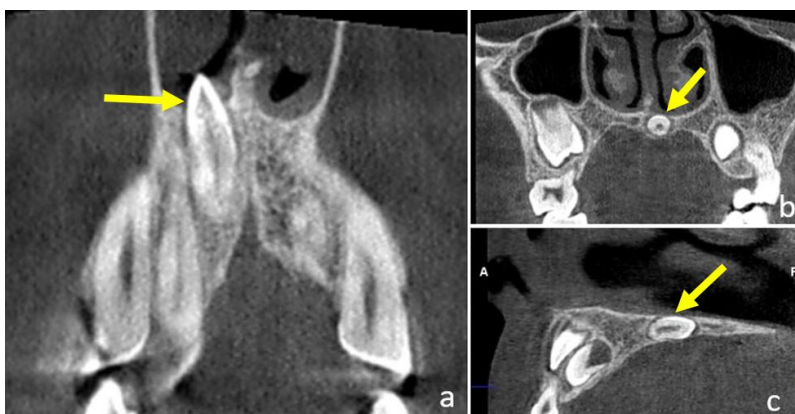


Figure 5.

Ectopic eruption of a mesiodens to the nasal cavity (a); another mesiodens associated with the nasal cavity (b, c)

DISCUSSION

Panoramic radiographs are used for the diagnosis of mesiodentes, but they may be inadequate in the anterior region because of the superimposition of cervical spine and being outside the focal trough.^{14,15} CBCT provides three dimensional images for mesiodentes. This radiographic technique is easier, cheaper, and it has less radiation dose than medical computed tomography.¹⁴ Also, CBCT would give us valuable information about the position, direction, and morphology of the mesiodentes; and their relationship with other structures.¹² Panoramic radiographic images were used in most of the studies.^{9,16,17} To best of our knowledge, mesiodentes have been evaluated by CBCT in only a few studies.^{12,13,18,19} For this reason, this study may be important in terms of filling in the gaps in information in the literature.

In the previous studies, mesiodentes were seen more frequently in males than females, the incidence in males ranging from 64.1% to 82.8%.^{9,13,16,19-22} In line with these studies, the male patient rate in our study was 74%.

In previous studies, mean age for the mesiodentes was variable according to the sample group. Only pediatric patients were evaluated in some studies. Kim et al¹³ evaluated pediatric patients who had mesiodens, and they found the mean age of the patients to be 6.8 years. As in our study, Asaumi et al⁹ investigated the patients between 3-84 ages, and they found the mean age to be 16.7 years. In line with that study, the ages of our patients ranged from 7 to 61, and mean age was found to be 16.3 years. However, Lee et al¹⁸ also evaluated both pediatric and adult patients, and they found the mean age to be 8.4 years.

Mesiodentes were mostly single instances. The rate of single mesiodentes were between 70.1% and 81.3% in the older studies while the double supernumerary teeth rates were between 16.6% and 29.6%.^{9,16-18,20,23} In the previous studies, only a few patients had three or four mesiodentes. The prevalence of three mesiodentes was found to be 0.3% and 1% while the rate of four mesiodentes

was 1%.^{9,18,20} Our results were compatible with other studies.

The shape of mesiodentes were classified in terms of form as conical, round, tuberculated, incisor-like, premolar-like, peg shaped, odontoma shaped, and atypical form.^{6,13,18} To the best of our knowledge, the most common type in all previous reports was the conical form, and the rate of occurrence of that shape was between 59.6% and 86.4%.^{6,13,16,20,21,23,24} However, in our study, the rate of incisor-like mesiodentes were 38.5%, followed by the conical type (33.8%), the round type (16.9%), and the tuberculate type (10.8%). The reason for this discrepancy may result from different classifications or different view of two dimensional images in the previous reports.

The direction of the mesiodentes were classified as inverted, vertical, semi-vertical and horizontal.^{6,9,16} The most common directions of the mesiodentes were vertical in some studies^{6,16,19-21,23,25} and inverted in some studies.^{9,13,18,26} According to our results, mesiodentes were mostly seen in vertical direction (38.5%) followed by inverted (32.3%) and horizontal (23.1%) directions. These rates were in line with the study by Yildizer Keris et al.¹⁹

Mesiodentes are usually impacted in the jawbone; only a very small portion of them actually erupt. The impacted or asymptomatic cases are often found incidentally during routine radiological examinations. The impaction status of the mesiodentes were found as mostly impacted (between 56% and 78.8%) in previous reports.^{16,21,23} At a higher rate than in other studies, 92.3% of the supernumerary teeth in our study were impacted.

Mesiodentes may cause some complications such as primary teeth retention, inhibition of eruption of both dentition, root resorption or dilaceration, pulp necrosis, axial rotation, diastema, loss of tooth vitality, and formation of cysts.^{27,28} Also, they are one of the causes of aesthetic problems in the

anterior region.²⁹ Additionally, it has been stated that mesiodentes may be a risk factor in the treatment of dental trauma.^{27,30} Most of the studies mentioned the prevalence of mesiodentes.^{23,16} The number of studies related to the characteristics/complications of mesiodentes were less.^{9,16,20}

Nearly half of the mesiodentes showed no complications in the previous studies.^{9,18,20,25} Diastema and delayed eruption were the most prevalent complications.^{2,13,18,25} The rate of diastema was between 10% and 33.3% while delayed eruption was between 6% and 41.7% of the teeth.^{9,13,16-18,20,25} Our results for these two parameters were compatible with previous reports. With the help of CBCT, we also evaluated the relationship between mesiodentes and anatomical structures. Two thirds of the supernumerary teeth were related to the nasopalatine canal while a quarter of the mesiodentes erupted into the nasal cavity. In the study by Yildizer Keris et al¹⁹, it was stated that 12.5% of the mesiodentes had a close relationship with the floor of the nasal cavity.

Clinical management of mesiodentes is a controversial issue both in terms of being surgically removed and followed up radiologically. There are two approaches for surgically removing of mesiodens: early extraction and late extraction (with regards to the root formation period of permanent incisor teeth).^{21,27,31} Some authors suggest that mesiodens should be extracted early in the course of premature dentition to better align the teeth and reduce the rate of the need orthodontic treatment.²⁸ However, periodic follow-up is also recommended to prevent the mesiodens causing any complications.^{21,31} The use of CBCT prior to the surgical removal of teeth has been reported to reduce the risk of damage to neighboring tissues.¹⁴

CONCLUSION

According to our results, the majority of the mesiodentes were impacted, in vertical position, and in the form of incisor teeth. Two thirds of the cases were associated with the nasopalatine canal. CBCT evaluation is recommended for identifying the location and number of mesiodentes. This imaging method is also valuable for better surgical or orthodontic planning because of the reduced risk of damage to surrounding anatomical structures.

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