

Evaluation of Prevalence and Positions of Mesiodens Using Cone-Beam Computed Tomography

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ABSTRACT

Objectives: The aim of this retrospective study is to investigate the prevalence, three-dimensional positions and supplementary findings of the presence of a mesiodens by using cone-beam computed tomography.

Material and Methods: A total of 5000 cone-beam computed tomography (CBCT) scans, taken between December 2015 and March 2018, from the archive of Istanbul University Faculty of Dentistry Department of Oral and Maxillofacial Radiology, were screened. In sum, 2003 CBCT scans fulfilled inclusion criteria in this study. In addition to number of mesiodens, age and sex of the patients, shape, eruption status and direction, findings of the presence of a mesiodens were also recorded. Mesiodentes were classified according to their positions in frontal, sagittal and axial planes.

Results: In this study, the prevalence of mesiodens was found 5.04% and to be more frequent in males than in females with the ratio of 1.9 : 1. One hundred thirty maxillary mesiodentes were detected in 101 cases out of 2003 CBCT scans. In 77 cases (76.2%), single mesiodens; in 19 cases (18.8%), two mesiodentes; and in 5 cases (4.9%), three mesiodentes were found. According to our classification, mesiodentes were mostly found in between midlines of central incisors (both the crown and root of mesiodens) in frontal plane, impacted and in contact with central incisors in sagittal plane, anterior to nasopalatine canal and in contact with nasopalatine canal in axial plane.

Conclusions: Cone-beam computed tomography provides more detailed information about position, neighbouring anatomic structures, and local findings of the presence of mesiodentes in multiplanar sections.

Keywords: cone-beam computed tomography; incisor; prevalence; supernumerary tooth; three-dimensional imaging.

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INTRODUCTION

Supernumerary tooth is the extra tooth or tooth-like structure in addition to 20 deciduous and 32 permanent teeth [1]. The aetiology of these extra teeth is still unclear. Various theories have been suggested about the aetiology of supernumerary teeth including dichotomy of tooth bud, hyperactivity of the dental lamina and a combination of genetic and environmental factors [2-4].

Mesiodens is the supernumerary tooth found in between the midlines of maxillary central teeth [2,5]. There may be single mesiodens or there may be multiple [2-4]. In the literature, the prevalence of the mesiodens were reported between 0.1 - 1.9% [2,5-7]. They account for 80% of all supernumerary teeth [8]. Mesiodens can be classified as conical, supplemental, tuberculate, molariform/multi-lobed depending on their morphology [5,6,9-12]. Besides being non-symptomatic, mesiodens can lead to crowding, delayed or prevented eruption of central incisors, midline diastema, root resorption, axial rotation and cyst formation [1,6,13,14].

In the previous studies, panoramic and conventional radiographs have been used for diagnosis, orthodontic and surgical management of mesiodens. However, in some cases, they do not provide the accurate information about the position of mesiodens. Cone-beam computed tomography (CBCT) provides three-dimensional imaging of the position of mesiodens and its contact with adjacent teeth and other anatomic structures like nasal cavity and nasopalatine canal. The purpose of this study is to investigate mesiodens prevalence using cone-beam computed tomography. Age and sex distribution, eruption status and direction, shape, complications, multiplanar positions of mesiodentes were also recorded.

MATERIAL AND METHODS

This study was conducted according to the principles of the Declaration of Helsinki and approved by the Ethics Committee of Istanbul University Faculty of Dentistry (Ref. 2018/30).

This retrospective study included 5000 CBCT scans of the patients who were referred to Istanbul University Faculty of Dentistry, Department of Oral and Maxillofacial Radiology between December 2015 and March 2018 for different reasons such as impacted and supernumerary teeth, implant planning or preoperative evaluation, presence of cyst or tumour in dentomaxillofacial region etc. All CBCT scans were

taken with the CBCT device Soredex SCANORA®3Dx (Tuusula, Finland), which has changeable field of view modes according to referred complaint. CBCT scans were evaluated with 0.2 mm slice thickness by using the computer program Ondemand 3D Project Viewer Cybermed Inc. (California, USA) on the monitor (Dell 24 UltraSharp U2415) in dim-light room.

Out of the 5000 CBCT scans, 2003 scans fulfilled our inclusion criteria. The rest CBCT scans were excluded due to: inefficient view of anterior maxilla and floor of nasal cavity; low quality scans; history of trauma, tooth extraction and surgical operation in anterior maxilla; cleft lip/palate and other associated conditions (syndromes) including Williams syndrome, Apert syndrome, Goldenhar syndrome, Hallerman-Streiff syndrome, Carpenter syndrome, Papillon-Lefèvre syndrome fibrous dysplasia, amelogenesis imperfecta, cleidocranial dysplasia, pycnodysostosis, cherubism.

In the present study, the presence of extra tooth or tooth-like structure in the area between the long axis of two maxillary central incisors was considered as mesiodens. Age and sex of the patients, number of mesiodens, shape, eruption status (impacted or partially/fully erupted), eruption direction, findings of the presence of a mesiodens and other abnormalities of mesiodentes, were recorded. According to eruption direction, we classified mesiodentes into three groups; vertical, inverted, and horizontal (mesiodistal and labiopalatal direction).

The shapes of mesiodentes were categorized into four groups: conical, supplemental, molariform and amorph, those who cannot be classified in former three groups. Mesiodentes were also evaluated according to the findings of their presence such as midline diastema, delayed or prevented eruption, rotation and inclination, hyperplastic dental follicle or cyst and root resorption.

In order to minimize variability, 3 observers (an oral and dentomaxillofacial radiologist, oral and dentomaxillofacial radiology research assistant and a dentist) examined frontal, sagittal, axial and cross-sectional CBCT scans, individually. The different results were re-evaluated by the observers together and common conclusions were reached.

CBCT analysis of the positions of mesiodens

In this study, the positions of mesiodentes were evaluated in frontal, sagittal and axial planes. Kim et al. [9] also investigated the positions of mesiodentes in three-dimensional planes by using CBCT. Differently from Kim et al. [9], we categorized the mesiodentes as:

- In frontal plane - the mesiodistal positions of

mesiodentes were classified as type A (straight long axis and no inclination), type B (crown in midline, root in distal), and type C (root in midline, crown in distal).

- In sagittal plane - superioinferior positions of mesiodentes were classified as type I (fully erupted), type II (partially erupted), type III (impacted and in contact with central incisor), type IV (impacted and not in contact with central incisor), type V (in contact with nasal cavity), and type VI (in contact with nasal septum).
- In axial plane - anterioposterior positions of mesiodentes were classified as type a (labial to dental arch), type b (in line with dental arch), type c (anterior to nasopalatine canal, in contact with nasopalatine canal), type d (behind nasopalatine canal and in contact with nasopalatine canal), and type e (behind nasopalatine canal and not in contact with nasopalatine canal).

The detailed illustrations designed by using Adobe InDesign CS6 (Version 8.0) can be seen in Figure 1.

Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences 21.0 computer software (SPSS Inc, Chicago, IL, USA). Descriptive statistics were prepared with mean and standard deviation (M [SD]). Chi-square test was used for the statistical evaluation of the presence of mesiodens related to gender. P value below 0.05 was considered statistically significant.

RESULTS

One hundred thirty mesiodentes were detected in 101 cases out of 2003 CBCT scans. The age of patients with mesiodens varied between 5 and 58 years. The mean age of patients was 16.6 (12.9). The sex ratio was 1.9 : 1 (67 male, 34 female). Predominance of mesiodens in males was statistically significant using Chi-square test ($P < 0.05$) (Table 1).

The number of mesiodentes was shown in Table 2.

Table 1. Gender distribution of mesiodens

Gender	Patients without mesiodens	Patients with mesiodens	Total	P-value
Male	882	67	949	0.00009 ^a
Female	1020	34	1054	
Total	1902	101	2003	

^aStatistically significant at the level $P < 0.05$ (Chi-square test).

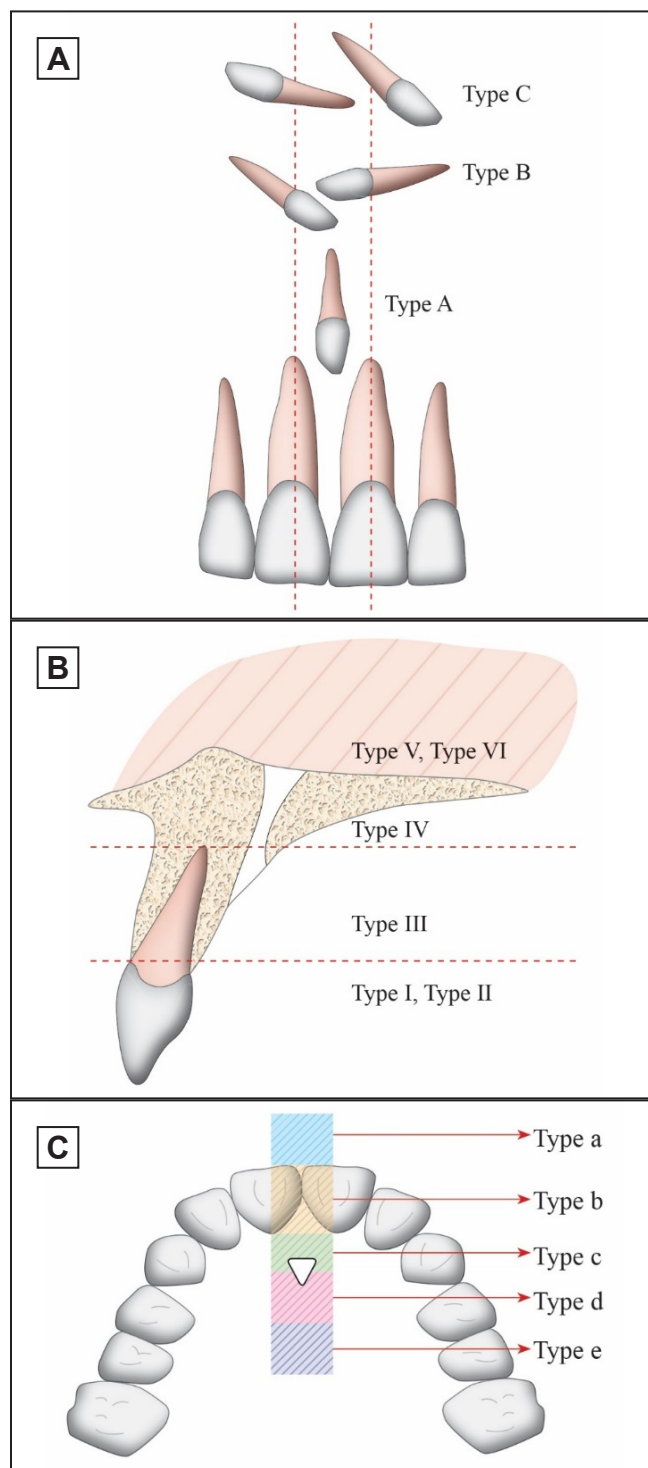


Figure 1. Illustrations of mesiodentes: A = frontal; B = sagittal; C = axial planes.

Table 2. Number of mesiodentes

Number of mesiodens	Patients N (%)
One mesiodens	77 (76.23)
Two mesiodens	19 (18.81)
Three mesiodens	5 (4.95)

N = total number of patients with mesiodens.

Among 101 patients, 77 (76.2%) of the cases had single mesiodens, 19 (18.8%) of the cases had two mesiodentes and 5 (4.9%) of the cases had three mesiodentes.

The shapes of mesiodentes were categorized in 4 groups (Table 3). Conical, supplemental, molariform and amorph shapes were observed 65.3%, 13.8%, 12.3%, 8.4%, respectively.

Eruption status and eruption direction of mesiodentes were shown in Table 4. One hundred two mesiodentes (78.4%) were impacted, followed by 23 fully erupted (3.8%) and 5 partially erupted (17.6%) mesiodentes. In present study, 82 mesiodentes (63%) were in normal eruption direction, 26 (20%) were inverted and 21 (16.1%) were in horizontal position. Mesiodentes in horizontal eruption direction were also subdivided into four groups as shown in Table 4.

The supplementary findings of the presence of mesiodens were mainly maxillary midline diastema (11.8%), delayed or prevented eruption of central incisors (56.4%), rotation and inclination (24.7%), hyperplastic dental follicle or cyst formation (8.9%). There were no supplementary findings in 40.5% of cases. Any mesiodentes associated with root resorption were not found (Table 5).

Table 3. Classifications of mesiodentes' shapes

Shapes	Mesiodens N (%)
Conical	85 (65.38)
Supplemental	18 (13.84)
Molariform	16 (53.33)
Amorph	11 (8.46)

N = total number of mesiodens.

Table 4. Eruption status and eruption direction of mesiodentes

Eruption status		Mesiodens N (%)
Impacted		102 (78.46)
Partially erupted		5 (3.84)
Fully erupted		23 (17.69)
Eruption direction		Mesiodens N (%)
Vertical		82 (63.07)
Inverted		26 (20)
Horizontal	Mesiodistal (crown in midline)	3 (2.3)
	Mesiodistal (root in midline)	2 (1.53)
	Labiopalatinal (crown in labial)	4 (3.07)
	Labiopalatinal (root in labial)	13 (10)

N = total number of mesiodens.

There were also some abnormalities observed with mesiodens like dens invaginatus (14.6%), root dilaceration (9.2%), internal resorption of crown (6.1%), pulpal calcification (1.5%) and fusion (0.7%) (Table 6).

CBCCT scans were used to classify mesiodentes in frontal, sagittal and axial planes as shown in Table 7.

Table 5. The supplementary findings of the presence of mesiodens

Complications	Patients N (%)
Asymptomatic	41 (40.59)
Midline diastema	12 (11.88)
Root resorption	0
Delayed or prevented eruption	57 (56.43)
Rotation and inclination	25 (24.75)
Hyperplastic dental follicle or cyst	9 (8.91)

N = total number of patients with mesiodens.

Table 6. Abnormalities observed with mesiodens

Abnormalities	Mesiodens N (%)
Dens invaginatus	19 (14.61)
Root dilaceration	12 (9.23)
Internal resorption of crown	8 (6.15)
Pulpal calcification	2 (1.53)
Fusion	1 (0.76)

N = total number of mesiodens.

Table 7. Classifications of mesiodens according to their positions using cone-beam computed tomography

In frontal plane		N (%)
Type A	Straight long axis, no inclination	78 (60)
Type B	Crown in midline, root in distal	24 (18.46)
Type C	Root in midline, crown in distal	28 (21.53)
In sagittal plane		N (%)
Type I	Fully erupted	24 (18.46)
Type II	Partially erupted	5 (3.84)
Type III	Impacted, in contact with the central teeth	85 (65.38)
Type IV	Impacted, not in contact with the central teeth	7 (5.38)
Type V	In contact with nasal cavity	8 (6.15)
Type VI	In contact with nasal septum	1 (0.76)
In axial plane		N (%)
Type a	Labial to dental arch	7 (5.38)
Type b	In line with dental arch	56 (43.07)
Type c	Anterior to NPC, in contact with NPC	60 (46.15)
Type d	Behind NPC, in contact with NPC	1 (0.76)
Type e	Behind NPC, not in contact with NPC	6 (4.61)

N = total number of mesiodens; NPC = nasopalatine canal.

In frontal plane, mesiodentes with long axis parallel to midline without inclination (type A) had the highest percentage (60%). In sagittal plane, impacted mesiodentes that are in contact with central teeth (type III) were mostly found (65.3%). In axial plane, mesiodentes were mostly found anterior to nasopalatine canal and in contact with nasopalatine canal (type c) (46.1%).

DISCUSSION

The aim of this study was to investigate the prevalence of mesiodens, which was found as 5.04%. Previous studies have reported the prevalence of mesiodens varying between 0.1% and 1.9% [5,8,15,16]. Besides the ethnic and genetic variations, usage of CBCT rather than panoramic and conventional radiographs may be the reason of higher prevalence in our study. The present study showed the sex ratio of 1.9 : 1, which was higher in males. Some previous studies had slightly higher sex ratio [3,7,9]. Different from previous studies, Colak et al. [16] reported that the mesiodens prevalence was higher in females than males.

According to the number, both single and double mesiodentes were reported in most of the cases [5,7,9,15]. In some studies, three mesiodentes were not found [5,8,9,15,17]. Up to our knowledge, more than three mesiodentes were not found in any case. Kim et al. [9] reported the single mesiodens prevalence as 69.2%. Patil et al. [8] reported the prevalence of single mesiodens as 89.7% and bilateral mesiodentes as 10.3%. Asaumi et al. [7] reported three mesiodentes as 1%. Whereas, we observed 76.2% of cases with single mesiodens and 18.8% of cases with two mesiodentes and 4.9% of cases with three mesiodentes.

In consistent with the literature, the mostly encountered mesiodens shape was conical [3,9,17,18]. Similar to other studies, impacted mesiodentes (78.4%) were the most common [3,5,15].

Our data demonstrated that the majority of mesiodentes (63%) were in normal eruption direction which is consistent with similar studies [5,16]. In contrast with our results, Asaumi et al. [7] and Kim et al. [9] reported the mesiodentes in normal direction as 27% and 21.4%, respectively.

In this study, mesiodentes were investigated in three planes. As a result, the majority of mesiodentes were impacted with both the crowns and roots between midlines of the central incisors and placed anterior to nasopalatine canal on palatal side. Previous studies have reported a prevalence of mesiodens

varying between 0.1% and 1.4%. In consistent with our results, previous studies have reported the majority of mesiodentes on palatal side as varying between 61.9% and 89% [5,7,9]. Mukhopadhyay et al. [5] reported 2.6% labially positioned mesiodens. However, Asaumi et al. [7] reported that none of the mesiodentes were on the labial side. We found 5.3% of mesiodentes labial to dental arch. Mossaz et al. [18] reported that 20.5% of the mesiodentes were in contact with the nasal floor and 49% in relation with nasopalatine canal. In the present study, mesiodentes in contact with nasal cavity were observed as 4.6% and mesiodentes in contact with nasal septum as 0.7%.

Mesiodentes may cause midline diastema, crowding, delayed or prevented eruption of central incisors, rotation and inclination, root resorption, dentigerous cyst formation [7,13,19-23]. Similar to Kim et al. [9], in our study, the most common supplementary observation of the presence of a mesiodens was delayed or prevented eruption of central incisors (56.4%). However, Shih et al. [17] found the midline diastema as the most frequent of all mesiodens related complications and reported root resorption of an adjacent tooth as 1.5%.

In literature, it is reported that supernumerary teeth may be seen with dental anomalies such as dens invaginatus, fusion, abnormal root development [22,24-29]. In our study, mesiodentes with dens invaginatus were found in 19 of the cases (14.6%). Różyło et al. [30] reported that the second most common teeth to have dens invaginatus are supernumerary teeth following lateral incisor.

There are two options in the management of mesiodentes; follow-up or extraction. The asymptomatic mesiodentes are generally followed-up. The second option should be applied if the mesiodentes cause or may cause harm to adjacent anatomical and dental structures, prevent orthodontic treatment or affect patients' comfort and aesthetic negatively.

CONCLUSIONS

Cone-beam computed tomography is not widely used for routine dental control due to higher X-ray emission. However, panoramic radiographs do not always provide accurate information, mostly about the impacted and supernumerary teeth. Usage of panoramic and conventional radiographs causes mesiodentes to be missed out due to examination in single plane and superpositions.

At this point, dentists need to make a decision whether the additional radiation is necessary for patients' welfare or not. If there is doubt, cone-beam computed tomography should be the method for the accurate diagnosis and treatment. Cone-beam computed tomography provides more detailed information about position, neighbouring anatomic structures, and local complications of mesiodens in multiplanar sections. Therefore, it prevents complications and enables the accurate treatment.

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