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Radiologic Evaluation of Inverted Teeth*

Invers Dişlerin Radyolojik Açıdan Değerlendirilmesi

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ABSTRACT

Aim: Inverted teeth are a very rare anomaly. In addition, there has been no detailed research on the subject except case reports. The aim of this study is to provide information about the radiologic and demographic features of inverted teeth.
Material and Methods: In the Department of Oral, Dental and Maxillofacial Radiology of Van Yüzüncü Yıl University, 153417 panoramic radiographs taken for diagnostic purposes between January 2018 and December 2022 were scanned and 154 inverted teeth (146 patients) were included in the study. Data were analyzed with IBM SPSS V23. Chi-square test was used to compare categorical variables according to groups. Significance level was taken as $p<0.050$.
Results: The prevalence of inverted teeth was found as 0.1%. Of the 154 cases (146 patients), 61 (39.6%) were female and 93 (60.4%) were male and 148 (96.1%) cases were seen in the maxilla and 6 (3.9%) in the mandible. 36 (23.4%) cases were seen on the right side, 45 (29.2%) on the left side and 73 (47.4%) in the midline. A statistically significant difference was observed in the distribution of inverted tooth types and the side of the teeth according to gender ($p<0.05$).
Conclusion: Inverted teeth are a rare anomaly seen mostly in males in the mesiodens in the maxilla. As with all impacted teeth, it should be kept in mind that pathologies may develop due to impacted inverted teeth and these teeth may erupt in the direction of eruption and patients should be informed for routine control.

Keywords: Inverted tooth, mesiodens, impacted tooth.

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ÖZ

Amaç: İnversiyon oldukça nadir gözlenen bir anomalidir. Ayrıca daha önce konu hakkında vaka raporları dışında detaylı bir araştırma yapılmamıştır. Bu çalışmanın amacı invers dişlerin radyolojik ve demografik özellikleri hakkında bilgi vermektir.
Gereç ve Yöntemler: Fakültemiz Ağız, Diş ve Çene Radyolojisi Anabilim Dalı'na Ocak 2018-Aralık 2022 tarihleri arasında herhangi dental bir sebeple başvurmuş ve teşhis amaçlı çekilmiş 153417 panoramik radyografi taranmış, tespit edilen 154 invers diş (146 hasta) çalışmaya dahil edilmiştir. Veriler IBM SPSS V23 ile analiz edilmiştir. Gruplara göre kategorik değişkenlerin karşılaştırılmasında Ki-kare testi kullanılmıştır. Önem düzeyi $p<0,050$ olarak alınmıştır.
Bulgular: İnvers diş prevalansı % 0,1 olarak bulunmuştur. 154 olgunun (146 hasta) 61'i (%39,6) kadın, 93'ü (%60,4) erkekti ve vakaların 148'i (%96,1) maksillada 6'sı (%3,9) mandibulada görülmüştür. 36 (%23,4) olgu sağ tarafta, 45 (%29,2) olgu sol tarafta ve 73 (%47,4) olgu orta hatta görülmüştür. Cinsiyete göre invers diş tipleri ve bulunduklara tarafa göre dağılımında istatistiksel olarak anlamlı bir fark gözlenmiştir ($p<0.05$).
Sonuç: İnvers dişler daha çok erkeklerde, maxillada mesiodenslerde görülen nadir bir anomalidir. Tüm gömülü dişlerde olduğu gibi gömülü invers dişlere bağlı patolojilerin gelişebileceği ve bu dişlerin sürme yönleri doğrultusunda erüpte olabilecekleri akılda tutulmalı ve hastalar rutin kontrol için bilgilendirilmelidir.

Anahtar Kelimeler: İnvers diş, mesiodens, gömülü diş,

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INTRODUCTION

Dental anomalies are differences in tooth structure caused by malformations during tooth formation or development and can be congenital, developmental, or acquired.[1] Changes in the size, number, eruption, structure, or shape of teeth constitute dental anomalies.[2] Congenital anomalies are genetically based and inherited.[3] Developmental anomalies occur during tooth development and can be caused by metabolic disorders, mutations, or physical, chemical, or environmental factors.[4] Acquired dental anomalies are observed after the teeth have completed the normal formation process. All these types of anomalies can act as symptoms and can be important in the early diagnosis of certain diseases or syndromes.[5]

Anomalies can complicate procedures such as tooth extraction or root canal treatment. They can also lead to increased hypersensitivity, malocclusion, and aesthetic problems.[1,6] The prevalence of dental anomalies has been investigated in many studies in diverse populations. However, varying ethnicities of patients and different diagnostic and sampling methods have led to inconsistent results.[3,7]

Before the development of tooth germination, abnormal growth of the odontogenic epithelium causes some teeth to deviate from their normal positions. The complete reversal of a tooth from its normal eruption direction is called invertion. Such teeth may erupt into the nasal cavity, sinus, or orbit. This type of anomaly is common in supernumerary teeth and wisdom teeth.[8] A mesiodens is a supernumerary tooth between maxillary central teeth,[9,10] and they may be one or more in number and can remain impacted.[11] They are usually asymptomatic and are identified during radiologic examination when they remain impacted.[12]

The aim of this study is to inform clinicians about the radiologic findings of inverted teeth, as there have been no previous detailed studies on inverted teeth.

MATERIAL AND METHODS

Approval for this study was obtained from the Non-Interventional Clinical Research Ethics Committee (2023/02-04). This retrospective study was conducted in accordance with the Declaration of Helsinki, and informed consent was obtained from the individuals included in the study. In the Department of Oral and Maxillofacial Radiology of Van Yuzuncu Yıl University. 153417 panoramic radiographs taken for diagnostic purposes between January 2018 and December 2022 were scanned and 154 inverted permanent teeth (146 patients) were included in the study.

The inclusion criteria were as follows: 8–71 years old, in permanent or mixed dentition, with teeth in the completely opposite eruption position, without previous orthodontic or orthognathic surgical treatment, and without craniofacial syndromes or obvious pathologies. The exclusion criteria were as follows: previous orthodontic or orthognathic surgery; impacted teeth or displacement of the roots as a result of structures such as cyst tumors; craniofacial anomalies; history of trauma or fractures in the mandibular or maxillary regions; and poor-quality panoramic images with metal and motion artifacts.

Acquisition of Panoramic Radiographs

All panoramic radiographs used in the study were taken with the ORTHOPHOS XG (Sirona, USA) brand device with 60 kV, 3 mA, and 14.1 s exposure parameters, which were routinely controlled and maintained by our faculty. The images were evaluated by two oral and maxillofacial radiologists with five years and nine years of experience, respectively, and a periodontologist with four years of experience.

Statistical Analysis

The data were analyzed using IBM SPSS V23 (IBM Co., Armonk, NY). statistics program. The chi-square test was used to compare categorical variables according to group. Analysis results were presented as mean ± standard deviation and median (minimum - maximum) for quantitative data and frequency (percentage) for categorical data. The significance level was taken as $p<0.05$.

Table-1: Demographic findings of inverted teeth.

	Total	Male	Female
	N		
	154	93	61
Age			
Range	8-71	8-71	9-59
Mean	27.05	26.12	28.46
Jaw			
Mandible	6	4	2
Maxilla	148	89	59
Side			
Right	36	19	17
Left	45	22	23
Middle	73	52	21

RESULTS

The study included 154 cases aged 8-71 years old with inverted teeth whose panoramic images were taken for any dental reason. The mean age of the patients participating in the study was 27.05 years (Table 1). The prevalence of inverted teeth was found as 0.1%. Of the 154 participants, 61 (39.6%) were female and 93 (60.4%) were male, and 148 (96.1%) of the cases were seen in the maxilla (Figure 1) and 6 (3.9%) in the mandible (Figure 2). In addition, 36 (23.4%) cases were seen on the right side, 45 (29.2%) on the left side, and 73 (47.4%) on the midline (Table 2).

A significant difference was observed in the distribution of inverted tooth types according to gender (p=0.009). A significant difference was observed in the distribution of inverted tooth types according to the side on which they were located (p< 0.001). There was no significant difference in the distribution of inverted tooth types according to the jaw region (p= 0.073) (Table 3).

Table-2: Distribution table of inverted teeth according to age, jaw and side.

Gender		Affected jaw		Inverted tooth side		
female(%)	male(%)	maxilla(%)	mandible(%)	right(%)	left(%)	midline(%)
61 (39,6)	93(60,4)	148 (96,1)	6 (3,9)	36(23,4)	45 (29,2)	73 (47,4)
N=154		N=154		N=154		
p*: 0,009		**p*<0.001**		**p*<0.001**		

*Chi-square test, *p<0.05.*

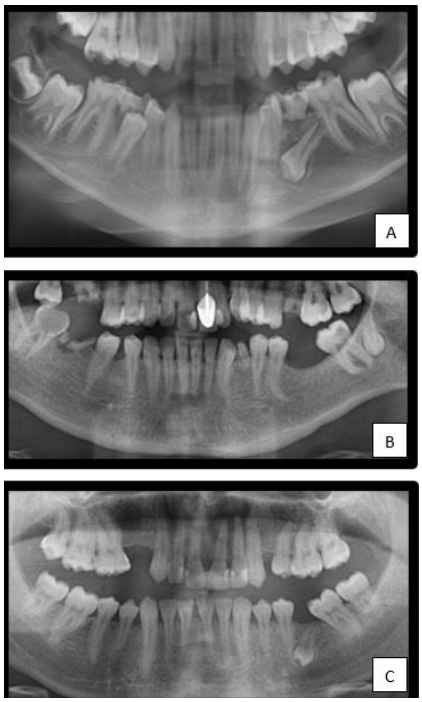
Table-3: Distribution of inverted tooth types by gender, jaw and side.

Teeth type	Gender		Jaw		Side		
	female	male	maxilla	mandible	middle	right	left
Central	12	11	23	0	0	7	16
Lateral	0	1	1	0	0	1	0
Canine	7	1	8	0	0	4	4
1.premolar	1	0	1	0	0	1	0
2.premolar	1	1	1	1	0	1	1
2.molar	1	0	1	0	0	1	0
3.molar	17	20	35	2	0	17	20
Mesiodens/surnumerary	22	59	78	3	73	4	4
Total	61	93	148	6	73	36	45
	p*:0,009		**p*<0.001**		**p*< 0.001**		

*Chi-square test, *p<0.05.*

Figure-1: Image of inverted teeth in the maxilla (A- dentigerous cyst of inverted mesiodens tooth, B- inverted mesiodens tooth, C- inverted double mesiodens teeth, D- inverted canine tooth.)

Figure-2: Image of inverted teeth in the mandible. (A-inverted second premolar tooth, B-inverted distomolar tooth, C-inverted surnumerer tooth.)



DISCUSSION

Surnumerary teeth are called mesiodenses, especially when they are located in the anterior maxilla. Mesiodenses are the most commonly erupted teeth.[13] Some studies argue that teeth that have erupted into the nose are caused by the eruption of inverted mesiodenses toward the nose.[14] There are also cases of extraoral eruption of inverted teeth in the mandible.[15] However, there are instances of intraoral eruption of mandibular inverted premolars.[16] Although there is no clear consensus about the direction of eruption of teeth with an inverted position, there are case reports of eruptions in both directions. This shows that no single factor is effective in tooth eruption theories. In this study, many inverted teeth in the maxilla and mandible were identified, but no case was found to have erupted either extraorally or intraorally.

According to the general literature, the treatment of intraoral or extraoral erupted inverted teeth is extraction without causing morbidity.[11] Since inverted teeth are mostly impacted in the jaw, various pathologies may develop due to these teeth. It has been observed that dentigerous cysts, which are less common in the maxilla than in the mandible, affect the anterior region of the maxilla.[17] Furthermore, 90% of dentigerous cysts seen in the anterior region of the maxilla originate from mesiodenses.[18] Kessler and Kraut[19] reported that 6% of erupted teeth may develop dentigerous cysts. Two of the 154 inverted teeth identified in this study developed dentigerous cysts (Figure 1). Dentigerous cysts developing due to mesiodenses, which are commonly seen in the anterior maxilla in children, should be planned and excised rapidly because of the risk of reaching large sizes in a very short time.

Impacted mesiodenses can prevent the eruption of teeth and can also cause occlusion disorders by causing space limitation.[20] Mesiodenses can be observed as normal, inverted or horizontal in position. It has been observed that the majority of cases are inverted in position and remain impacted.[10,21]

It has been observed that mesiodenses cause diestema in the anterior region of the maxilla, occlusal gap, root resorption in the surrounding teeth and prevent the eruption of central incisors.[22]

Problems caused by mesiodenses teeth should be detected at an early age, such complications should be examined radiologically in detail and in cases that pose a risk, teeth should be extracted quickly.

In this study, 49.4% of the cases were inverted mesiodenses and 10 cases were double and 1 case was triple mesiodenses. In addition, it was observed that in 76 of the cases, the third molars were in the inverted position and impacted in 37 of the cases (Figure 1).

Mutluay et al. [23]reported three cases in which central incisors were inverted and impacted. There are also cases in which teeth in function, phonation and aesthetically important positions such as central incisors were extracted and reimplanted. [24]

In this study, 23 central incisors were found to be in an inverted and impacted position. Since the study was a retrospective study, the history of trauma could not be questioned, but it was noted that one case had a history of trauma.

Abu-Mostafa et al. [25] mentioned that there were a few cases in the literature in which third molars were in the invertion position. In this study, a total of 37 third molars in the maxilla mandible were found to be in the invertion position. According to the general literature, extraction of inverted third molars is more difficult than extraction of teeth in normal position.

Accessibility has become difficult in the extraction of these teeth. In addition, more bone has to be removed and the possibility of damage to the nerve vascular bundle is high. For this reason, it has been stated that planning should be made by considering the clinical benefit and complications in the patient.[26] However, Chen et al.[27] reported a case of unicystic ameloblastoma originating from an inverted third molar. Therefore, routine radiographic examination is very important for the early detection of possible pathologies in the presence of impacted third molars where clinical benefit is prioritized and no extraction decision is made.

De Oliveira Gomes et al.[28] categorized 460 eruptive teeth detected in children and adolescents according to various characteristics. They reported that 37.1% of the cases were inverted. Similarly, Tay et al. [29] reported that 77.6% of the surnumerary teeth in the anterior maxilla were inverted. Assaumi et al.[30] found that 67% of the mesiodens were inverted. In this study, 47% of the teeth with inverted position were located in the midline. Considering the literature, the reason why teeth with inverted position are mostly seen in the maxilla and anterior region may be thought to be a region that is more likely to be exposed to trauma during the development of the maxilla. In addition, the fact that the mesiodens are mostly inverted may be thought to be due to the fact that the developmental direction of the maxilla is downward and forward and the dental germs such as the mesiodens in this region cause changes in their positions and cause them to remain inverted.

There is no information in the literature about the distribution of inverted teeth according to gender. The prevalence of surnumerary teeth is statistically significantly higher in males.[31] Invertion are also an anomaly mostly observed in surnumerary teeth, similar to the literature, inverted teeth were statistically significantly more common in males in this study.

It has been reported that inverted teeth are mostly observed in maxillary canines, surnumerary, maxillary central, maxillary lateral and mandibular third molars in the anterior region of the maxilla, respectively.[32,33] However, in this study, it was observed that the teeth with inverted positions were mostly maxillary anteriorly located surnumerary teeth, maxillary third molars, maxillary central, maxillary canine teeth.

Tuna et al.[34] evaluated 38 inverted surnumerary teeth clinically and radiologically. While 47.4% of the cases were observed in the midline, 26.3% were observed on the right and 26.3% on the left side. Similarly, in this study, inverted teeth were observed in the midline mostly, but inverted teeth were observed on the left side much more than on the right side. In addition, Tuna et al.[34] conducted that their study focused only on surnumerary teeth and therefore only the characteristics of these teeth were recorded. However, in this study, all teeth with inverted position were evaluated and this comprehensive analysis may be the novel aspect of this study.

CONCLUSION

Inverted teeth are a rare anomaly seen mostly in males, in the permanent, surnumerary teeth especially mesiodenses and in the maxilla. Radiologic imaging is important in diagnosis and treatment planning. As with all impacted teeth, it should be kept in mind that pathologies may develop due to impacted inverted teeth and, also these inverted teeth can also erupt in different anatomical spaces due to unusual eruption directions, such as the nasal cavity. Patients should be informed for routine control. In addition, teeth causing clinical symptoms should be extracted immediately.

Ethics Committee Approval: Ethical approval for this study was obtained by Van Yuzuncu Yil University Non-Invasive Ethics Committee (2023/02-04).

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