

## CONGRESS PROCEEDING

# Investigation of Frequency of Heterotopic Teeth: A Cone Beam CT Study

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## Abstract

**Purpose:** Teeth that are encountered in distant places from the alveolar arch (maxillary sinus, orbit, infratemporal fossa, condylar region, etc.) because of various local or systemic factors are named heterotopic teeth. The heterotopic tooth is a rare phenomenon. Although the etiology is still unknown, it is known that it may be seen because of pathologies caused by cystic lesions, cleft lip-palate, trauma history, and infectious conditions. They are usually asymptomatic, so they are detected by chance in routine clinical and radiological examinations. This study aims to determine the frequency of heterotopic permanent teeth and their anatomical localization with the help of cone-beam computed tomography (CBCT).

**Methods:** This study was retrospectively performed with CBCT slices. CBCT sections of 2590 individuals (1432 females, 1158 males) between the ages of 10-89 (mean:  $44 \pm 17$  years) were evaluated in the study. Heterotopic teeth were investigated using coronal, axial, sagittal CBCT sections in regions distant from the maxillary-mandibular arch. SPSS V.21 software (IBM Corp., Armonk, NY, USA) was used for data analysis.

**Results:** Heterotopic teeth were found in 10 of 2590 individuals (0.4%). All the heterotopic teeth detected were molar teeth; 4 were mandibular third molar teeth, 5 were maxillary third molar teeth and 1 was maxillary second molar tooth. The frequency of heterotopic teeth according to gender did not show a statistically significant difference (4 females, 6 males,  $p > 0.05$ ). The average age of individuals with heterotopic teeth was 35.3 (17-65 years). 4 of the heterotopic impacted teeth were located in the ramus and 6 in the maxillary sinus.

**Conclusions:** The prevalence of heterotopic teeth was very rare (0.4%). The teeth with the highest frequency of heterotopia were the third molars. Heterotopic teeth did not have an anatomical location and gender that they preferred predominantly.

**Key words:** Heterotopia; Ectopia; Impacted tooth; CBCT

## Introduction

Heterotopic tooth is a term used when a tooth is not on the jaws due to various local or systemic factors and is encountered in another organ. The heterotopic teeth are rare phenomena, so the etiology is still not clear.<sup>1</sup> Various factors may cause heterotopic teeth like cleft lip-palate, traumas, cystic lesions, and maxillary infections.<sup>2</sup> When a heterotopic tooth is detected, teeth are generally located in the orbit, nasal cavity, maxillary sinuses, infratemporal fossa, condylar process, and mandibular ramus.<sup>3,4</sup> The most common heterotopic teeth are maxillary and mandibular third molars.<sup>2</sup> In the literature, very few cases have been reported; therefore, the knowledge about its prevalence, tendency of anatomical location, or gender is limited. This study aims to investigate data of the frequency of heterotopic teeth, their gender tendency, and preferred anatomical localization using cone-beam computed tomography (CBCT) slices.

## Methods

This study was retrospectively performed in Necmettin Erbakan University Faculty of Dentistry, Department of Oral and Maxillofacial Radiology, with CBCT slices obtained between 2018-2021 years. The study protocol was approved by the Research Ethics Committee of Necmettin Erbakan University, Faculty of Dentistry (no. 2021/04-53) and was done under with the principles defined in the Declaration of Helsinki, including all revisions. CBCT sections of 2590 individuals (1432 females, 1158 males) between the ages of 10-89 (mean:  $44 \pm 17$  years) were evaluated in the study. CBCT records of heterotopic tooth-related jaw pathologies, heterotopic deciduous teeth, mesiodens, supernumerary, and supplementary teeth were excluded from the study.

Heterotopic teeth were investigated using coronal, axial and, sagittal CBCT (J Morita MFG Corp., Kyoto, Japan) sections in regions

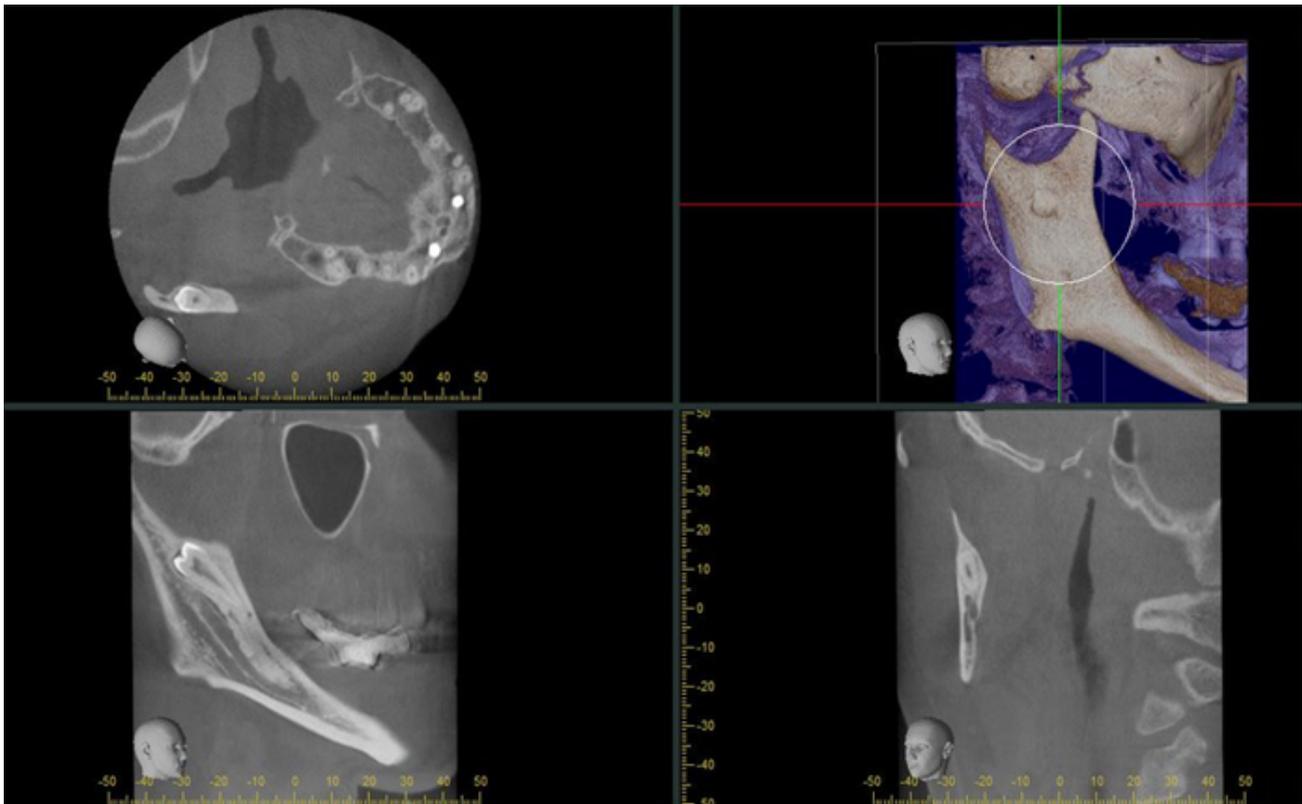


Figure 1. A heterotopic right mandibular third molar tooth in the mandibular ramus on coronal, axial and sagittal CBCT sections. White arrows show the heterotopic teeth.

distant from the maxillary-mandibular arch (e.g. ramus, maxillary sinus, condylar region, orbital region) Figure 1, Figure 2. Observations were done by large FOV images (100x100 mm, 140x100 mm, 170x120). Images were taken using 250  $\mu\text{m}$  voxel size, 17.5 seconds exposure time, 5 mA, and 90 kVp parameters. All scans and parameters were determined according to the manufacturer's recommended protocol. 2.66 GHz Intel Xeon computer with 3.25 GB RAM and Windows XPTM Professional operating system processor and 27" Dell U2711HTM monitor with 2560x1600-pixel resolution (U2711HTM; Dell, Round Rock, TX, USA). All assessments were done by using i-Dixel software (J Morita MFG Corp., Kyoto, Japan) on a flat-screen monitor by the same examiner.

SPSS V.21 software (IBM Corp., Armonk, NY, USA) was used for data analysis. Descriptive statistics (mean, standard deviation) were calculated for all parameters in this study. Mann-Whitney U test was applied to test the relationship between age and heterotopic tooth. The chi-square test was used to determine the relationships between categorical variables, and significance level was  $p < 0.05$ .

## Results

Heterotopic teeth were found in 10 of 2590 individuals (0.4%). All the heterotopic teeth detected were molar teeth; 4 of them were mandibular third molar teeth, 5 of them were maxillary third molar teeth and 1 of them was maxillary second molar tooth. 4 of the heterotopic impacted teeth were located in the ramus, and 6 in the maxillary sinus. The distribution of heterotopic teeth according to the region is given in Table 1. The frequency of heterotopic teeth according to gender did not show a statistically significant difference (4 females, 6 males,  $p > 0.05$ ). The average age of individuals with heterotopic teeth was 35.3 (17-65 years). There was no statistically significant relationship between age and heterotopic teeth. The distribution of heterotopic teeth according to age and gender was given in Table 2.

All experience indicates that distance education will be more

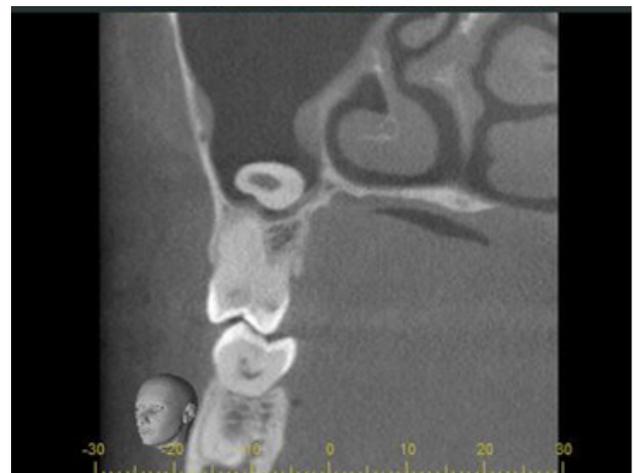


Figure 2. A heterotopic right maxillary third molar tooth in the maxillary sinus on coronal CBCT sections and white arrow shows the heterotopic teeth.

than a necessity in the coming period. Especially, ensuring the continuity of service and education is very important in maxillofacial radiology, which is an indispensable branch for the scientific continuity of dentistry. Data obtained as a result of studies showed that distance education still has shortcomings in radiology practical training. Despite some drawbacks, the integration of online learning into radiology education should be utilized rapidly. It is inevitable to change hygiene habits after the pandemic and to make necessary changes in maxillofacial radiology education.

**Table 1.** The distribution of heterotopic teeth according to region

Tooth Number	Frequency	Region
18	3	Maxillary Sinus
27	1	Maxillary Sinus
28	2	Maxillary Sinus
38	2	Mandibular Ramus
48	2	Mandibular Ramus
<b>Total</b>	<b>10</b>	

## Discussion

The occurrence of heterotopic teeth, which is a dental position anomaly, is a very rare condition. They are usually asymptomatic so do not cause patient complaints. Therefore, clinicians usually notice it by chance during the clinical examination. The location where they are found, relationship with anatomical structures, the age of the patient are factors that determine the prognosis of the heterotopic tooth. The purpose of this study was to investigate the frequency of heterotopic teeth, their gender tendency, and preferred anatomical localization using CBCT. The terms heterotopia and ectopia are two terms that are often used and confused interchangeably. Both conditions are very rare and etiologically similar factors cause them. In the literature, the term ectopia was used more frequently in the presence of an abnormal eruption pattern with the teeth on the dental arch.<sup>5</sup> Therefore, it would be more appropriate to use the term heterotopia for teeth detected in regions distant from the dental arch. The first case report on heterotopic teeth published in the literature is by Keros et al.<sup>4</sup> in 1997. Prior to the case reported by Keros et al.<sup>4</sup>, there were some reports of impacted teeth in the maxillary sinus or mandibular condyle under the term ectopic teeth.<sup>6</sup> Although there are many case reports published from then to now, a systematic review or epidemiological study is not available due to very rare occurrence of heterotopic teeth. The study, which is conducted by Elsayed et al.<sup>7</sup> with 9000 dental panoramic radiographies, has found the frequency of ectopic teeth to be 0.7%. Similarly, in this study, which was performed with 2590 CBCT slices, the frequency of heterotopic teeth was found to be 0.4%. Heterotopic teeth may be permanent, deciduous or supernumerary. Although usually heterotopic teeth are supernumerary teeth or mesiodens, they were excluded in this study. This study is only focused on permanent teeth. Of the 10 heterotopic teeth detected in this study, 9 were third molars. Third molars are the last to take place in the dental arch and are the last to develop embryologically, and the teeth that are most affected by developmental conditions and traumas. Therefore, third molars are the most frequently encountered heterotopic teeth.<sup>1,4</sup> In the literature review of Iglesias et al.<sup>8</sup> covering the years 1980–2011, they collected 14 well-documented clinical cases about ectopically located molar teeth. Of the detected teeth, 11 were reported as mandibular third molars, of which 5 were in the mandibular ramus and 6 were in the coronoid process. Thus, it may be said lower ectopic third molars prefer the subcondylar or condylar region. In the maxillary region, ectopically located teeth may be found in many various anatomical locations as infratemporal fossa, intranasal region, maxillary sinus, etc. In the study of Baykul et al.,<sup>9</sup> in which they only evaluated teeth located in the maxillary sinus, the most common teeth in the maxillary sinus were molars, with a rate of 66.6%. Half of the molars were formed by the third molars. It is also supported by the results of the present study that the maxillary sinus is the place where molar teeth are often encountered ectopically. According to the results of the present study, gender was not effective in the appearance of heterotopic teeth. However, no gender tendency was observed in studies on ectopic teeth.<sup>7</sup> In contrast, some studies have reported a slight gender tendency.<sup>10</sup> Since some of these studies have a female tendency and some have a male tendency, it is not possible to talk about the existence of a specific dominant gender. Consider-

ing the age of individuals with heterotopic teeth, there were case reports presented at very different ages in the literature.<sup>1,8</sup> Since heterotopic teeth are usually asymptomatic, they can be detected incidentally in different age groups. It is likely to be detected at an earlier age in syndromic individuals and symptomatic patients. Nevertheless, for heterotopic teeth, more epidemiological studies are needed. Panoramic radiography is the standard diagnostic imaging method for dentistry. However, the third dimension may be needed to overcome the disadvantages of panoramic radiography.<sup>8</sup> Generally, the first examination of impacted teeth is done by panoramic radiographs and CBCT could be taken before surgical procedures, to determine the exact relationship with anatomical structures or to differentiate them from tooth-like calcifications.<sup>3</sup> This study was performed with axial, coronal, and sagittal CBCT slices so that heterotopic calcifications with tooth-like appearance could be exactly identified. When heterotopic teeth are detected, they are appropriate to be regular, followed by most clinicians or surgeons due to their surgically difficult-to-access location. Although they usually tend to be asymptomatic, there were cases with symptoms such as pain, limitation of mouth opening, swelling, facial asymmetry, nasal obstruction, speech problem or chronic rhinorrhea.<sup>8,9</sup> In cases where a surgical approach will be performed, the experience and preference of the surgeons are the main determinants.<sup>9</sup> Conservative treatment that will create minimal trauma should be determined according to the position of the tooth. Although the intraoral approach is generally preferred in the operation, the extraoral approach may also be preferred in cases where the field of view will be limited. On the other hand, the aesthetic disadvantage of the extraoral approach should be considered as an additional complication.

## Conclusion

The prevalence of heterotopic teeth was very rare (0.4%). The teeth with the highest frequency of heterotopia were the third molars. Heterotopic teeth did not have an anatomical location and gender that they preferred predominantly. More epidemiological studies are needed regarding the distribution of heterotopic of teeth with larger samples.

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## Author Contributions

Conception / design of the work: M.T. Acquisition, analysis and interpretation of the data: M.T., F.Y. Drafting the work: M.T., F.Y. Final approval of the version to be published: M.T. Investigation of accuracy and integrity of any part of work: M.T.

## Conflict of Interest

Authors declare that they have no conflict of interest.

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**Table 2.** The distribution of heterotopic teeth according to age and gender of the patient

Tooth number	Region	Age of patient	Gender of patient
18	Maxillary sinus	21	Female
18	Maxillary sinus	24	Female
18	Maxillary sinus	33	Male
27	Maxillary sinus	49	Male
28	Maxillary sinus	17	Male
28	Maxillary sinus	19	Female
38	Mandibular ramus	60	Female
38	Mandibular ramus	65	Male
48	Mandibular ramus	32	Male
48	Mandibular ramus	33	Male

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