



Neşe Oral¹, Şükran Ayran², Aslıhan Aslan Balcı³, Gülay Özdoğan⁴, Selma Ece Karabıyıkolu², Hilal Peker Öztürk², Hüseyin Aykut Özyiğit⁵, Ercan Türerer⁶, Gürdoğan Aydın⁶

Retrospective Evaluation of Tooth Agenesis in Different Regions of Turkey with Panoramic Radiography

Retrospektivna procjena ageneze zuba u različitim regijama Turske očitana s pomoću ortopantomograma

- ¹ Department of Dentomaxillofacial Radiology, Faculty of Dentistry, Cappadocia University, Nevşehir, Turkey
Odjel za dentomaksilofacijalnu radiologiju Stomatološkog fakulteta Sveučilišta Cappadocia, Nevşehir, Turska
- ² Department of Dentomaxillofacial Radiology, Faculty of Gulhane Dentistry, University of Health Sciences, Ankara, Turkey
Zavod za dentomaksilofacijalnu radiologiju Stomatološkog fakulteta Gulhane Sveučilišta zdravstvenih znanosti, Ankara, Turska
- ³ Department of Dentomaxillofacial Radiology, Etimesgut Oral and Dental Health Center, T.C. Ministry of Health, Ankara, Turkey
Odjel za dentomaksilofacijalnu radiologiju Etimesgut Oralnoga i stomatološkoga zdravstvenog centra (Oral and Dental Health Center, T.C.) Ministarstva zdravlja, Ankara, Turska
- ⁴ Department of Dentomaxillofacial Radiology, Faculty of Dentistry, Antalya Bilim University, Antalya, Turkey
Odjel za dentomaksilofacijalnu radiologiju Stomatološkog fakulteta Sveučilišta Antalya Bilim, Antalya, Turska
- ⁵ Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, University of Kyrenia, Kyrenia, Cyprus
Zavod za oralnu i maksilofacijalnu kirurgiju Stomatološkog fakulteta Sveučilišta Kyrenia, Cipar
- ⁶ Medical Imaging Techniques, Vocational College, Cappadocia University, Nevşehir, Turkey
Tehnike medicinskih slikovnih prikaza – Strukovni fakultet Sveučilišta Cappadocia, Nevşehir, Turska

Abstract

Objectives: Dental agenesis refers to the absence of one or more teeth, occurring in both primary and permanent dentitions. It can result in several complications, impacting functional aspects of the dentition, such as chewing and speech. This study aimed to evaluate the prevalence of agenesis of permanent incisors, premolars, and third molars in patients aged 8-18. The prevalences were compared according to age, gender, and the regions they live in. **Material and Methods:** This study was conducted in the Central Anatolia and Mediterranean regions of Turkey. It included data from 593 patients, 304 females and 289 males. The study involved a retrospective evaluation of the patients' orthopantomographic images. Descriptive statistics were employed for the analysis. **Results:** In the study, the prevalence of incisor agenesis among all patients was 2.4%. Premolar agenesis was found in 3.9% of patients, with the mandibular second premolar being the most commonly missing premolar (missing in 19 patients). The prevalence of third molar agenesis was 19.9% (118 patients). Incisor and premolar agenesis were more common in the Central Anatolia region than the Mediterranean region, whereas third molar agenesis was more prevalent in the Mediterranean region. In both regions, the left mandibular premolar was the most frequently missing premolar tooth, and the left maxillary third molar was the most frequently missing third molar tooth. **Conclusion:** This study presents a thorough analysis of the prevalence and distribution of tooth agenesis, with a particular focus on incisors, premolars, and third molars. The results emphasize the necessity of considering gender differences and specific tooth locations in the diagnostic and therapeutic approaches to tooth agenesis.

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Address for correspondence

Hüseyin Aykut ÖZYIĞIT
University of Kyrenia, Faculty of
Dentistry
Şehit Yahya Bakır Sok.
Karakum, Kyrenia, Cyprus
aykut.ozyigit@kyrenia.edu.tr

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Neşe ORAL - ORCID: 0000-0003-2038-2897
Şükran AYRAN - ORCID: 0009-0003-5988-2685
Aslıhan ASLAN BALCI - ORCID: 0000-0001-6374-0303
Gülay ÖZDOĞAN - ORCID: 0000-0002-2231-8963
Selma Ece KARABIYIKOĞLU - ORCID: 0009-0005-8505-3367

Hilal PEKER ÖZTÜRK - ORCID: 0000-0003-4774-6232
Hüseyin Aykut ÖZYIĞIT - ORCID: 0009-0007-8488-6564
Ercan TÜRERER - ORCID: 0000-0002-8201-5542
Gürdoğan AYDIN - ORCID: 0000-0003-0464-2855

Introduction

Dental agenesis is the condition in which one or more teeth are congenitally missing, occurring in both primary and permanent dentitions. The absence of a single tooth is classified as hypodontia, while the complete absence of all teeth is termed anodontia. Oligodontia is used to describe the condition when six or more teeth are missing (1, 2). The prevalence of dental agenesis varies among different populations, with reported rates ranging from 1.6% to 36.5%, depending on the

Uvod

Dentalna ageneza stanje je u kojemu jedan ili više zuba kongenitalno nedostaje, a pojavljuje se i u mlječnoj i u trajnoj denticiji. Nedostatak jednog zuba klasificira se kao hipodonticija, a potpuni nedostatak svih zuba naziva se anodonticija. Pojam oligodonticija upotrebljava se za opisivanje stanja kada nedostaje šest ili više zuba (1, 2). Prevalencija dentalne ageneze varira među različitim populacijama, s prijavljenim stopama u rasponu od 1,6 % do 36,5 %, ovisno o specifičnoj

specific cohort and geographical region (2, 3).

The etiology of dental agenesis is multifactorial, encompassing genetic, epigenetic, and environmental factors (4). Familial patterns observed in clinical settings underscore the genetic basis of the condition; however, sporadic cases are also prevalent (5). The incidence of dental agenesis is significantly higher in females compared to males, with a reported ratio of 3:2. Nevertheless, gender does not appear to influence the specific patterns of dental agenesis (6).

In permanent dentition, the mandibular second premolars are the most frequently missing teeth, followed by the maxillary lateral incisors. Distinct patterns of agenesis have been identified, with unilateral agenesis occurring more frequently than bilateral agenesis. Third molars and second premolars are commonly absent across all quadrants and often appear in combination with these two tooth types and incisors (1, 6).

Clinically, dental agenesis can lead to various complications, affecting both the functional aspects of dentition, such as chewing and speech (7). Early diagnosis and intervention are essential for effective management, thus facilitating timely treatment planning, and the implementation of strategies to prevent or mitigate potential complications (8).

Dental agenesis is a multifaceted condition with significant implications for oral health. A thorough understanding of its etiology, clinical manifestations, and management strategies is crucial for delivering optimal oral care. Ongoing research and technological advancements are vital for enhancing diagnostic and therapeutic approaches, with the ultimate goal of effectively preventing and managing this prevalent dental anomaly (8).

The objective of this study was to evaluate the prevalence of agenesis in permanent incisors, premolars, and third molars among patients aged 8 to 18. Additionally, the study aimed to compare prevalences based on age, gender, and geographic region.

Materials and Methods

This study was conducted in the Central Anatolia and Mediterranean regions of Turkey. Data were collected from 909 patients aged 8 to 18, including 505 from the Oral and Maxillofacial Radiology Clinic at Gülhane Faculty of Dentistry, University of Health Sciences, and 404 from the Oral and Maxillofacial Radiology Clinic at the Faculty of Dentistry, Antalya Bilim University. Among these patients, 53.4% were female and 46.6% were male. Orthopantomographic images were evaluated retrospectively to examine the prevalence of missing incisors, premolars, and third molars. The study assessed the agenesis of permanent teeth by comparing factors such as age, gender, and geographic region. Given that third molar germ formation may not occur in the 8-10 age group, this cohort was excluded from the analysis of third molar agenesis. Consequently, data from 593 patients (304 females and 289 males) were included in this segment of the study. In the retrospective study conducted on panoramic radiographs, the images were independently examined and confirmed by two different oral and maxillofacial radiology specialists.

skupini i zemljopisnoj regiji (2, 3).

Etiologija dentalne ageneze je multifaktorijalna i obuhvaća genetske, epigenetske te okolišne čimbenike (4). Obiteljski obrasci promatrani u kliničkim okruženjima ističu genetsku osnovu stanja. No prevladavaju i sporadični slučajevi (5). Učestalost dentalne ageneze značajno je veća kad je riječ o ženama u usporedbi s muškarcima, s prijavljenim omjerom 3 : 2. Ipak, čini se da spol ne utječe na specifične obrasce dentalne ageneze (6).

U trajnoj denticiji najčešće nedostaju drugi donji pretkutnjaci, a zatim slijede gornji bočni sjekutići. Identificirani su različiti obrasci ageneze, pri čemu se jednostrana ageneza pojavljuje češće nego obostrana. Treći kutnjaci i drugi pretkutnjaci obično nedostaju u svim kvadrantima i često se pojavljuju u kombinaciji s ova dva tipa zuba i sjekutićima (1, 6).

Klinički gledano, dentalna ageneza može rezultirati raznim komplikacijama zato što zahvaća i funkcionalne aspekte denticije poput žvakanja i govora (7). Rana dijagnoza i intervencija ključni su za učinkovito liječenje, jer se tako olakšava pravodobno planiranje liječenja i provedba strategija za sprječavanje ili ublažavanje mogućih komplikacija (8).

Dentalna ageneza stanje je s velikim implikacijama na oralno zdravlje. Temeljito razumijevanje njezine etiologije, kliničkih manifestacija i strategija liječenja presudno je za pružanje optimalne oralne skrbi. Sadašnja istraživanja i tehnološki napredak ključni su za poboljšanje dijagnostičkih i terapijskih pristupa, a krajnji je cilj učinkovita prevencija i liječenje te česte dentalne anomalije (8).

Cilj ovog istraživanja bio je procijeniti prevalenciju ageneze trajnih sjekutića, pretkutnjaka i trećih kutnjaka među pacijentima u dobi od 8 do 18 godina. Dodatno se željela usporediti prevalenciju na temelju dobi, spola i zemljopisne regije.

Materijali i metode

Ova studija provedena je u središnjoj Anatoliji i u sredozemnim regijama Turske. Podatci su prikupljeni od 909 pacijenata u dobi od 8 do 18 godina, uključujući njih 505 iz Klinike za oralnu i maksilofacijalnu radiologiju Stomatološkog fakulteta Sveučilišta zdravstvenih znanosti Gülhane i 404 iz Klinike za oralnu i maksilofacijalnu radiologiju Stomatološkog fakulteta Sveučilišta Antalya Bilim. Među tim pacijentima 53,4 % bile su žene i 46,6 % muškarci. Ortopantomografske slike procijenjene su retrospektivno kako bi se ispitala prevalencija nedostataka sjekutića, pretkutnjaka i trećih kutnjaka. Autori studije procjenjivali su agenezu trajnih zuba uspoređujući čimbenike kao što su dob, spol i zemljopisna regija. S obzirom na to da se formiranje zametka trećeg kutnjaka možda neće dogoditi u dobnoj skupini od 8 do 10 godina, ta je skupina isključena iz analize ageneze trećeg kutnjaka. Slijedom toga, podatci 593 pacijenta (304 žene i 289 muškaraca) uključeni su u taj dio istraživanja. U retrospektivnoj studiji provedenoj na panoramskim radiografijama, slike su neovisno pregledale i potvrdile dvije različite specijalistice oralne i maksilofacijalne radiologije.

The study was conducted following the principles outlined in the Helsinki Declaration and was granted ethical approval by the Health Sciences University Gülhane Scientific Research Ethics Committee in April 2024 (Decision Number: 2024-131; Meeting Number: 2024/04). Descriptive statistical methods were utilized for data analysis, and statistical evaluations were carried out using SPSS software (version 22.0; SPSS Inc., Chicago, IL, USA).

Results

Ageneza of incisor teeth

Among patients from the Central Anatolia region, 3.8% exhibited at least one missing incisor tooth. The prevalence of maxillary incisor hypodontia (3.2%) was higher compared to mandibular incisor hypodontia. No patients were reported with missing central incisors. A total of 19 patients (3.8%) had at least one missing lateral incisor, with a higher prevalence in females (57.1%) compared to males. Maxillary lateral incisor ageneza (3.2%) was more common than mandibular lateral incisor ageneza. The most frequently affected lateral incisors were, in descending order: the right maxillary lateral (12 patients), (Figure 1), the left maxillary lateral (9 patients), the right mandibular lateral (2 patients), and the left mandibular lateral (1 patient).

In the Mediterranean region, 0.7% of patients exhibited ageneza of at least one incisor tooth. Incisor ageneza was identified in only 3 patients, all of whom had missing upper lateral incisors. Notably, no male patients presented with incisor tooth deficiency.

Ageneza of premolar teeth

In the Central Anatolia region, 24 patients (4.8%) were found to have at least one missing premolar tooth. Although the number of females and males with premolar ageneza was equivalent, the prevalence was higher in males compared to females. Ageneza of mandibular premolars was more frequent than that of maxillary premolars. The left mandibular premolar was the most commonly affected, with a prevalence of 2.2% (11 patients).

In the Mediterranean region, the prevalence of ageneza of at least one premolar tooth was 2.7%. Females exhibited a higher prevalence (3.9%, affecting 8 patients) compared to males (1.5%, affecting 3 patients). Mandibular premolar ageneza was more common than maxillary ageneza. On a tooth-specific basis, the left mandibular second premolar was the most frequently affected, with 8 patients presenting with its absence. The right and left maxillary second premolars, (Figure 2), were each missing in an equal number of patients (4 patients each). No patients had ageneza of the first premolar.

Ageneza of third molar teeth

In the Central Anatolia region, 62 patients (18.7%) had at least one missing third molar tooth. More than half of these patients were female, totaling 38 individuals. The prevalence of third molar ageneza was higher in females (20.8%) compared to males (16.2%). Ageneza of maxillary third molars was more common than that of mandibular third molars. The most frequently missing third molar was the right maxillary

Istraživanje je provedeno u skladu s načelima navedenima u Helsinškoj deklaraciji i odobrio ga je Etički odbor za znanstvena istraživanja Sveučilišta zdravstvenih znanosti Gülhane u travnju 2024. (broj odluke: 2024.-131; broj sastanka: 2024./04). Za analizu podataka korištene su deskriptivne statističke metode, a statističke evaluacije provedene su u softveru SPSS (verzija 22.0; SPSS Inc., Chicago, IL, SAD).

Rezultati

Ageneza sjekutića

Među pacijentima iz središnje Anatolije njih 3,8 % bilo je barem bez jednog sjekutića. Prevalencija hipodontije gornjih sjekutića (3,2 %) bila je veća u usporedbi s hipodontijom donjih sjekutića. Nijedan pacijent nije prijavljen s nedostatkom središnjih sjekutića. Kod ukupno 19 pacijenata (3,8 %) zabilježena je hipodontija najmanje jednoga bočnog sjekutića, s većom prevalencijom kod žena (57,1 %) u odnosu prema muškarcima. Ageneza gornjega bočnog sjekutića (3,2 %) bila je češća nego ageneza donjega bočnog sjekutića. Najčešće zahvaćeni bočni sjekutići bili su, silaznim redoslijedom: gornji desni bočni (12 pacijenata) (slika 1.), gornji lijevi bočni (9 pacijenata), donji desni bočni (2 pacijenta) i donji lijevi bočni (1 pacijent).

U mediteranskoj regiji 0,7 % pacijenata imalo je agenezu barem jednoga sjekutića. Ageneza sjekutića identificirana je samo kod 3 pacijenta, a svima su nedostajali gornji bočni sjekutići. Zanimljivo je da nijednom muškom pacijentu nije nedostajao sjekutić.

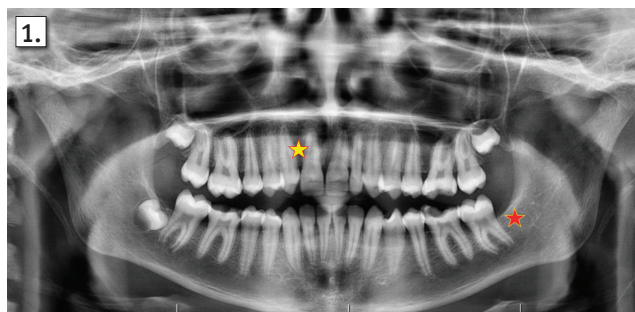
Ageneza pretkutnjaka

U središnjoj Anatoliji 24 pacijenta (4,8 %) nisu imala barem jedan pretkutnjak. Iako je broj žena i muškaraca s agenezom pretkutnjaka bio jednak, prevalencija je bila veća kod muškaraca u usporedbi sa ženama. Ageneza donjih pretkutnjaka bila je češća od ageneze gornjih pretkutnjaka. Donji lijevi pretkutnjak bio je najčešće zahvaćen, s prevalencijom od 2,2 % (11 pacijenata).

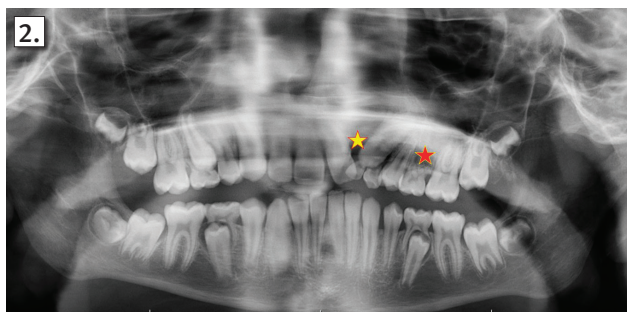
U mediteranskoj regiji prevalencija ageneze barem jednoga pretkutnjaka bila je 2,7 %. Žene su imale veću prevalenciju (3,9 %, zahvaćeno 8 pacijentica) u usporedbi s muškarcima (1,5 %, zahvaćena 3 pacijenta). Ageneza donjih pretkutnjaka bila je češća nego gornjih. Što se tiče zuba, najčešće je bio zahvaćen donji lijevi drugi pretkutnjak – nije ga imalo 8 pacijenata. Desni i lijevi gornji pretkutnjaci (slika 2.) nedostajali su jednakom broju pacijenata (svaki po 4 pacijenta). Nijedan pacijent nije imao agenezu prvog pretkutnjaka.

Ageneza trećeg kutnjaka

U središnjoj Anatoliji 62 pacijenta (18,7 %) bila su barem bez jednoga trećeg kutnjaka. Više od polovine tih pacijenata bile su žene, ukupno njih 38. Prevalencija ageneze trećeg kutnjaka bila je veća kod žena (20,8 %) u odnosu prema muškarcima (16,2 %). Ageneza gornjih trećih kutnjaka bila je češća od one donjih. Treći kutnjak koji je najčešće nedostajao bio je gornji desni treći kutnjak (43 pacijenta), za-



Slika 1. Ortopantomogram pokazuje agenezu gornjega desnog bočnog sjekutića (žuta zvijezda) i donjega lijevog trećeg kutnjaka (crvena zvijezda)
Figure 1 Orthopantomograph showing agenesia of right maxillary lateral tooth (yellow star) and agenesia of left mandibular third molar tooth (red star).



Slika 2. Ortopantomogram pokazuje agenezu gornjega lijevog bočnog sjekutića (žuta zvijezda) i gornjega lijevoga drugog pretkutnjaka (crvena zvijezda)
Figure 2 Orthopantomograph showing agenesia of left maxillary lateral tooth (yellow star) and agenesia of left maxillary second premolar tooth (red star)

third molar (43 patients), followed by the left maxillary third molar (39 patients), left mandibular third molar (26 patients) (Figure 1), and right mandibular third molar (25 patients).

In the Mediterranean region, 56 patients (21.4%) had agenesia of at least one third molar. The majority of these patients were male (57.1%, or 32 patients), indicating a higher prevalence in males compared to females. Agenesia of third molars was more common in the mandible (14.9%, affecting 39 patients) than in the maxilla (13%, affecting 34 patients). The most frequently missing third molars, in descending order, were the left mandibular (33 patients), right mandibular (40 patients), right maxillary (29 patients), and left maxillary (26 patients) (refer to Table 1).

In the analyzed patient data, the prevalence of incisor agenesia was 2.4%. The majority of affected patients were female (68.1%). All cases of incisor agenesia involved lateral incisors, with 86.3% occurring in the maxilla. The most frequently absent lateral incisor was the right maxillary lateral (14 patients), followed by the left maxillary lateral (12 patients), (Figure 2), right mandibular lateral (2 patients), and left mandibular lateral (1 patient).

The prevalence of premolar agenesia was 3.9%, with the majority of affected patients being female (57.1%). Agenesia was more common in the mandible (2.4%) compared to the maxilla (1.8%). The mandibular second premolar was the most frequently missing premolar tooth, affecting 19 patients.

The prevalence of third molar agenesia was 19.9% (118 patients). This condition was more prevalent in the maxilla (14.2%) compared to the mandible. The most commonly missing third molar was the right maxillary third molar, with 72 affected patients, (Table 2).

The prevalence of incisor and premolar agenesia was higher in the Central Anatolia region compared to the Mediterranean region, whereas the Mediterranean region exhibited a higher prevalence of third molar agenesia. In the Central Anatolia region, the most frequently missing incisor was the right maxillary lateral tooth, whereas in the Mediterranean region, it was the left maxillary lateral tooth. In both regions, the left mandibular premolar was the most commonly missing premolar, and the left maxillary third molar was the most frequently absent third molar.

tim gornji lijevi treći kutnjak (39 pacijenata), donji lijevi treći kutnjak (26 pacijenata) (slika 1.) i donji desni treći kutnjak (25 pacijenata).

U mediteranskoj regiji 56 pacijenata (21,4 %) imalo je agenezu najmanje jednoga trećeg kutnjaka. Većina su bili muškarci (57,1 %, ili 32 pacijenta), što upozorava na veću prevalenciju kod muškaraca u usporedbi sa ženama. Agenezu trećih kutnjaka bila je češća u donjoj čeljusti (14,9 %, 39 pacijenata) nego u gornjoj (13 %, 34 pacijenta). Treći kutnjaci koji su najčešće nedostajali, prema silaznom redoslijedu, bili su donji lijevi (33 pacijenta), donji desni (40 pacijenata), gornji desni (29 pacijenata) i gornji lijevi (26 pacijenata) (tablica 1.).

U analiziranim podacima pacijenata, prevalencija ageneze sjekutića bila je 2,4 %. Većina su bile žene (68,1 %). Svi slučajevi ageneze sjekutića uključivali su bočne sjekutiće, a 86,3 % gornje. Najčešće je nedostajao gornji desni bočni sjekutić (14 pacijenata), zatim gornji lijevi bočni (12 pacijenata) (slika 2.), donji desni bočni (2 pacijenta) i donji lijevi bočni (1 pacijent).

Prevalencija ageneze pretkutnjaka bila je 3,9 %, a većina pacijenata bile su žene (57,1 %). Agenezu je bila češća u mandibuli (2,4 %) u usporedbi s maksilom (1,8 %). Donji drugi pretkutnjak bio je pretkutnjak koji je najčešće nedostajao (19 pacijenata).

Prevalencija ageneze trećeg kutnjaka bila je 19,9 % (118 pacijenata). To stanje bilo je češće u gornjoj čeljusti (14,2 %) u usporedbi s donjom. Treći kutnjak koji je najčešće nedostajao bio je gornji desni treći kutnjak. Nisu ga imala 72 pacijenta (tablica 2.).

Prevalencija ageneze sjekutića i pretkutnjaka bila je veća u središnjoj Anatoliji u usporedbi s mediteranskom regijom, a mediteranska regija imala je veću prevalenciju ageneze trećeg kutnjaka. U središnjoj Anatoliji sjekutić koji je najčešće nedostajao bio je gornji desni bočni sjekutić, a u mediteranskoj regiji to je bio gornji lijevi bočni sjekutić. U obje regije, od pretkutnjaka najčešće je nedostajao donji lijevi pretkutnjak, a od kutnjaka gornji lijevi treći kutnjak.

Table 1 The prevalence of patients with agenesis of incisors, premolars and third molars in the Central Anatolia Region and the Mediterranean Region.**Tablica 1.** Prevalencija pacijenata s agenezom sjekutića, pretkutnjaka i trećih kutnjaka u regijama Središnje Anatolije i Mediterana

The prevalence of patients with agenesis of incisors • Prevalencija pacijenata s agenezom sjekutića	The Central Anatolia Region • Regija središnje Anatolije			The Mediterranean Region • Mediteranska regija		
	Female • Ženski	Male • Muški	Total • Ukupno	Female • Ženski	Male • Muški	Total • Ukupno
Incisor agenesis • Ageneza sjekutića	12 (4.3%)	7 (3.1%)	19 (3.8%)	3 (1.4%)	-	3 (0.7%)
Maxillary incisor agenesis • Ageneza gornjeg sjekutića	11 (3.9%)	5 (2.2%)	16 (3.2%)	3 (1.4%)	-	3 (0.7%)
Mandibular incisor agenesis • Ageneza donjeg sjekutića	1 (0.4%)	2 (0.9%)	3 (0.6%)	-	-	-
Central agenesis • Ageneza središnjeg sjekutića	-	-	-	-	-	-
Lateral agenesis • Ageneza bočnog sjekutića	12 (4.3%)	7 (3.1%)	19 (3.8%)	3 (1.4%)	-	3 (0.7%)
Maxillary central agenesis • Ageneza gornjega središnjeg sjekutića	-	-	-	-	-	-
Maxillary lateral agenesis • Ageneza gornjega bočnog sjekutića	11 (3.9%)	5 (2.2%)	16 (3.2%)	3 (1.4%)	-	3 (0.7%)
Mandibular central agenesis • Ageneza donjega središnjeg sjekutića	-	-	-	-	-	-
Mandibular lateral agenesis • Ageneza donjega bočnog sjekutića	1 (0.4%)	2 (0.9%)	3 (0.6%)	-	-	-
Agenesis of premolars • Ageneza pretkutnjaka						
Premolar agenesis • Ageneza pretkutnjaka	57 (59.4%)	41 (52.6%)	98 (56.3%)	8 (3.9%)	3 (1.5%)	11 (2.7%)
Maxillary premolar agenesis • Ageneza gornjega pretkutnjaka	54 (56.3%)	39 (50%)	93 (53.4%)	3 (1.4%)	1 (0.5%)	4 (1%)
Mandibular premolar agenesis • Ageneza donjega pretkutnjaka	36 (37.5%)	24 (30.8%)	60 (34.5%)	6 (2.9%)	2 (1%)	8 (2%)
Agenesis of third molars • Ageneza trećih kutnjaka						
Third molar agenesis • Ageneza trećeg kutnjaka	38 (20.8%)	24 (16.2%)	62 (18.7%)	24 (19.8%)	32 (22.7%)	56 (21.4%)
Maxillary third molar agenesis • Ageneza gornjega trećeg kutnjaka	30 (16.4%)	20 (13.5%)	50 (15.1%)	16 (13.2%)	18 (12.8%)	34 (13%)
Mandibular third molar agenesis • Ageneza donjega trećeg kutnjaka	18 (9.8%)	11 (7.4%)	29 (8.8%)	16 (13.2%)	23 (16.3%)	39 (14.9%)

Table 2 The prevalence of patients with agenesis of incisors, premolars and third molars.**Tablica 2.** Prevalencija pacijenata s agenezom sjekutića, pretkutnjaka i trećih kutnjaka

The prevalence of patients with agenesis of incisors • Prevalencija bolesnika s agenezom sjekutića	Female • Ženski	Male • Muški	Total • Ukupno
Incisor agenesis • Ageneza sjekutića	15 (3.1%)	7 (1.7%)	22 (2.4%)
Maxillary incisor agenesis • Agenezija gornjeg sjekutića	14 (2.9%)	5 (1.2%)	19 (2.1%)
Mandibular incisor agenesis • Ageneza donjeg sjekutića	1 (0.2%)	2 (0.5%)	3 (0.3%)
Central agenesis • Ageneza središnjeg sjekutića	-	-	-
Lateral agenesis • Ageneza bočnog sjekutića	15 (3.1%)	7 (1.7%)	22 (2.4%)
Maxillary central agenesis • Ageneza gornjega središnjeg sjekutića	-	-	-
Maxillary lateral agenesis • Ageneza donjega središnjeg sjekutića	14 (2.9%)	5 (1.2%)	19 (2.1%)
Mandibular central agenesis • Ageneza donjega središnjeg sjekutića	-	-	-
Mandibular lateral agenesis • Ageneza donjega bočnog sjekutića	1 (0.2%)	2 (0.5%)	3 (0.3%)
Agenesis of premolars • Ageneza pretkutnjaka			
Premolar agenesis • Ageneza pretkutnjaka	20 (4.1%)	15 (3.5%)	35 (3.9%)
Maxillary premolar agenesis • Ageneza gornjeg pretkutnjaka	7 (1.4%)	9 (2.1%)	16 (1.8%)
Mandibular premolar agenesis • Ageneza donjeg pretkutnjaka	15 (3.1%)	7 (1.7%)	22 (2.4%)
Agenesis of third molars • Ageneza trećeg kutnjaka			
Third molar agenesis • Ageneza trećeg kutnjaka	62 (20.4%)	56 (19.4%)	118 (19.9%)
Maxillary third molar agenesis • Ageneza gornjega trećeg kutnjaka	46 (15.1%)	38 (13.1%)	84 (14.2%)
Mandibular third molar agenesis • Ageneza donjega trećeg kutnjaka	34 (11.2%)	34 (11.8%)	68 (11.5%)

Discussion

The prevalence of incisor agenesis

In our study, the prevalence of incisor agenesis was 2.4%, with a notable majority of affected patients being female (68.1%). Our results were consistent with those of other studies, which reported a prevalence range of 1.6% to 7.5% in various populations (2,9,10*). All cases of incisor agenesis involved lateral incisors, and 86.3% of these were located in the maxilla. This similar findings from studies like Arte et al. (2001) and Meistere et al. (2024), which also identified the maxillary lateral incisor as the most commonly missing tooth in cases of incisor agenesis (11,12).

The most commonly missing lateral incisor was the right maxillary lateral (14 patients), followed by the left maxillary lateral (12 patients). Mandibular lateral incisors were less frequently missing, with only three cases reported (right: 2 patients; left: 1 patient). In a comparable study carried out in the Central Black Sea region among individuals aged 15-60, the prevalence of mandibular incisor agenesis was reported to be 1.1% (12). These findings are consistent with previous research, which suggests a higher prevalence of agenesis in maxillary lateral incisors compared to other incisors, likely due to the complex developmental processes associated with these teeth (2, 13).

The prevalence of premolar agenesis

The prevalence of premolar agenesis was found to be 3.9%, with a slightly higher proportion of female patients (57.1%). Notably, the prevalence of missing premolars was higher in the mandible (2.4%) compared to the maxilla, a finding supported by Schalk-van der Weide et al. This mandibular predilection may have implications for occlusal harmony and treatment planning, as mandibular premolars play a pivotal role in maintaining posterior arch stability (22). The mandibular second premolar was the most frequently absent premolar, affecting 19 patients. This finding is consistent with the existing literature, which often identified the mandibular second premolar as one of the most common sites of tooth agenesis (10,14). The higher prevalence of mandibular premolar agenesis may be attributed to the distinct embryological development pathways of mandibular teeth (5). No comparable study on premolar agenesis has been identified in Turkey.

The prevalence of third molar agenesis

Third molar agenesis was the most prevalent type of tooth agenesis, affecting 19.9% of patients (118 individuals). In another similar study conducted in Turkey among patients aged 14-18, the prevalence of third molar agenesis was found to be 11.79% (16). In a similar study conducted in patients aged 10-14 in Erzincan province of Turkey, the prevalence of third molar agenesis was found to be 35.6% (17). The prevalence of third molar agenesis was significantly more common in the maxilla (14.2%) compared to the mandible in our study. Similar results were observed in the study conducted by Karaca et al (17). The right maxillary third molar was the most frequently missing, with 72 patients affected. This high prevalence of third molar agenesis is con-

Rasprava

Prevalencija ageneze sjekutića

U našem istraživanju prevalencija ageneze sjekutića bila je 2,4 %, pri čemu su zamjetnu većinu zahvaćenih pacijenata činile žene (68,1 %). Naši rezultati bili su u skladu s onima iz drugih istraživanja u kojima su autori izvijestili o rasponu prevalencije od 1,6 % do 7,5 % u različitim populacijama (2, 9, 10*). Svi slučajevi ageneze sjekutića uključivali su bočne sjekutiće, a 86,3 % njih bilo je smješteno u gornjoj čeljusti. Nalazi su slični onima iz studija poput onih Artea i suradnika (2001.) i Meistera i suradnika (2024.) koji su također identificirali gornji bočni sjekutić kao zub koji najčešće nedostaje u slučaju ageneze sjekutića (11, 12).

Najčešće je nedostajao gornji desni bočni sjekutić (14 pacijenata), a zatim gornji lijevi bočni (12 pacijenata). Donji bočni sjekutići rjeđe su nedostajali – prijavljena su samo tri slučaja (desno: 2 pacijenta; lijevo: 1 pacijent). U usporedivoj studiji provedenoj u regiji Srednjega Crnog mora među pojedincima u dobi od 15 do 60 godina, prijavljena je prevalencija ageneze donjih sjekutića od 1,1 % (12). Ti su nalazi u skladu s prijašnjim istraživanjima u kojima se sugerira veća prevalencija ageneze gornjih bočnih sjekutića u usporedbi s ostalim sjekutićima, vjerojatno zbog složenih razvojnih procesa povezanih s tim zubima (2, 13).

Prevalencija ageneze pretkutnjaka

Utvrđena je prevalencija ageneze pretkutnjaka od 3,9 %, s nešto većim udjelom pacijentica (57,1 %). Uočeno je da je prevalencija nedostajućih pretkutnjaka bila veća u donjoj čeljusti (2,4 %) u usporedbi s gornjom čeljusti, a nalaz podupiru Schalk van der Weide i suradnici. Ta predilekcija u donjoj čeljusti može imati implikacije na okluzalni sklad i planiranje liječenja s obzirom na to da su donji pretkutnjaci ključni u održavanju stabilnosti stražnjega luka (22). Drugi pretkutnjak donje čeljusti najčešće je nedostajao kad je riječ o pretkutnjacima – bez njega je bilo 19 pacijenata. Taj je nalaz u skladu s postojećom literaturom koja često identificira drugi donji pretkutnjak kao jedno od najčešćih mjesta ageneze zuba (10, 14). Veća učestalost ageneze donjih pretkutnjaka može se pripisati različitom embriološkom razvoju zuba mandibule (5). U Turskoj nema usporedivog istraživanja o agenezi pretkutnjaka.

Prevalencija ageneze trećih kutnjaka

Ageneza trećeg kutnjaka bila je najčešća vrsta ageneze zuba koja je zahvaćala 19,9 % pacijenata (118 osoba). U drugom sličnom istraživanju provedenom u Turskoj među pacijentima u dobi od 14 do 18 godina ustanovljeno je da je prevalencija ageneze trećeg kutnjaka 11,79 % (16). U sličnom istraživanju na pacijentima u dobi od 10 do 14 godina u pokrajini Erzincan u Turskoj, utvrđeno je da je prevalencija ageneze trećeg kutnjaka 35,6 % (17). Prevalencija ageneze trećeg kutnjaka bila je znatno češća u maksili (14,2 %) u usporedbi s mandibulom u našem istraživanju. Slični rezultati zabilježeni su u istraživanju koje su proveli Karaca i suradnici (17). Gornji desni treći kutnjak najčešće je nedostajao kod 72 pacijenta. Ta visoka prevalencija ageneze trećeg kutnjaka

sistent with trends observed in various populations, where third molars are often the most commonly absent teeth. The increased incidence of agenesis in third molars may be attributed to developmental variability and evolutionary reduction of these teeth (18,19).

Our study identified a higher prevalence of tooth agenesis in females for both incisors and premolars. This is consistent with previous research, such as the study by Nikolov Borić et al. (20). This gender disparity is consistent with previous research and suggests that genetic or hormonal factors may contribute to the increased susceptibility of females to tooth agenesis (21, 22). The prevalence of missing teeth in dental agenesis based on gender, age, and region offers numerous benefits for research, clinical practice, and public health planning. It helps identify prevalence rates and risk groups. Gender differences may provide insights into genetic factors, while regional variations highlight the influence of environmental factors. Age-based data support optimal treatment timing and early intervention during growth and development.

While the percentages are low (0.9%, 1.4% etc.), their significance cannot be dismissed. They are less likely to affect general clinical practice but are crucial for specific populations, advancing diagnostic and therapeutic approaches, and informing public health strategies. In addition, high prevalences (such as 59.4%) may be significant. Clinicians should be aware that this condition may be encountered more frequently and health systems should be prepared for the increased need for treatments. It also highlights the importance of investigating the underlying causes and preventive strategies to reduce the burden on health systems.

The findings of this study have notable clinical implications for the diagnosis and management of tooth agenesis. Understanding the prevalence and distribution patterns of missing teeth is crucial for early detection and effective treatment planning. For example, the high prevalence of agenesis in maxillary lateral incisors and mandibular second premolars underscore the need for targeted screening and intervention for these frequently affected sites. Moreover, the significant prevalence of third molar agenesis emphasizes the importance of routine evaluation of third molar development in dental practice (23).

This study investigated the prevalence of tooth agenesis, specifically focusing on incisors, premolars, and third molars. The results identified significant patterns in the prevalence and distribution of missing teeth, providing valuable insights into the epidemiology of this dental anomaly. There are differences in genetic, environmental, nutritional, socioeconomic and cultural factors between the Central Anatolia and Mediterranean regions. Since we think that these differences may have an effect on the prevalence of dental agenesis, the difference between the two regions were evaluated in our study.

Our study has several limitations. First, the sample size was relatively small, which may limit the generalizability of our findings to broader populations. Second, our research was based on cross-sectional data. This restricts our ability to draw conclusions about the long-term impact of tooth loss on oral health and treatment outcomes. Third, our study did not

u skladu je s trendovima uočenima u različitim populacijama u kojima treći kutnjaci najčešće nedostaju. Povećana učestalost ageneze trećih kutnjaka može se pripisati razvojnoj varijabilnosti i evolucijskom smanjenju tih zuba (18, 19).

U našem istraživanju utvrđena je veća prevalencija ageneze zuba kod žena i kad je riječ o sjekutićima i pretkutnjacima. To je u skladu s dosadašnjim istraživanjima, poput studije Nikolov Borića i suradnika (20). Ta spolna razlika u skladu je s dosadašnjim istraživanjima i sugerira da genetski ili hormonalni čimbenici mogu pridonijeti povećanoj osjetljivosti žena na starenje zuba (21, 22). Prevalencija nedostatka zuba u dentalnoj agenezi na temelju spola, dobi i regije nudi mnogobrojne prednosti kad je riječ o istraživanju, kliničkoj praksi i planiranju javnoga zdravlja. Pomaže identificirati stope prevalencije i rizične skupine. Spolne razlike mogu dati uvid u genetske čimbenike, a regionalne varijacije ističu utjecaj okolišnih čimbenika. Podatci temeljeni na dobi podupiru optimalno vrijeme liječenja i ranu intervenciju tijekom rasta i razvoja.

Iako su postotci niski (0,9 %, 1,4 % itd.), njihovo se značenje ne može odbaciti. Manje je vjerojatno da će utjecati na opću kliničku praksu, ali su ključni za specifične populacije zato što unaprijeđuju dijagnostičke i terapijske pristupe i informiraju strategije javnoga zdravstva. Osim toga, visoka prevalencija (kao što je 59,4 %) može biti značajna. Kliničari bi trebali biti svjesni da se to stanje može češće pojavljivati pa zdravstveni sustavi trebaju biti spremni na povećanu potrebu za liječenjem. Također ističe važnost istraživanja temeljnih uzroka i preventivnih strategija za smanjenje opterećenja zdravstvenih sustava.

Nalazi iz ovog istraživanja imaju značajne kliničke implikacije za dijagnozu i liječenje ageneze zuba. Razumijevanje prevalencije i distribucija obrazaca, kad je riječ o nedostatku zuba, ključni su za rano otkrivanje i učinkovito planiranje liječenja. Na primjer, visoka prevalencija ageneze gornjih bočnih sjekutića i drugih donjih pretkutnjaka ističe potrebu za ciljanim pregledom i intervencijom na tim često zahvaćenim mjestima. Štoviše, značajna prevalencija ageneze trećega kutnjaka ističe koliko je važna rutinska procjena razvoja trećeg kutnjaka u stomatološkoj praksi (23).

Autori ove studije istraživali su prevalenciju ageneze zuba, posebno se fokusirajući na sjekutiće, pretkutnjake i treće kutnjake. Rezultati su pokazali značajne obrasce u prevalenciji i distribuciji zuba koji nedostaju i omogućili su vrijedan uvid u epidemiologiju te dentalne anomalije. Postoje razlike u genetskim, okolišnim, prehrambenim, socioekonomskim i kulturnim čimbenicima između središnje Anatolije i mediteranskih regija. Budući da smatramo da bi te razlike mogle utjecati na prevalenciju dentalne ageneze, u našem su istraživanju procijenjene razlike između dviju regija.

Naše istraživanje ima nekoliko ograničenja. Prvo, veličina uzorka bila je razmjerno mala, što može ograničiti generalizaciju nalaza na širu populaciju. Drugo, naše se istraživanje temeljilo na presječnim podacima. To ograničava našu sposobnost u donošenju zaključaka o dugoročnom utjecaju gubitka zuba na oralno zdravlje i ishode liječenja. Treće, naše istraživanje nije uključivalo genetsku analizu. Uključiva-

include genetic analysis. Incorporating genetic data would enhance our understanding of the underlying etiological factors contributing to tooth loss.

Conclusions

In conclusion, this study presents a comprehensive examination of the prevalence and distribution of dental agenesis, with particular emphasis on incisors, premolars, and third molars. The findings underscore the importance of considering gender differences and specific tooth locations when diagnosing and managing tooth agenesis. When all these factors are considered, this study can serve as a preliminary work that will contribute to conducting a comprehensive epidemiological study covering the entirety of Turkey.

Conflict of interest: There is no conflict of interest in our study.

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nje genetskih podataka poboljšalo bi razumijevanje temeljnih etioloških čimbenika koji pridonose gubitku zuba.

Zaključci

Zaključno, ova studija zapravo je opsežno istraživanje prevalencije i distribucije dentalne ageneze, s posebnim naglaskom na sjekutiće, pretkutnjake i treće kutnjake. Nalazi ističu koliko je važno uzeti u obzir spolne razlike i specifične položaje zuba pri dijagnosticiranju i liječenju ageneze zuba. Kada se uzmu u obzir svi ti čimbenici, ovo istraživanje može poslužiti kao preliminarni rad koji će pridonijeti provođenju opsežne epidemiološke studije koja bi obuhvatila cijelu Tursku.

Sukob interesa: Autori nisu bili u sukobu interesa.

Doprinos autora: N.O., Ş.A., S.E.K. – konceptualizacija i dizajn; A.A.B, H.P.Ö. – pregled literature; N.O., Ş.A., S.E.K. – metodologija i validacija; Ş.A. – formalna analiza; A.A.B; H.P.Ö – priprema izvornog nacrt; H.A.Ö – recenzija i montaža; H.A.Ö., E.T., G.A., I.Ç.I. - nadzor

Sažetak

Svrha rada: Dentalna ageneza odnosi se na nedostatak jednoga ili više zuba, a pojavljuje se i u mliječnoj i u trajnoj denticiji. Kako utječe na funkcionalne aspekte denticije kao što su žvakanje i govor, može se pojaviti nekoliko komplikacija. Cilj ovog istraživanja bio je procijeniti prevalenciju ageneze trajnih sjekutića, pretkutnjaka i trećih kutnjaka pacijenata u dobi od 8 do 18 godina, a uspoređivana je prema dobi, spolu i regijama u kojima ispitanici žive. **Materijali i metode:** Ovo istraživanje provedeno u središnjoj Anatoliji i u sredozemnim regijama Turske. Obuhvaća podatke o 593 pacijenta – 304 žene i 289 muškarca. Istraživanje je uključivalo retrospektivnu procjenu ortopantomografskih slika pacijenata. Za analizu je korištena deskriptivna statistika. **Rezultati:** U istraživanju je prevalencija ageneze sjekutića među svim pacijentima bila 2,4 %. Ageneza pretkutnjaka iznosila je 3,9 %, pri čemu je najčešće nedostajao drugi donji pretkutnjak (19 pacijenata). Prevalencija ageneze trećeg kutnjaka bila je 19,9 % (118 pacijenata). Ageneza sjekutića i pretkutnjaka bila je češća u središnjoj Anatoliji nego u mediteranskoj regiji, a ageneza trećeg kutnjaka bila je zastupljenija u području Mediterana. U obje regije donji lijevi pretkutnjak bio je pretkutnjak koji je najčešće nedostajao, a gornji lijevi umnjak bio je kutnjak koji je najčešće nedostajao. **Zaključak:** Ovo istraživanje temeljita je analiza prevalencije i distribucije ageneze zuba, s posebnim fokusom na sjekutiće, pretkutnjake i treće kutnjake. Prema dobivenim rezultatima prijedok je potrebno uzeti u obzir spolne razlike i specifični položaj zuba u dijagnostičkom i terapijskom pristupu agenezi.

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Adresa za dopisivanje

Hüseyin Aykut ÖZYİĞİT
University of Kyrenia, Faculty of
Dentistry
Şehit Yahya Bakır Sok.
Karakum, Kyrenia, Cyprus
aykut.ozyigit@kyrenia.edu.tr

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