

Rebeca Ayala Sola¹, Pablo Ayala Sola², Javier De La Cruz Pérez³, Iván Nieto Sánchez³, Inés Díaz Renovales³

Prevalencija hipodoncije u uzorku španjolskih stomatoloških pacijenata

Prevalence of Hypodontia in a Sample of Spanish Dental Patients

¹ Student magistarskog studija – Zavod za ortodontiju Sveučilišta Alfonsa X. El Sabija, Madrid, Španjolska
Master's Student, Department of Orthodontics, University Alfonso X El Sabio, Madrid, Spain

² Specijalizant oralne i maksilofacijalne kirurgije – Complejo hospitalario de Navarra, Pamplona, Španjolska
Oral and Maxillofacial Trainee Surgeon, Complejo Hospitalario De Navarra, Pamplona, Spain

³ Zavod za ortodontiju Sveučilišta Alfonsa X. El Sabija Madrid, Španjolska
Department of Orthodontics, University Alfonso X El Sabio, Madrid, Spain

Sažetak

Svrha rada: Ovim retrospektivnim istraživanjem željela se procijeniti prevalencija hipodoncije u uzorku stomatoloških pacijenata u dobi između sedam i jedanaest godina na Sveučilištu Alfonsa X. Mudroga (El Sabio) u Madridu (Španjolska). **Materijali i metode:** Broj slučajeva s hipodoncijom i najčešće zahvaćeni zubi analizirani su na temelju 2500 panoramskih snimaka na slučajnom uzorku stomatoloških pacijenata koji se sastojao od 1235 ispitanica i 1265 ispitanika. Bili su podijeljeni prema dobi, vrsti hipodoncije (nedostatak jednog ili više zuba), strani gdje se nalazi te kvadrantu u gornjoj ili u donjoj čeljusti. Hi-kvadrat test ($P < 0,05$) korišten je za usporedbu razlika u agenezi kod muškaraca i žena. **Rezultati:** Uzorak od 2500 uključenih pacijenata činilo je 1235 ispitanica – od kojih 41 s hipodoncijom (3,31 %) i 1265 ispitanika – kod njih 46 nedostajao je barem jedan zubni zametak (3,63 %). Između spolova nije bilo statistički značajne razlike u hipodonciji ($p > 0,05$). **Zaključak:** Postotak ageneze zuba kod 2500 uključenih pacijenata iznosio je 3,48 %.

Zaprimljen: 19. srpnja 2017.
Prihvaćen: 30. siječnja 2018.

Adresa za dopisivanje
Rebeca Ayala Sola
University Alfonso X El Sabio
Department of Orthodontics
Madrid, Spain
rebeca.ayala.sola@gmail.com

Ključne riječi
anodoncija; hipodoncija; denticija; prirođene anomalije

Uvod

Hipodoncija je kongenitalni nedostatak zuba ili kongenitalna dentalna ageneza. To je jedna od najčešćih anomalija koja može nepovoljno utjecati na estetiku i funkciju. Posljedica je poremećaja u ranim fazama razvoja (1).

Etiologija hipodoncije je multifaktorska. Najzastupljenija teorija upućuje na poligeni način nasljeđivanja, s genima i okolišnim čimbenicima koji utječu na fenotipsku ekspresiju uključenih gena (2). U našem istraživanju hipodoncija je procijenjena na temelju panoramskih rendgenskih snimaka kao, uostalom, i u mnogim drugim istraživanjima (3, 4). Može se reći da se kod različitih autora uočava velika varijabilnost podataka o postotku prevalencije hipodoncije, a kreće se u rasponu od 4,28 do 8,5 posto (5, 6, 7).

Najčešće su zahvaćeni drugi donji pretkutnjaci, a slijede gornji bočni sjekutići ili drugi gornji pretkutnjaci (8). Prema spolu hipodoncija je češća kod žena (9,10).

Svrha ovog istraživanja bila je procijeniti prevalenciju hipodoncije na uzorku djece od sedam do jedanaest godina na madridskom Sveučilištu Alfonsa X. Mudroga.

Introduction

Hypodontia is a congenital absence of teeth or congenital dental aplasia. It is one of the most common dental anomalies, which can adversely affect both aesthetics and function. It is one of the results of alterations during the early stages of development (1).

The etiology of hypodontia is multifactorial. The most supported theory suggests a polygenic mode of inheritance, with genes and environmental factors that exert some influence on the phenotypic expression of the genes involved (2). The hypodontia, in our study, was evaluated from panoramic radiographs as in many other studies (3, 4). It can be said that there is great variability in the figures obtained regarding the percentage of prevalence of hypodontia by different authors ranging from 4.28% to 8.5 % (5, 6, 7).

The most frequently affected teeth are the second lower premolars, followed by the upper lateral incisors or the upper second premolars (8). Based on gender, hypodontia is more frequent in women (9, 10).

This study aimed to evaluate the prevalence of hypodontia in a sample of children aged 7–11 at the University Alfonso X el Sabio (Madrid).

Materijali i metode

Općenito, svrha ovog retrospektivnog istraživanja bila je procijeniti prevalenciju hipodontije kod 2500 djece u dobi između sedam i jedanaest godina, što je uključivalo 500 sedmogodišnjih pacijenata – 247 djevojčica i 253 dječaka; 500 osmogodišnjih pacijenata – 242 djevojčice i 258 dječaka; 500 devetogodišnjih pacijenata – 232 djevojčice i 268 dječaka; 500 desetogodišnjih pacijenata – 249 djevojčica i 251 dječak; i konačno 500 jedanaestogodišnjih pacijenata – 265 djevojčica i 235 dječaka. Panoramske rendgenske snimke unatrag deset godina odabrane su slučajno.

Primijenjeni su sljedeći kriteriji za uključivanje: pacijenti rođeni između 2004. i 2009., pacijenti Sveučilišne klinike Sveučilišta Alfonsa X. Mudroga između 2014. i 2016. godine, pacijenti s panoramskim rendgenskim snimkama i oni bez povijesti gubitka zuba zbog karijesa ili traume.

Kriteriji za isključivanje iz istraživanja bili su sljedeći: pacijenti s kraniofacijalnim sindromima ili razvojnim poremećajima, oni s poviješću vađenja zuba prema dokumentaciji, ili oni bez panoramskih rendgenskih snimaka te loše rendgenske snimke.

U istraživanju su analizirani spol, zubi, čeljust i strana na kojoj je ageneza bila češća kod uključenih pacijenata u dobi od sedam do jedanaest godina. Razlike su analizirane s pomoću testa χ^2 ili Fisherova testa. Statistička analiza obav-

Materials and methods

The main objective of this retrospective study was to evaluate the prevalence of hypodontia in 2500 children between seven and eleven years of age, which included 500 seven-year-old patients, out of which 247 were females and 253 males; 500 eight-year-old patients, out of which 242 were females and 258 males; 500 nine-year-old patients, 232 of whom were females and 268 males; 500 ten-year-old patients, out of which 249 were females and 251 males; and finally 500 eleven-year-old patients, of which 265 were females and 235 males. The panoramic radiographs which were less than 10 years old were randomly evaluated according to the following criteria:

The following were the inclusion criteria: patients born between the years 2004–2009, current patients of the university clinic of the Alfonso X El Sabio University who were being treated between 2014–2016, patients with panoramic radiography performed at the Alfonso X El Sabio University, and patients with no history of extractions because of decay or dental trauma.

The following were the exclusion criteria: patients with craniofacial syndromes or developmental disorders, patients with a history of extractions according to dental records, patients without panoramic x-ray taken at Alfonso X El Sabio University, and radiographs in poor condition.

Tablica 1. Učestalost nedostatka zametka po zubu
Table 1 Prevalence of dental agenesis per tooth

Zub • Tooth	Ageneza • Dental agenesis (n)	%
17	0	0
16	0	0
15	16	0.64
14	1	0.04
13	0	0
12	20	0.8
11	1	0.04
21	0	0.04
22	20	0,8
23	0	0
24	1	0.08
25	15	0.6
26	0	0
27	0	0
37	0	0
36	0	0
35	29	1.16
34	2	0.08
33	1	0.04
32	5	0.2
31	3	0.12
41	3	0.12
42	3	0.12
43	1	0,04
44	2	0.08
45	20	0.8
46	0	0
47	0	0

ljena je softverom SPSS za Windowse (verzija 20, IBM, Armonk, NY).

Istraživanje je realizirano na sveučilišnoj klinici Sveučilišta Alfonsa X. Mudroga u Madridu.

Rendgenske snimke analizirao je isti istraživač. Zbog prirode istraživanja nije bilo potrebno etičko odobrenje.

Rezultati

Uzorak od 2500 uključenih pacijenata činilo je 1235 djevojčica, od kojih 41 s hipodoncijom (3,31 %) i 1265 dječaka – njih 46 imalo je agenezu najmanje jednog zuba (3,63 %).

Nije bilo značajne razlike u incidenciji hipodoncije između ispitanika i ispitanica ($p > 0,05$).

Četrdeset pacijenata (1,6 %) imalo je agenezu u gornjoj čeljusti, 39 (1,56 %) u donjoj i devet (0,36 %) u objema; nisu pronađene statistički značajne razlike između gornje i donje čeljusti ($p > 0,05$). Češće je zabilježena hipodoncija u jednoj čeljusti negoli u objema ($p < 0,0001$). Ukupno 56 pacijenata (2,24 %) imalo je jednostranu hipodonciju, a 43 (1,72 %) obostranu, no razlika nije bila statistički značajna ($p > 0,05$). Ukupno 48 pacijenata (1,92 %) imalo je agenezu jednog zuba, a 40 (1,6 %) višestruku. Ni ta razlika nije bila statistički značajna ($p > 0,05$). Tablica 1. pokazuje da su zubi najčešće pogođeni agenezom drugi donji pretkutnjaci, a slijede gornji bočni sjekutići. Nije pronađena hipodoncija prvih gornjih i donjih kutnjaka, drugih gornjih i donjih kutnjaka te donjih očnjaka.

U ovom istraživanju nije pronađena dentalna ageneza u mliječnoj denticiji.

Rasprava

Hipodoncija je predmet istraživanja na mnogim sveučilištima i u mnogim specijaliziranim klinikama jer je to vrlo česta anomalija kod ljudi. U ovom istraživanju postoje i neka ograničenja, kao što je činjenica da nismo uzeli u obzir etničku pripadnost svakog pacijenta jer u mnogim radovima pronađenima u literaturi uspoređuju se razlike u prevalenciji hipodoncije između rasa (11). Iz našeg istraživanja također su bili isključeni pacijenti sa sindromima, zbog čega smo ostali zakinuti za informaciju o prevalenciji hipodoncije u takvim slučajevima, što je zanimljivo pitanje za buduća istraživanja (12).

Nismo uzeli u obzir prevalenciju hipodoncije trećih kutnjaka, uglavnom zbog dobi pacijenata; prevalencija hipodoncije bez trećih kutnjaka bila je 6,2 posto (ispitanice 8 % i ispitanici 4,2 %) prema Abedu Al Jawadu (13), a u jednom drugom istraživanju iznosila je 9,7 posto (14). U oba slučaja postotci su veći od naših rezultata koji su pokazali prevalenciju od 3,48 posto, točnije 3,63 posto kod dječaka i 3,31 posto kod djevojčica, a također su bili isključeni treći kutnjaci.

U ostalim istraživanjima koja se nalaze u literaturi, hipodoncija je češća kad je riječ o ženama, iako razlike prema spolu nisu statistički značajne (15, 16).

The study evaluated the teeth, the maxilla, the side and the gender where agenesis is more prevalent among the studied patients aged seven to eleven. The differences in the proportions were analyzed in contingency tables by means of the χ^2 statistics, or the Fisher's exact test. Statistical analyses were performed using SPSS software for Windows (version 20; IBM, Armonk, NY).

The study was performed at the university clinic of the University Alfonso X El Sabio located in Madrid.

X-rays were evaluated by the same operator (RAS). No ethical approval was considered to be necessary because of the nature of the study.

Results

The sample of 2500 patients studied consisted of 1235 females, out of which 41 presented hypodontia (3.31%) and 1265 males, out of which 46 had at least a dental agenesis (3.63%).

There was no significant difference in proportion of hypodontia between males and females ($p > 0.05$).

40 patients (1.6%) had agenesis on the upper quadrants, 39 (1.56%) on the lower and 9 (0.36%) on both; no differences were found between upper and lower ($p > 0.05$); there was a higher proportion of hypodontia in only one jaw than in both jaws ($p < 0.0001$). 56 patients (2.24%) had unilateral hypodontia and 43 of them had (1.72%) bilateral, but the difference was not significant ($p > 0.05$). 48 (1.92%) patients had single agenesis, whereas 40 (1.6%) had multiple agenesis. Again, the difference was not significant ($p > 0.05$). Table 1 shows that the teeth more affected by agenesis were lower second premolars, followed by upper lateral incisor. No hypodontia of the upper and lower first molars, upper and lower second molars, and lower canines has been found.

In this study, no dental agenesis was found in temporary dentition.

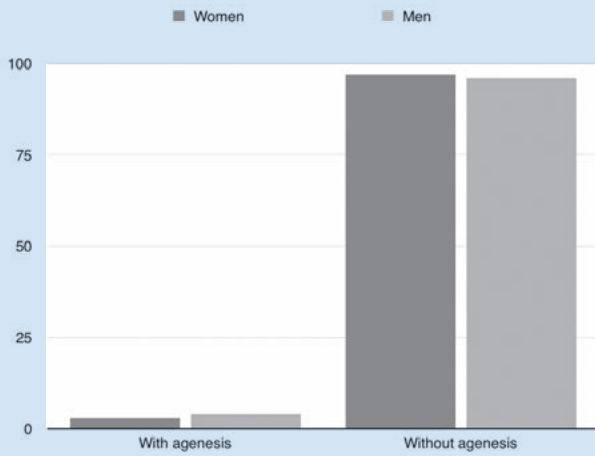
Discussion

Hypodontia is the object of study in many universities and in many specialized clinics, since it is a very frequent anomaly in humans. This study has some limitations, since we didn't consider the ethnicity of each patient as some other articles do (11). In our study, syndromic patients were also ruled out; hence we did not obtain the knowledge of hypodontia's prevalence in them, which is an interesting issue for future research (12).

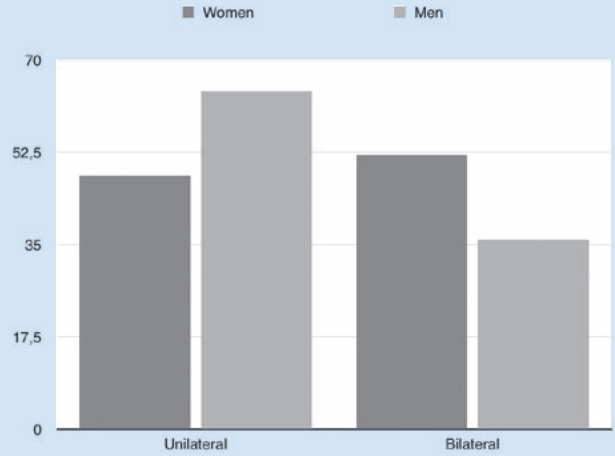
We did not take into account the prevalence of hypodontia in the third molars, mainly because of patients' age; the prevalence of hypodontia excluding third molars was 6.2% (women 8% and men 4.2%) according to Abed Al Jawad (13) and in another study, the prevalence was 9.7% (14). Both are higher than our results, which showed a prevalence of 3.48%, being 3.63% in males and 3.31% in females, also excluding third molars.

In other studies found in the literature, hypodontia is more frequent in women, although the differences found by gender are not significant (15, 16).

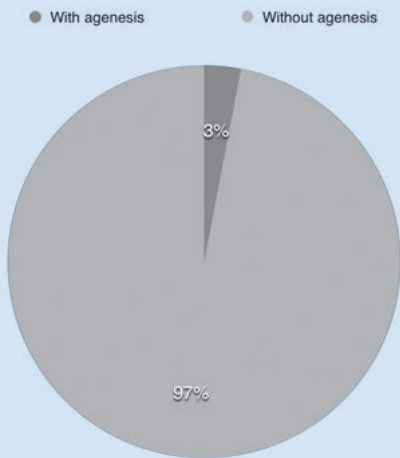
Nevertheless, in our study, there were no significant differences in the hypodontia between men and women. Obser-



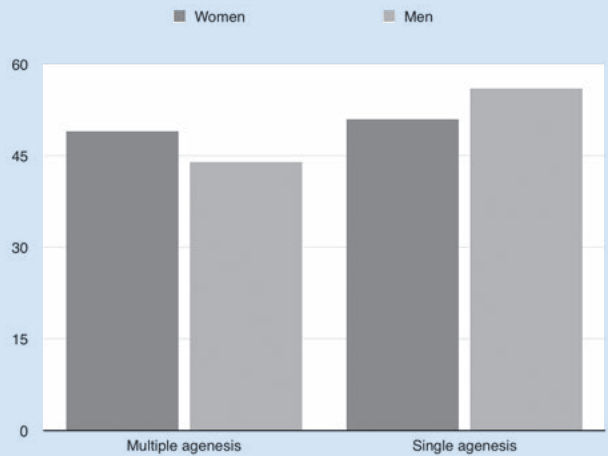
Slika 1. Postotci hipodontije kod muških i ženskih ispitanika
 Figure 1 Percentages of hypodontia in men and women.



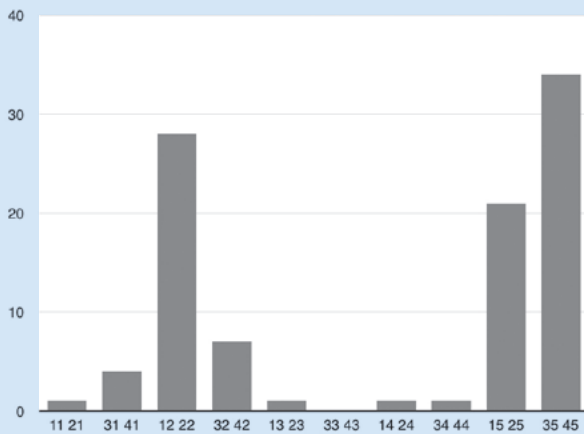
Slika 2. Postotci obostrane i jednostrane hipodontije kod muških i ženskih ispitanika
 Figure 2 Percentages of bilateral and unilateral hypodontia in women and men.



Slika 3. Ukupni postotci hipodontije kod 2500 pacijenata uključenih u istraživanje
 Figure 3 Total hypodontia percentage of the 2500 patients studied.



Slika 4. Postotak nedostatka zametka jednoga ili više zuba kod muških i ženskih ispitanika
 Figure 4 Percentage of single and multiple hypodontia in both women and men.



Slika 5. Postotak hipodontije po pojedinom ispitaniku uključenom u istraživanje
 Figure 5 Percentages of hypodontia per piece found in the patients studied.

Ni u našem istraživanju nije bilo statistički značajnih razlika u hipodonciji između muškaraca i žena. Podatci iz literatura pokazuju da su u gornjem luku zubi s najvećim postotkom hipodoncije bili bočni sjekutići, a slijede drugi pretkutnjaci. U donjem luku to je bio drugi pretkutnjak, a zatim bočni sjekutići (17). Ovo je potpuno u skladu s rezultatima našeg istraživanja. Općenito, prema rezultatima različitih autora (18, 19, 20) najčešće zahvaćeni zubi su drugi donji pretkutnjaci, zatim gornji bočni sjekutići i drugi gornji pretkutnjaci. Jedno drugo istraživanje pokazuje češći nedostatak donjih bočnih sjekutića i drugih donjih pretkutnjaka (21).

U literaturi se nalaze postotci dentalne ageneze kako slijedi: drugi donji lijevi pretkutnjak (5,9 %), drugi donji desni pretkutnjak (5,1 %), gornji lijevi bočni sjekutić (4,0 %), drugi gornji desni pretkutnjak (3,1 %) i drugi gornji lijevi pretkutnjak (3 %) (22). Ostali zahvaćeni zubi su drugi donji pretkutnjak (20,7 %) i drugi gornji pretkutnjak (10,2 %) (23).

Postojeća literatura potvrđuje da je hipodoncija u gornjem luku češća (5,3 %) negoli u donjem (3,5 %) (24). U nekim dosadašnjim istraživanjima uočen je veći broj obostrane hipodoncije (68,9 %) negoli jednostrane (31,1 %) (25, 26, 27). To je suprotno rezultatima našeg istraživanja u kojemu je i kod muškaraca i kod žena zabilježena veća učestalost jednostranih hipodoncija negoli obostranih.

U našem istraživanju bilo je 54 posto hipodoncija na lijevoj strani, a 46 posto na desnoj; pronašli smo 45,7 posto pojedinačnih hipodoncija i 54,3 posto višestrukih, a u drugim istraživanjima zabilježen je veći broj hipodoncija na desnoj strani negoli na lijevoj (28) te više pojedinačnih negoli višestrukih (11).

Druga istraživanja pokazuju da se oligodoncija (6 ili više zuba koji nedostaju) pojavljuje kod 0,8 do 1,4 posto pacijenata (29, 30). U našem istraživanju samo je kod 0,04 posto pacijenata nedostajalo najmanje šest zuba.

Zaključak

Postotak ageneze među 2500 uključenih pacijenata iznosi je 3,48 posto. U našem uzorku hipodoncija je bila češća kod pacijenata (3,63 %) negoli kod pacijentica (3,31 %), osim kod onih u dobi između osam i deset godina među kojima je zabilježen veći postotak hipodoncije kod pacijentica. No nije bilo statistički značajne razlike u hipodonciji između dječaka i djevojčica ($X^2 = 0,25$, $df = 1$, $p > 0,05$, $n = 2500$). Osim trećih kutnjaka, zub koji je najčešće pogođen agenezom u našem je uzorku bio drugi gornji pretkutnjak (34 – 50 %), nakon čega je slijedio gornji bočni sjekutić (28,16 %) i drugi gornji pretkutnjak (21,12 %). Najrjeđe su nedostajali donji bočni sjekutić (7,04 %), donji središnji sjekutić (4,22 %), gornji središnji sjekutić (1,40 %), gornji očnjak (1,40 %), prvi donji pretkutnjak (1,40 %) i gornji pretkutnjaci (0,70 %).

Sukob interesa

Autori nisu bili u sukobu interesa.

Results from literature show that in the upper arch the teeth that have the highest percentage of hypodontia have been the lateral incisors, followed by the second premolars. In the lower arch, it is the second premolars, followed by lateral incisors, in contrast to what occurred in the upper arch (17). This is completely in accordance with the results of our study. In general, according to different authors (18, 19, 20), the most frequently affected teeth are the second lower premolars, followed by the upper lateral incisors and the second upper premolars. Another study shows a greater absence of lower lateral incisors and lower second premolars (21).

Some of the percentages found in the literature on dental agenesis are: second lower left premolar (5.9%), second lower right premolar (5.1%), upper left lateral incisor (4.0%), second upper right premolar (3.1%), and second upper left premolar (3%) (22). Other percentages are: lower second premolar (20.7%) and upper second premolar (10.2%) (23).

The available literature shows that the number of hypodontia in the upper arch (5.3%) was higher than that in the lower one (3.5%) (24). In some previous studies, a greater number of bilateral hypodontia (68.9%) than unilateral hypodontia (31.1%) has been observed (25, 26, b nghb27). It is in contrast to what happened in our study, where there was a higher prevalence of unilateral hypodontia than bilateral hypodontia in men and women.

In our study, there was 54% of hypodontia in the left side and 46% in the right side; we found 45.7% of single hypodontia and 54.3% of multiple hypodontia, whereas in other studies there has been a greater number of hypodontia on the right side than on the left side (28) and more single hypodontia than multiple ones (11).

Other studies refer to oligodontia (6 or more missing pieces) observed in 0.8 and 1.4% of patients (29, 30). In our study, only 0.04% of patients had at least 6 missing pieces.

Conclusions

1. The percentage of total agenesis of 2500 patients studied was 3.48%.
2. In our sample, there was a greater number of hypodontia in males (3'63%) studied than in females (3'31%), except for eight-year-old patients and ten year-old- patients who presented a higher percentage of hypodontia in females than in males. However, there was no significant difference in the hypodontia between men and women ($x^2=0.25$, $df=1$, $p>0.05$, $n=2.500$).
3. Excluding third molars, the tooth more affected by agenesis in our sample was the second highest premolar tooth (34'50%), followed by the upper lateral incisor (28'16%), and the second superior premolar (21'12%). The least frequent absences were the lower lateral incisor (7'04%), the lower central incisor (4'22%), the upper central incisor (1'40%), the upper canine (1'40%), the first premolar inferior 1 '40%), and superior premolar (0'70%).

Conflict of Interest

None declared

Abstract

Objectives: The aim of this retrospective study was to evaluate the prevalence of hypodontia in a sample of dental patients, aged between seven and eleven years at University Alfonso X in Madrid (Spain). **Materials and Methods:** The number of hypodontia cases and the most affected teeth were evaluated in 2500 panoramic radiographs in a random sample of dental patients consisting of 1235 females and 1265 males. We divided them according to age, number of hypodontia present in each patient (multiple or single), each side, each quadrant either in the upper jaw or in the mandible. The chi-square test ($P < 0.05$) was used to compare the differences in agenesis among males and females. **Results:** The sample of 2500 patients who were studied consisted of 1235 women, out of which 41 presented hypodontia (3.31%) and 1265 men, out of which 46 had at least a dental absence (3.63%). There was no significant difference in the proportion of hypodontia between men and women ($p > 0.05$). **Conclusion:** The percentage of total agenesis of 2500 patients studied was 3.48%.

Received: July 19, 2017

Accepted: January 30, 2018

Address for correspondence

Rebeca Ayala Sola
University Alfonso X El Sabio
Department of Orthodontics
Madrid, Spain
rebeca.ayala.sola@gmail.com

Key words

Anodontia; Hypodontia; Dentition;
Congenital Abnormalities; Tooth

References

- Vahid R. Congenitally missing teeth (hypodontia): A review of the literature concerning the etiology, prevalence, risk factors, patterns and treatment. *Dent Res J (Isfahan)*. 2015 Jan-Feb;12(1):1-13.
- Varela M, Arrieta P, Ventureira C. Non-syndromic concomitant hypodontia and supernumerary teeth in an orthodontic population. *Eur J Orthod*. 2009 Dec;31(6):632-7.
- Citak M, Cakici EB, Benkli YA, Cakici F, Bektas B, Buyuk SK. Dental anomalies in an orthodontic patient population with maxillary lateral incisor agenesis. *Dental Press J Orthod*. 2016 Nov-Dec;21(6):98-102.
- Al-Amiri A, Tabbaa S, Preston CB, Al-Jewair T. The prevalence of dental anomalies in orthodontic patients at the State University of New York at Buffalo. *J Contemp Dent Pract*. 2013 May 1;14(3):518-23.
- Gomes R, Calaça da Fonseca J, Lillian M, Faber J, Acevedo A. Prevalence of hypodontia in orthodontic patients in Brasilia, Brazil. *Eur J Orthod*. 2010 Jun;32(3):302-6.
- Dang HQ, Constantine S, Anderson PJ. The prevalence of dental anomalies in an Australian population. *Aust Dent J*. 2017 Jun;62(2):161-164.
- Endo T, Ozoe R, Kubota M, Akiyama M, Shimooka S. A survey of hypodontia in Japanese orthodontic patients. *Am J Orthod Dentofacial Orthop*. 2006 Jan;129(1):29-35.
- Choi SJ, Lee JW, Song JH. Dental anomaly patterns associated with tooth agenesis. *Acta Odontol Scand*. 2017 Apr;75(3):161-165.
- Sajjad A, Sajjad SS, Husain N, Al-Enezi AM. A retrospective cross-sectional study on the prevalence of hypodontia in a target population of Al-Jouf Province, Saudi Arabia. *Contemp Clin Dent*. 2016 Oct-Dec;7(4):500-505.
- Celikoglu M, Kazanci F, Miloglu O, Oztek O, Kamak H, Ceylan I. Frequency and characteristics of tooth agenesis among an orthodontic patient population. *Med Oral Patol Oral Cir Bucal*. 2010 Sep 1;15(5):e797-801.
- Medina AC. Radiographic study of prevalence and distribution of hypodontia in a pediatric orthodontic population in Venezuela. *Pediatr Dent*. 2012 Mar-Apr;34(2):113-6.
- Valid R, Hamid R. Meta-analysis and systematic review of the number of non-syndromic congenitally missing permanent teeth per affected individual and its influencing factors. *Eur J Dent*. 2016;38(2):170-177.
- Abed Al Jawad FH, Al Yafei H, Al Sheeb M, Al Emadi B, Al Hashimi N. Hypodontia prevalence and distribution pattern in a group of Qatari orthodontic and pediatric patients: A retrospective study. *Eur J Dent*. 2015 Apr-Jun;9(2):267-71.
- Syed M. Yassin. Prevalence and distribution of selected dental anomalies among Saudi children in Abha, Saudi Arabia. *J Clin Exp Dent*. 2016 Dec 1;8(5):e485-e490.
- Rakhshan V. Meta-Analysis of observational studies on the most commonly missing permanent dentition (excluding the third molars) in non-syndromic dental patients or randomly-selected subjects, and the factors affecting the observed rates. *J Clin Pediatr Dent*. 2015 Spring;39(3):199-207.
- Berna G, Melih M, Betül K. Prevalence and characteristics of non-syndromic hypodontia among Turkish orthodontic patient population. *J Int Soc Prev Community Dent*. 2015 May-Jun;5(3):170-5.
- Hashim HA, Al-Said S. The prevalence and distribution of hypodontia in a sample of Qatari patients. *J Orthod Sci*. 2016 Jan-Mar;5(1):1-6.
- Sisman Y, Uysal T, Gelgor IE. Hypodontia. Does the prevalence and distribution pattern differ in orthodontic patients? *Eur J Dent*. 2007 Jul;1(3):167-73.
- Hassan DA, Abuaffan AH, Hashim HA. Prevalence of hypodontia in a sample of Sudanese orthodontic patients. *J Orthod Sci*. 2014 Jul;3(3):63-7.
- Aktan A, Kara I, Şener İ, Bereket C, Ay S, Çiftçi M. Radiographic study of tooth agenesis in the Turkish population. *Oral Radiol*. 2010;26(2):95-100.
- Chung CJ, Han JH, Kim KH. The pattern and prevalence of hypodontia in Koreans. *Oral Dis*. 2008 Oct;14(7):620-5.
- Behr M, Proff P, Leitzmann M, Pretzel M, Handel G, Schmalz G, et al. Survey of congenitally missing teeth in orthodontic patients in Eastern Bavaria. *Eur J Orthod*. 2011 Feb;33(1):32-6.
- Gokkaya B, Kargul B. Prevalence and pattern of non-syndromic hypodontia in a group of Turkish children. *Acta Stomatol Croat*. 2016 Mar;50(1):58-64.
- Amini F, Rakhshan V, Babaei P. Prevalence and pattern of hypodontia in the permanent dentition of 3374 Iranian orthodontic patients. *Dent Res J (Isfahan)*. 2012 May;9(3):245-50.
- Andersson EM, Axelsson S, Austeng ME, Øverland B, Valen IE, Jensen TA, Akre H. Bilateral hypodontia is more common than unilateral hypodontia in children with Down syndrome: a prospective population-based study. *Eur J Orthod*. 2014 Aug;36(4):414-8.
- Antonarakis GS, Suri S. Prevalence and patterns of permanent tooth agenesis in patients with nonsyndromic Pierre Robin sequence. *Am J Orthod Dentofacial Orthop*. 2014 Apr;145(4):452-60.
- Rolling S, Poulsen S. Agenesis of permanent teeth in 8138 Danish school-children: prevalence and intraoral distribution according to gender. *Int J Paediatr Dent*. 2009;19(3):172-175.
- Tan SP, van Wijk AJ, Prah Andersen B. Severe hypodontia: identifying patterns of human tooth agenesis. *Eur J Orthod*. 2011 Apr;33(2):150-4.
- Laganà G, Venza N, Borzabadi-Farahani A, Fabi F, Danesi C, Cozza P. Dental anomalies: prevalence and associations between them in a large sample of non-orthodontic subjects, a cross-sectional study. *BMC Oral Health*. 2017;17(1):62.
- Goya HA, Tanaka S, Maeda T, Akimoto Y. An orthopantomographic study of hypodontia in permanent teeth of Japanese pediatric patients. *J Oral Sci*. 2008 Jun;50(2):143-50.