Revista Estomatológica Herediana
ISSN: 1019-4355
ISSN: 2225-7616
faest.revista@oficinas-upch.pe
Universidad Peruana Cayetano Heredia
Perú

Silva-Castillo, Rocío Itzel; Juárez-Medel, Carlos Alberto; Gutiérrez-Ventura, Evangelina; Robles-Andrade, Manuel Salvador; Salas-Franco, Liliana Sarahí; Alvarado-Castro, Víctor Manuel

Agenesis of third molars and associated factors in patients at an outpatient dental clinic

Revista Estomatológica Herediana, vol. 35, no. 2, 2025, April-June, pp. 101-109
Universidad Peruana Cayetano Heredia
Lima, Perú

DOI: https://doi.org/10.20453/reh.v35i2.5656

Available in: https://www.redalyc.org/articulo.oa?id=421582899003

Revista
ESTOMATOLÓGICA
Herediana
E-ISSN 2225-7616

ORIGINAL ARTICLE

DOI: https://doi.org/10.20453/reh.v35i2.5656

Agenesis of third molars and associated factors in patients at an outpatient dental clinic

Rocío Itzel Silva-Castillo[1,a],
Carlos Alberto Juárez-Medel[2,b],
Evangelina Gutiérrez-Ventura[3,a],
Manuel Salvador Robles-Andrade[4,c],
Liliana Sarahí Salas-Franco[5,d],
Víctor Manuel Alvarado-Castro[5,e]

[1] Clínica Odontológica de Ortodoncia Mx Brackets. Morelos, Mexico
[2] Public Health Services of the Instituto Mexicano del Seguro Social para el Bienestar, Office of Health Education, State Coordination Guerrero. Chilpancingo, Mexico.
[3] Colegio de Cirujanos Dentistas del Estado de Guerrero AC. Acapulco, Guerrero.
[4] Instituto Nacional de Perinatología. Mexico City, Mexico.
[5] Universidad Autónoma de Guerrero, Tropical Diseases Research Center. Guerrero, Mexico.
[a] Dental surgeon.
[b] Doctor of Science in Public Health.
[c] Specialist in Periodontics and Implantology.
[d] Master's Degree in Public Health.
[e] Doctor of Epidemiology.

ABSTRACT

Objective: To determine the occurrence of third molar agenesis and associated factors in patients at an outpatient dental clinic in Morelos, Mexico. **Materials and methods:** Cross-sectional design based on a series of 295 digital panoramic radiographs, selected through consecutive sampling and evaluated using CS Imaging® software (Carestream Dental, Atlanta, GA, USA). Binary logistic regression analysis was performed using the SPSS v. 24 statistical package (IBM Corp., Armonk, NY, USA) to calculate odds ratios and 95% confidence intervals between agenesis and explanatory factors. **Results:** Agenesis was more prevalent in the maxillary third molars, with 59.3% (n = 175) in tooth 18 and 53.9% (n = 159) in tooth 28. In contrast, mandibular third molar agenesis was less frequent, with 46.8% (n = 138) in tooth 38 and 45.8% (n = 135) in tooth 48. The absence of two molars showed the highest occurrence, with 40.1% (n = 118) of cases. Age increased the probability of agenesis in tooth 18 (aOR = 1.74; 95% CI: 1.07-2.94) and 28 (aOR = 1.91; 95% CI: 1.13-3.21), while female sex was associated with a higher probability of agenesis in tooth 38 (aOR= 1.82; 95% CI: 1.17-3.06). **Conclusion:** Third molar agenesis is a common condition influenced by age and sex, suggesting the usefulness of these sociodemographic factors to anticipate patterns in different populations.

Keywords: dental agenesis; third molar; panoramic radiography.

Received: July 18, 2024
Accepted: March 18, 2025
Online: June 30, 2025

Cite as:
Silva-Castillo RI, Juárez-Medel CA, Gutiérrez-Ventura E, Robles-Andrade MS, Salas-Franco LS, Alvarado-Castro VM. Agenesis of third molars and associated factors in patients at an outpatient dental clinic. Rev Estomatol Herediana. 2025; 35(2): 89-96. DOI: 10.20453/reh.v35i2.5656

INTRODUCTION

The World Health Organization (1) defines tooth agenesis, or anodontia, as the absence of development of a dental germ. It is an oral and craniofacial developmental anomaly of multifactorial origin, influenced by genetic, environmental, pathological, anthropometric, and evolutionary factors (2-5). Moreover, it involves the absence of one or more teeth in the human dentition; however, third molars are most commonly affected, with reported prevalence ranging from 5% to 56% (6).

The prevalence of agenesis varies widely. In South Asian countries, studies report a prevalence of 6% in Pakistan among patients treated at faculties of dentistry, while in India and among Bangladeshi populations, prevalence has been reported at ~38%; in patients from faculties of dentistry in Solapur, it was 46.7%; and in Manipal, 24% (7-10). In Europe, Turkey reports a third molar agenesis prevalence of 29% (11-13), whereas orthodontic clinics in Switzerland and Greece reported 50.8% (14). In South America, Peru has documented an occurrence of 21%, and Colombia, 24% (15, 16). In the Mexican population, prevalence has ranged between 22% and 56% in patients from Veracruz, Puebla, and San Luis Potosí (17-19).

Regarding factors associated with third molar agenesis, women have a 14% probability of presenting it. By quadrant, the maxilla has a 36% higher likelihood of occurrence, and agenesis of one or two molars is the most common pattern, while agenesis of three to four molars is less frequent (6, 7, 12). Individuals with third molar agenesis have been reported to exhibit a less convex craniofacial configuration, a shorter anterior facial height, and more retrusive maxilla and mandible (20). Although panoramic radiography provides a two-dimensional view, it is useful for the presumptive diagnosis, allowing observation of the absence of dental germ formation and the status of surrounding structures (21).

The age of initiation of third molar calcification remains a topic of debate, as various studies suggest that the dental follicle may begin to form around age 7, reach a mature size by age 8, and present a fully developed capsule and crown by age 10 (6, 7, 9, 17, 22). However, the developmental chronology shows individual variation. In that sense, it has been observed that if the third molar crown is not radiographically evident by age 10, there is a 50% probability of agenesis. Crown calcification is typically completed around age 16, while root formation is finalized around age 25 (23). Based on these findings, some authors propose age 14 as a critical threshold for considering possible third molar agenesis (24, 25). Furthermore, there is strong genetic control over tooth development, and any alterations affect both sexes similarly (4).

In this context, it is important for dental professionals to use panoramic radiography in order to examine the structures and detect the absence of third molars. In the region, no studies have reported on the status of this phenomenon; therefore, the aim of this study was to determine the occurrence of third molar agenesis and to identify associated factors in patients from an outpatient dental clinic in Morelos, Mexico.

MATERIALS AND METHODS

This cross-sectional study was based on a case series of 301 digital panoramic radiographs, evaluated at a private outpatient dental clinic in Morelos, Mexico, during August 2023. Given the absence of a defined sampling frame, no sample size calculation was performed and a consecutive sampling was performed, collecting radiographs of patients treated during the first six months of the year.

Panoramic radiographs from the diagnostic area were included if they contained complete data of interest for patients aged 14 years or older, based on evidence-based recommendations (24, 25). Exclusion criteria were defined using information recorded in clinical records: patients with a history of tooth extraction or loss due to trauma, general or maxillofacial malformations, previous orthodontic treatment, or infections that could have affected odontogenesis or dental eruption periods. Radiographs with artifacts that hindered proper visualization of structures were also discarded. Six radiographs from patients with previous tooth extractions were excluded based on clinical record data, leaving a final sample of 295 records.

Digital panoramic radiographs were uploaded to CS Imaging® software (Carestream Dental, Atlanta, GA, USA) and evaluated by an orthodontic specialist using an objective operational criterion. Although no formal inter-examiner calibration process was performed, the software standardization allowed precise visualization and analysis, minimizing observational bias. Filters were applied to optimize image quality, and using zoom and annotation tools, the response variable was defined as the absence of the dental germ at any stage of development (Figure 1). Third molars were identified using the two-digit tooth numbering system of the FDI World Dental Federation (18: upper right molar; 28: upper left molar; 38: lower left molar; 48: lower right molar) (26).

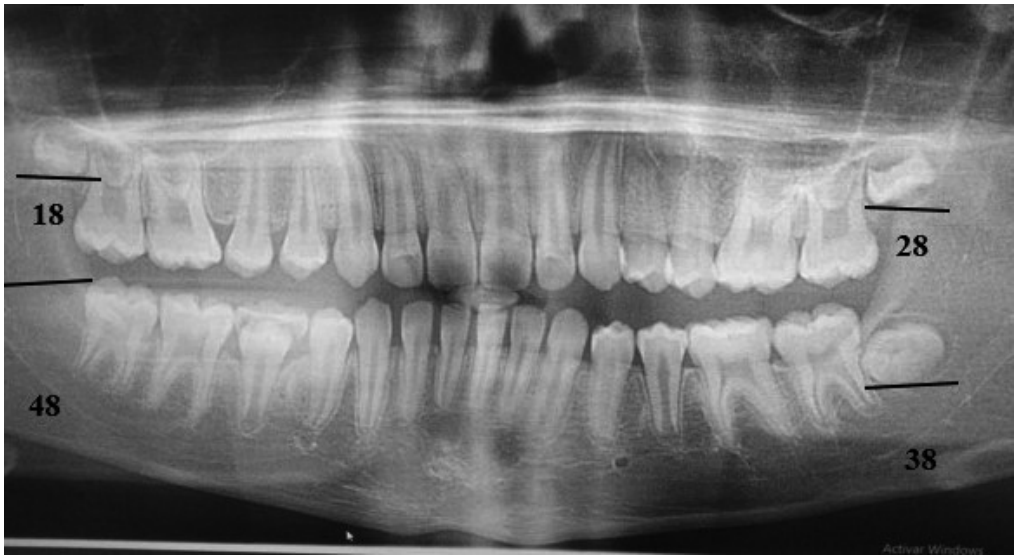

Figure 1. Digital panoramic radiograph of a 14-year-old patient from a dental clinic in Morelos, Mexico. The operational definition of agenesis considered the absence of the dental germ development for each third molar (e.g., agenesis of molar 48). On the other hand, presence was defined as the existence of the dental germ at any stage of development (e.g., third molars 18, 28, and 38).

Explanatory variables considered as potential associated factors were sex, age, and place of origin. Age was dichotomized as 14-20 vs ≥21 years, reflecting critical stages of third-molar development; sex, based on biological differences; and rural origin, according to a standard population criterion associated with localities of fewer than 2,500 inhabitants.

Data were tabulated in Excel and coded for statistical analysis in SPSS v.24 (IBM Corp., Armonk, NY, USA). A univariate analysis was performed to obtain simple frequencies, measures of central tendency, and dispersion. Subsequently, a bivariate analysis using binary logistic regression was conducted to evaluate the relationship between agenesis of each third molar and the explanatory variables, calculating the odds ratio (OR) with its 95% confidence interval (95% CI). Variables found to be significant in the bivariate analysis ($p < 0.05$) were included in a multivariate model, also adjusted for those with biological plausibility, even if not significant in the previous analysis.

The study protocol was developed in a private dental institute and was approved by the Research Ethics Committee of Universidad Autónoma de Guerrero, Mexico (Record 2023-013). With authorization from the dental clinic owners, all patients attending the clinic during the first six months were informed of the study objectives, regardless of the date their panoramic radiographs were taken. Informed consent was obtained from all participants and, in the case of minors, from their parents or legal guardians. Data were used exclusively for scientific dissemination, in strict compliance with ethical principles, Mexican Official Standard 004 of the Ministry of Health on clinical records, and the General Health Law Regulations on Research (27, 28).

RESULTS

Based on the sociodemographic characteristics, women accounted for 65.1% (n = 192) of the sample. Patients' ages ranged from 14 to 30 years, with a mean of 19.9 years (SD = 4.7). Most patients, 69.8% (n = 206), were in the 14-20-year age range. Regarding place of origin, 79.1% (n = 233) were from urban areas (Table 1).

Table 1. Sociodemographic characteristics of patients from an outpatient dental clinic in Morelos, Mexico.

Factor	n	%
Sex		
Female	192	65.1
Male	103	34.9
Age range		
14-20 years	206	69.8
21-30 years	89	30.2
Place of origin		
Urban	233	79.1
Rural	62	20.9

Regarding the occurrence of third molar agenesis, it was more frequent in the maxilla, with 59.3% (n = 175) in

molar 18 and 53.9% (n = 159) in molar 28. In contrast, the mandible showed a lower relative frequency, with 46.8% (n = 138) agenesis in molar 38 and 45.8% (n = 135) in molar 48 (Table 2).

On the other hand, agenesis of at least two third molars was the most common, occurring in 40.1% (n = 118) of patients (Table 3).

Table 2. Occurrence of third molar agenesis in patients from an outpatient dental clinic in Morelos, Mexico.

Anatomical location	Third molar*	Agenesis		Presence	
		n	%	n	%
Maxilla	18	175	59.3	120	40.7
	28	159	53.9	136	46.1
Mandible	38	138	46.8	157	53.2
	48	135	45.8	160	54.2

* Third molar nomenclature according to the FDI World Dental Federation.

Table 3. Occurrence of combined third molar agenesis in patients from an outpatient dental clinic in Morelos, Mexico.

Combined agenesis occurrence	n	%
One molar	101	34.2
Two molars	118	40.1
Three molars	34	11.5
Four molars	42	14.2
Total	295	100.0

In the bivariate analysis, factors associated with third molar agenesis were identified. Age was associated with a higher probability of agenesis in maxillary third molars (18 and 28). In the mandible, female sex was associated with a higher probability of agenesis in molar 38, whereas no significant associations were observed for molar 48 (Table 4).

In the final multivariate model, significant factors maintained independent effects, adjusted for the explanatory variables selected based on biological plausibility criteria (Table 5).

Table 4. Bivariate analysis of factors associated with third molar agenesis in patients from an outpatient dental clinic in Morelos, Mexico.

Third molar*	Factor	Agenesis	Presence	OR (unadj.)	95% CI	p
		n = 175	**n = 120**			
18	Sex					
	Female(ref)	114	78	0.99	0.61-1.61	0.979
	Male	61	42			
	Age					
	≥21 years(ref)	61	28	1.75	1.04-2.97	0.035
	14-20 years	114	92			
	Place of origin					
	Urban(ref)	143	90	1.48	0.84-2.61	0.165
	Rural	32	30			
		n = 159	**n = 136**			
28	Sex					
	Female(ref)	104	88	1.03	0.63-1.66	0.899
	Male	55	48			
	Age					
	≥21 years(ref)	58	31	1.94	1.16-3.25	0.011
	14-20 years	101	105			
	Place of origin					
	Urban(ref)	129	104	1.32	0.75-2.31	0.328
	Rural	30	32			

Table 4. (*Continuation*).

Third molar*	Factor	Agenesis	Presence	OR (unadj.)	95% CI	p
		n = 138	**n = 157**			
38	Sex					
	Female(ref)	100	92	1.85	1.13-3.03	0.013
	Male	38	65			
	Age					
	≥21 years(ref)	42	47	1.02	0.62-1.68	0.925
	14-20 years	96	110			
	Place of origin					
	Urban(ref)	106	127	0.78	0.44-1.37	0.391
	Rural	32	30			
		n = 135	**n = 160**			
48	Sex					
	Female(ref)	95	97	1.54	0.94-2.51	0.081
	Male	40	63			
	Age					
	≥21 years(ref)	41	48	1.01	0.61-1.67	0.945
	14-20 years	94	112			
	Place of origin					
	Urban(ref)	105	128	0.87	0.49-1.53	0.640
	Rural	30	32			

* Third molar nomenclature according to the FDI World Dental Federation.
OR (unadj.): unadjusted odds ratio; (ref): reference category; p: significance level.

Table 5. Final multivariate model of factors associated with third molar agenesis in patients from an outpatient dental clinic in Morelos, Mexico.

Third molar*	Factor	Category	OR (unadj.)	OR (adj.)	95 % CI
18	Age	≥21 years	1.75	1.74	1.07-2.94
28	Age	≥21 years	1.94	1.91	1.13-3.21
38	Sex	Female	1.85	1.82	1.17-3.06

* Third molar nomenclature according to the FDI World Dental Federation.
OR (unadj.): unadjusted odds ratio; OR (adj.): adjusted odds ratio.
For molars 18 and 28, age was adjusted for sex, whereas for molar 38, sex was adjusted for age.

DISCUSSION

The occurrence of third molar agenesis was determined in a Mexican population treated at a private outpatient dental clinic. The upper right third molar showed the highest occurrence of this phenomenon, with 59.3%. Agenesis of at least two third molars was the most common pattern, with 40.1%. Regarding associated factors, age was associated with a higher probability of agenesis in the upper third molars, and females showed a higher predisposition towards agenesis of the lower left third molar.

The reported occurrence of agenesis in our study falls within the range observed in different research studies conducted in South Asian populations (7-10) and in various European countries (11, 13, 14). Concerning the Americas, the results falls within the range reported for South American countries (15, 16). Similarly, compared with Mexican populations from Veracruz, Puebla, and San Luis Potosí, the distribution is similar (17-19).

The upper right third molar was the most frequently affected by agenesis, similar to reports from India and Turkey (7, 10, 13), and consistent with findings

in the populations of San Luis Potosí and Puebla (17, 19). Other studies have reported the lower right third molar as the most frequent, as documented by Botina et al. (16) in Colombian patients, and by Colorado-Pinillo and Huitzil-Muñoz (18) in Mexican patients from Veracruz. Unlike other studies that analyze agenesis at the patient level, this study considered each third molar as the unit of analysis, so the occurrence is reported per molar rather than as a global estimate per patient.

Regarding biological variables, females showed a higher probability of agenesis of the lower left third molar. This could be explained by anthropometric differences in maxillary and mandibular size and overall facial configuration in females (5). The results are similar to those reported by Singh et al. (7) in females treated in a faculty of dentistry in India, and by Pamukcu et al. (12) in a Turkish population of different ages. Additionally, Carter and Worthington (6), in their systematic review, mention that females have a 14% probability of agenesis compared with males; they also emphasize that the maxilla has a 36% probability of third molar agenesis, and that the absence of one or two of these teeth is the most common pattern.

Age 21 years or older was associated with a higher probability of third molar agenesis. The absence of a third molar observed in our study could be explained by a lack of development, taking 14 years as the critical age, as indicated by Tavajohi-Kermani et al. (24) and Dumas et al. (25). These authors report that if the crown of a third molar is not radiographically visible by age 10, there is a 50% probability of agenesis (25). According to San Román-Hernández et al. (17), examining radiographs at early ages (7-8 years) allows detection of calcification signs of these molars, so their absence at later ages permits establishing a diagnosis of agenesis.

It is important for dental professionals to be able to interpret a panoramic radiograph that allows visualization of structures and detection of third molar agenesis. Radiographic identification of the third molar germ during the early stages of calcification, before eruption, is essential for adequate treatment planning, particularly in orthodontics (29). A panoramic radiograph from around age 7 can help monitor third-molar development, since the eruption direction is crucial, and early detection can prevent or allow timely management of associated complications (17). It is also fundamental to consider measurements to determine facial biotype, skeletal class, dental age, and maxillary dimensions (5, 20, 25).

This study presents limitations that restrict the generalization of the results at the regional level, mainly due to the absence of a defined population base. Although ORs may overstate associations when the outcome is common, its use is justified as this is the first analysis in the region that evaluates third molar agenesis individually (6). Nevertheless, it is recommended that future research studies with more robust and reproducible designs consider the application of alternative estimators to improve the precision of reported associations.

In terms of temporality, it would be valuable for subsequent studies to include follow-up of the population from early childhood until the formation of the third molar, which would allow for a more solid exploration of causal associations and developmental patterns. In addition, due to the clinic's operational constraints, it was not possible to collect additional data, such as family history and environmental factors, which limits etiological interpretation; therefore, their inclusion is suggested for future research.

Concerning the evaluation procedure, although digital radiographs facilitated precise and reliable assessment by an orthodontic expert using an objective operational criterion based on the absence of the dental germ at any stage of development, no formal calibration process among evaluators was conducted. Nevertheless, it is recommended that future studies implement calibration procedures to increase reproducibility of results.

The consecutive sample in this study is not representative of the Morelos region, as only the available radiographs within a specified period were considered. The study provides a basis for conducting other types of studies with greater methodological robustness to achieve regional representativeness. Although not generalizable to the entire population, the sample permits comparisons with similar private outpatient clinic populations that lack a defined sampling frame but share comparable characteristics.

CONCLUSIONS

Third molar agenesis is a recurrent condition, particularly in the maxillary region. Age and sex showed a higher predisposition to agenesis, suggesting these factors may influence the absence of these teeth and, therefore, could be useful for anticipating associated patterns in different populations.

Conflict of interest:
The authors declare no conflict of interest.

Funding:
Self-funded.

Ethics approval:
The research was approved by the Research Ethics Committee of Universidad Autónoma de Guerrero, Mexico.

Author contributions:
RISC: conceptualization, data curation, methodology, writing – original draft.
CAJM: conceptualization, formal analysis, methodology, software, visualization, writing – review & editing.
EGV, MSRA: conceptualization, writing – original draft.
LSSF: software, writing – review & editing.
VMAC: formal analysis, software, visualization, writing – review & editing.

Acknowledgments:
The authors thank physician Eduardo Mario Dangond Contreras, owner of the dental clinic, for the support provided for the completion of this project.

Corresponding author:
Carlos Alberto Juárez-Medel
✉ carlos.juarezm@imssbienestar.gob.mx

REFERENCES

1. World Health Organization. Diseases of oral cavity, salivary glands and jaws (K00-K14) [Internet]. In: International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10 version: 2019). WHO; 2019. Available from: https://icd.who.int/browse10/2019/en#/K00-K14
2. Echeverri J, Restrepo LA, Vásquez G, Pineda N, Isaza DM, Manco HA, et al. [Tooth agenesis: Epidemiological, clinical and genetic analysis in patients from Antioquia]. Av Odontoestomatol [Internet]. 2013; 29(3): 119-130. Available from: https://scielo.isciii.es/pdf/odonto/v29n3/original1.pdf Spanish.
3. Fournier BP, Bruneau MH, Toupenay S, Kerner S, Berdal A, Cormier-Dairé V, et al. Patterns of dental agenesis highlight the nature of the causative mutated genes. J Dent Res [Internet]. 2018; 97(12): 1306-1316. Available from: https://doi.org/10.1177/0022034518777460
4. Alamoudi R, Ghamri M, Mistakidis I, Gkantidis N. Sexual dimorphism in third molar agenesis in humans with and without agenesis of other teeth. Biology [Internet]. 2022; 11(12): 1725. Available from: https://doi.org/10.3390/biology11121725
5. Gkantidis N, Tacchi M, Oeschger ES, Halazonetis D, Kanavakis G. Third molar agenesis is associated with facial size. Biology [Internet]. 2021; 10(7): 650. Available from: https://doi.org/10.3390/biology10070650
6. Carter K, Worthington S. Morphologic and demographic predictors of third molar agenesis: a systematic review and meta-analysis. J Dent Res [Internet]. 2015; 94(7): 886-894. Available from: https://doi.org/10.1177/0022034515581644
7. Singh N, Chaudhari S, Chaudhari R, Nagare S, Kulkarni A, Parkarwar P. A radiographic survey of agenesis of the third molar: a panoramic study. J Forensic Dent Sci [Internet]. 2017; 9(3): 130-134. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC5887635/
8. Sujon MK, Alam MK, Rahman SA. Prevalence of third molar agenesis: associated dental anomalies in non-syndromic 5923 patients. PLoS ONE [Internet]. 2016; 11(8): e0162070. Available from: https://doi.org/10.1371/journal.pone.0162070
9. Zeb M, Ishfaq M, Arbab S, Khattak AA, Khattak I, Rehman A. Agenesis, position, class and angulation of impacted mandibular third molar teeth in 21 - 25 years old subjects visiting dental teaching hospital in Peshawar. Professional Med J [Internet]. 2022; 29(10): 1569-1575. Available from: https://doi.org/10.29309/TPMJ/2022.29.10.6962
10. Chugh A, Smriti K, Singh A, Kumar M, Pentapati KC, Gadicherla S, et al. Radiographic assessment of third molars agenesis patterns in young adults. Pesqui Bras Odontopediatria Clín Integr [Internet]. 2021; 21: e0212. Available from: https://doi.org/10.1590/pboci.2021.076

11. Atay MT, Ozveren N, Serindere G. Evaluation of third molar agenesis associated with hypodontia and oligodontia in Turkish pediatric patients. Eur Oral Res [Internet]. 2020; 54(3): 136-141. Available from: https://doi.org/10.26650/eor.20200134
12. Pamukcu U, Ispir NG, Toraman M, Altunkaynak B, Peker I. Evaluation of the frequency of third molar agenesis according to different age groups. Am J Hum Biol [Internet]. 2021; 33(3): e23487. Available from: https://doi.org/10.1002/ajhb.23487
13. Ercal P, Taysi AE. Third molar agenesis: Prevalence and association with agenesis of other teeth in a Turkish population. Niger J Clin Pract [Internet]. 2020; 23(3): 392-397. Available from: https://doi.org/10.4103/njcp.njcp_520_19
14. Scheiwiller M, Oeschger ES, Gkantidis N. Third molar agenesis in modern humans with and without agenesis of other teeth. PeerJ [Internet]. 2020; 8: e10367. Available from: https://doi.org/10.7717/peerj.10367
15. Miranda-Medina A. Agenesis of third molars and its association with other dental anomalies in a Peruvian population. J Oral Res [Internet]. 2020; 9(3): 166-170. Available from: https://doi.org/10.17126/%25x
16. Botina CJ, Rodríguez LF, Cepeda EC, Zabala DF, González G. [Frequency of third molar agenesis: relation to jaw size]. Rev Nac Odontol [Internet]. 2012; 8(15): 52-56. Available from: https://revistas.ucc.edu.co/index.php/od/article/view/272 Spanish.
17. San Román-Hernández JV, Pozos-Guillén A, Martínez-Rider R, Ruiz-Rodríguez S, Garrocho-Rangel A, Rosales-Berber MA. [Radiographic evaluation of the presence/agenesis of third molars in a Mexican child population]. Odovtos-Int J Dental Sc [Internet]. 2020; 22(1): 113-121. Available from: https://www.medigraphic.com/cgi-bin/new/resumen.cgi?IDARTICULO=94142 Spanish.
18. Colorado-Pinillo ML, Huitzil-Muñoz EE. Agenesia de terceros molares en pacientes del Centro del Estado de Veracruz. Rev Tamé [Internet]. 2015; 4(11): 379-382. Available from: https://www.uan.edu.mx/d/a/publicaciones/revista_tame/numero_11/Tam1511-03i.pdf
19. Colorado-Pinillo ML, Huitzil-Muñoz EE. Agenesia e impactación de terceros molares en pacientes del Centro del Estado de Puebla. Rev Tamé [Internet]. 2020; 9(25): 1001-1006. Available from: https://www.uan.edu.mx/d/a/publicaciones/revista_tame/numero_25/Tam2025-2i.pdf
20. Kanavakis G, Alamoudi R, Oeschger ES, Tacchi M, Halazonetis D, Gkantidis N. Third molar agenesis relates to human craniofacial form. Eur J Orthod [Internet]. 2024; 46(1): cjad057. Available from: https://doi.org/10.1093/ejo/cjad057
21. RóżyłoKalinowska I. Panoramic radiography in dentistry. Clin Dent Rev [Internet]. 2021; 5: 26. Available from: https://doi.org/10.1007/s41894-021-00111-4
22. González Espangler L, Mok Barceló P, De la Tejera Chillón A, George Valles Y, Leyva Lara ML. [Characterization of the formation and development of the third molars]. Medisan [Internet]. 2014; 18(1): 34-44. Available from: http://scielo.sld.cu/pdf/san/v18n1/san06114.pdf Spanish.
23. García-Hernández F, Toro YO, Vega VM, Verdejo MM. [Third molar agenesis in young people between 14 and 20 years of age, Antofagasta, Chile]. Int J Morphol [Internet]. 2008; 26(4): 825-832. Available from: https://scielo.conicyt.cl/pdf/ijmorphol/v26n4/art08.pdf Spanish.
24. Tavajohi-Kermani H, Kapur R, Sciote JJ. Tooth agenesis and craniofacial morphology in an orthodontic population. Am J Orthod Dentofacial Orthop [Internet]. 2002; 122(1): 39-47. Available from: https://doi.org/10.1067/mod.2002.123948
25. Dumas M, Mariano-Pereira P, Bugaighis I, Fernandes-Retto P, Proença L. Criteria for early diagnosis of third molar agenesis: a retrospective radiographic study. Dental Press J Orthod [Internet]. 2023; 28(3): e2321322. Available from: https://doi.org/10.1590/2177-6709.28.3.e2321322.oar
26. Rajendra AB, Jones T. Enhancing precision: Proposed revision of FDI's 2-digit dental numbering system. Int Dent J [Internet]. 2024; 74(2): 359-360. Available from: https://doi.org/10.1016/j.identj.2023.12.001
27. Norma Oficial Mexicana NOM-004-SSA3-2012, del Expediente Clínico [Internet]. Mexico City: Diario Oficial de la Federación; 2012, October 15. Available from: http://dof.gob.mx/nota_detalle_popup.php?codigo=5272787
28. Decreto por el que se reforman, adicionan y derogan diversas disposiciones del Reglamento de la Ley General de Salud en Materia de Investigación para la Salud [Internet]. Mexico City: Diario Oficial de la Federación; 2014, April 2. Available from: https://www.dof.gob.mx/nota_detalle.php?codigo=5339162&fecha=02/04/2014#gsc.tab=0
29. Almpani K, Kolokitha OE. Role of third molars in orthodontics. World J Clin Cases [Internet]. 2015; 3(2): 132-140. Available from: https://doi.org/10.12998/wjcc.v3.i2.132