

Prevalence of Third Molar Agenesis among Patients Visiting a Tertiary Health Centre in Nepal: A Radiographic Study

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ABSTRACT

Introduction: Tooth agenesis is the developmental absence of a tooth. The most commonly involved tooth in agenesis is the third molar. The variation of agenesis of the third molar may vary in different populations.

Objective: To assess the pattern of prevalence of third molar agenesis and explore its variation based on gender among patients attending Kathmandu University School of Medical Sciences (KUSMS), Dhulikhel Hospital (DH), a tertiary health care centre in Nepal.

Methods: This was an analytical cross-sectional study conducted in the Department of Oral Medicine and Radiology, KUSMS, DH from 2024 June to 2024 October after ethical approval. A total of 638 panoramic radiographs of patients above 18 years of age were included in the study to assess the agenesis of third molars using convenience sampling. Data were entered in Microsoft Excel 2019 and analysed in SPSS v.25. Cross-tabulation was done using descriptive statistics. The Chi-square test and Fischer's exact test were used to compare the pattern of prevalence of missing third molars based on gender.

Results: The prevalence of third molar agenesis in the present study was 22.26% (n=142), with a prevalence of 20.32% (n = 63) in males and 26.22% (n = 86) in females, the difference being statistically significant (p=0.013).

Conclusions: In this study group, the prevalence of third molar agenesis was higher among females than males.

Keywords: Agenesis; anodontia; Nepal; panoramic radiographs; third molar.

INTRODUCTION

Tooth agenesis is defined as the congenital absence of one or more teeth.¹ The third molar, commonly known as the wisdom tooth, is the last to erupt in the oral cavity and is marked by considerable variation in its formation, eruption timing, and presence.^{2,3} Various genetic and epigenetic factors influence jaw size, which subsequently impact the size and number of teeth.⁴ However, it has also been suggested that tooth agenesis may, in turn, affect jaw size.⁵ Some authors consider the absence of third molars as a physiologic variation or an evolutionary adaptation of the dentition

rather than a developmental anomaly.⁶ This condition is an important anthropometric characteristic that can vary across different populations.⁷ Therefore, different authors have conducted studies on the prevalence of third molar agenesis in various population groups. It has been reported that the average prevalence of agenesis of the third molar in the world is 22.6% with 29.7% in the Asian population.⁸ Although, the absence of third molars is the most common developmental anomaly of teeth, there is limited data available from Nepal. Thus, this study aimed to assess the pattern of prevalence of agenesis of third molars and its variation according to gender among patients visiting Kathmandu University School of Medical Sciences (KUSMS), Dhulikhel Hospital (DH), a Tertiary Health Centre of Nepal.

METHODS

This analytical cross-sectional study was conducted among the patients visiting the Department of Oral

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Citation

Adhikari S, Bhattarai B, Shrestha S, Bali H. Prevalence of Third Molar Agenesis among Patients Visiting a Tertiary Health Centre in Nepal: A Radiographic Study. J Nepal Soc Perio Oral Implantol. 2024 Jul-Dec;8(16):62-6.

Medicine and Radiology, KUSMS, DH for routine panoramic radiography from 2024 June to 2024 October. Ethical clearance was obtained from the Institutional Review Committee of KUSMS (Ref. IRC-KUSMS Approval No. 173/24) before data collection. Written informed consent was obtained. Patients above 18 years of age who were indicated for routine panoramic radiography and willing to provide consent were enrolled in the study. Patients with a prior history of extraction of permanent molars, gross developmental anomalies of the face, any obvious local or systemic disease affecting jaw size or tooth number, gross abnormality resulting in root resorption or tooth migration, cyst or tumour of maxilla and mandible were excluded. Panoramic radiographs that contained projection or image acquisition errors, leading to non-interpretable images, were excluded from the study.^{3,9}

Convenience sampling was implied. The sample size was calculated using the formula, $n = Z^2(pq)/d^2$ where, n = sample size, p = prevalence, $q = 1 - p$, d = margin of error, 0.05 (5%), $Z = 1.96$ at 95% confidence interval. Taking prevalence as 38.4% as reported by Sujon et al.,¹⁰ the sample size calculated was 364. With a non-response rate of 10%, the final sample size was 401.

Planmeca ProMax™ was used for image acquisition with exposure parameters of 68kVp, 13mA and 17s. The panoramic radiographs of the patients meeting the inclusion and exclusion criteria were assessed. The acquired images were viewed using Planmeca Romexis 3.8.3.R in a desktop under ambient light with all curtains closed at a horizontal viewing distance of approximately 50 cm.¹¹ The basic demographic data (age and gender) and the primary findings regarding the presence or absence of third molars in the maxillary and mandibular arches were recorded systematically in a specially designed proforma. Agenesis was considered when there was a complete absence of a third molar or when there was no sign of tooth development or radiolucency with crypt formation. Before the data collection, 60 radiographs were independently assessed twice by four observers (all authors) at an interval of one week. Cohen's Kappa was calculated to assess intra and inter-observer reliability. The Kappa value for both the intra-observer reliability within observer and inter-observer reliability between different observers was 1.0 indicating a perfect intra and inter-observer

agreement. The final data were entered in Microsoft Excel 2019 and analysed in IBM SPSS (Statistical Package for Social Science) for Windows, version 25 (IBM Corp., Armonk, N.Y., USA). Cross-tabulation was done using descriptive statistics. The Chi-square test and Fischer's exact test were used to compare the pattern of prevalence of missing third molars based on gender.

RESULTS

A total of 638 panoramic radiographs of the patients were assessed of which 310 (48.58%) were male and 328 (51.41%) were female. The mean age of the patients was 34.33 ± 12.40 years. Of the total sample, a third molar was present in all the quadrants in 496 (77.74%) subjects, with agenesis of at least one third molar in 142 (22.26%) subjects. The agenesis of at least one third molar was present in 63 (20.32%) males and 86 (26.22%) females, the difference being statistically significant ($p = 0.013$, Chi-square test). The distribution of patients based on the number of agenesis of third molars is presented in (Figure 1). The most common pattern of agenesis was single third molar (70, 10.97%), followed by two third molars (48, 7.52%). There was equal distribution of subjects with agenesis of three and four third molars (12, 1.88%).

The pattern of distribution of agenesis of third molar based on location and gender is presented in (Table 1). The most common agenesis was the right maxillary third molar among 42 (13.55%) males and 72 (21.95%) females followed by the left maxillary third molar among 36 (11.61%) males and 52 (15.85%) females. There was a statistically significant difference in the prevalence of agenesis of right maxillary third molar ($p = 0.006$, Chi-square test) and left mandibular third molar ($p = 0.030$, Chi-square test) based on gender. There was no statistically significant difference in the prevalence of agenesis of left maxillary third molars and right mandibular third molar based on gender. The agenesis of bilateral maxillary molars was present in 26 (8.39%) males and 27 (8.23%) females, the difference being not significant statistically ($p = 0.934$, Chi-square test). The agenesis of bilateral mandibular molars was present in two (0.65%) males and 12 (3.66%) females, the difference being statistically significant ($p = 0.012$, Fischer's exact test). Notably, none of the males had agenesis of all the third molars compared to 12 (3.66%) females ($p < 0.001$, Fischer's exact test).

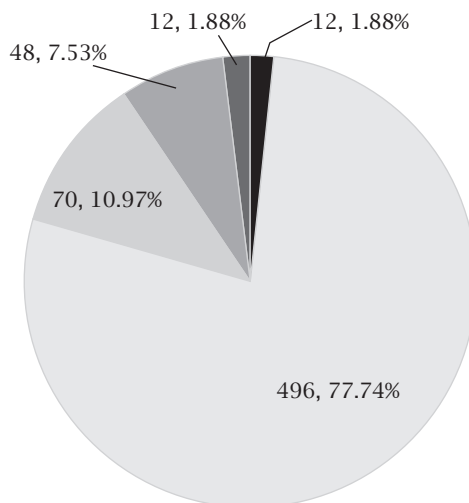


Figure 1: Distribution of third molar agenesis, n (%).

Table 1: Distribution of agenesis of third molar based on location and gender, n (%).

Tooth	Male	Female	p-value
Right maxillary third molar	42 (13.55)	72 (21.95)	0.006*
Left maxillary third molar	36 (11.61)	52 (5.85)	0.121*
Left mandibular third molar	8 (2.58)	20 (6.10)	0.030*
Right mandibular third molar	8 (2.58)	16 (4.88)	0.127*
Bilateral maxillary third molars	26 (8.39)	27 (8.23)	0.934*
Bilateral mandibular third molars	2 (0.65)	12 (3.66)	0.012 [†]
All third molars	-	12 (3.66)	<0.001 [†]

*Chi-square test, p <0.05: statistically significant; [†]Fischer’s exact test, p <0.05: statistically significant.

DISCUSSION

In present study, the prevalence of third molar agenesis was 22.26% (142). The result is similar to the average worldwide prevalence of agenesis of third molar as reported by Carter and Worthington (22.63%).⁸ However, the value is significantly low compared to the prevalence of 56.0% reported in the South Indian population¹² and 41.10% in the Korean Population.¹³ On the contrary, the prevalence in the present study is remarkably high compared to 5.80% reported in American Blacks¹⁴ and 5.00% reported in the Libyan population.¹⁵

In the findings from this study, the prevalence of agenesis of third molars was high in females compared to males, the difference being statistically significant. Similar is the finding reported by Sujon et al.,¹⁰ and Harris and Clark.¹⁴ However, findings from this study contradict Ercal and Taysi,¹ Endo et

al.,¹⁶ and Alamoudi et al.¹⁷ who reported no sexual predilection of agenesis of third molars. Kaur et al.¹⁸ reported a higher predilection for missing third molars in males compared to females, which contrasts with findings from this study that suggest the opposite trend.

The current study found a statistically significant difference in the prevalence of agenesis of the right maxillary and left mandibular third molars between males and females with higher prevalence among females. Similarly, there was a statistically significant difference in the prevalence of missing bilateral mandibular third molars and missing all third molars. However, Chug et al. reported statistically significant differences in the distribution of agenesis of right maxillary third molar, left maxillary third molar, right mandibular third molar, and bilateral maxillary third molars based on gender.⁹

Studies have shown significant variation in the prevalence of third molar agenesis among different populations, with the highest rates observed in Asian populations and the lowest in African populations. A missense mutation in the *MSX1* gene, located on chromosome 4p16.1, appears to play a role in the absence of third molars. Early in dental epithelial development, bone morphogenetic protein-4 regulates the expression of mesenchymal genes involved in tooth formation, including *MSX1*. The combined influence of these genes and their associated growth factors likely contributes to the clinical manifestation of tooth agenesis. Variations in genetic makeup across populations along with the difference in the contributing environment may explain the differences in the prevalence of agenesis of the third molar.¹⁹ The reasons behind the higher occurrence of third molar agenesis in women remain unclear. One possible explanation suggests that women's smaller, more delicate jaw structure may contribute to this phenomenon. However, evidence is mixed, with some studies indicating a correlation between smaller jaws and increased rates of agenesis, while others do not support this relationship.^{8,20}

With the continuous process of human evolution, the third molars have been considered to be a vestigial structure. It has been advocated that with the change in dietary habits and decrease in jaw size, the functionality of third molar is decreasing and consequently resulting in its agenesis.²¹ However, this tooth has been known to be associated with many pathological conditions including caries due to difficult plaque control, pericoronitis, cysts, tumours, malocclusion due to arch-length discrepancies and root resorption of the adjacent tooth.²² Moreover, this non-functional tooth holds a significant forensic value.²³ The relatively large pulp

chamber in third molars provides a rich source of deoxyribonucleic acid (DNA), which is crucial for forensic identification, particularly in cases where other tissues have decomposed or are unavailable.²⁴ Furthermore, the third molars play a critical role in age estimation, especially in young adults. The development and eruption of third molars occur later than other teeth, and their formation can be used as a biological marker for estimating age.²⁵

Present study was conducted at a single site, which may limit the generalisability of the findings to the broader Nepali population. Additionally, only the prevalence of the condition was recorded, without any analysis of associated factors. To achieve more generalizable results, future research may consider a multicentric approach that includes a comprehensive investigation of contributing factors.

CONCLUSIONS

The findings of this study suggest a higher likelihood of third molar agenesis in females compared to males. This highlights the need for further research to explore potential genetic, environmental, or developmental factors contributing to third molar agenesis. Future studies could also investigate longitudinal trends, regional variations, and potential causal relationships to provide a deeper understanding of third molar agenesis in the Nepali population.

ACKNOWLEDGEMENTS

None.

Conflict of interest: None.

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