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Third Molar Agenesis: Evolutionary Adaptation or Regenerative Opportunity Loss? An Institutional Demographic and Radiographic Study

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ABSTRACT

Background

Third molars are the most variable teeth in the human dentition and are frequently affected by developmental anomalies. Third molar agenesis, defined as the congenital absence of one or more third molars, has shown increasing prevalence in modern populations and is considered an indicator of evolutionary changes in craniofacial growth and dentition.

Aim

To evaluate the prevalence and radiographic patterns of third molar agenesis in an institutional population using digital orthopantomography (OPGs).

Materials and Methods

A cross-sectional study was conducted using 1000 digital OPGs. Third molar agenesis was assessed based on sex, jaw involvement, laterality, and the number of missing third molars. Descriptive statistical analysis was performed.

Results

Third molar agenesis was observed in 39.4% of the study population. Absence of two third molars was the most common pattern (79.5%), while absence of all four third molars was seen in 20.5% of cases. Females showed slightly higher prevalence (53.8%) than males (46.2%). Agenesis involved both jaws in 46.2% of cases, followed by maxillary-only involvement (35.9%). Bilateral agenesis (59.0%) was more common than unilateral agenesis (41.0%). Maxillary third molars demonstrated higher absence rates.

Conclusion

The study demonstrated a high prevalence of third molar agenesis with predominant bilateral and maxillary involvement, supporting ongoing evolutionary changes in human dentition. “While this concept does not challenge existing clinical guidelines, it emphasizes the need to reconsider third molar agenesis beyond routine epidemiologic and evolutionary interpretations.”

Keywords

Dental evolution, Hypodontia, Orthopantomography, Regenerative dentistry, Third molar agenesis, Wisdom tooth

INTRODUCTION

Third molars are the last teeth to develop and erupt in the permanent dentition and demonstrate the greatest variability in morphology, eruption pattern, and presence or absence.[1] Congenital absence of one or more third molars, known as third molar agenesis, is among the most common developmental dental anomalies observed in humans.[2] Increasing prevalence of third molar agenesis in modern populations has been considered an indicator of ongoing evolutionary reduction in craniofacial dimensions and dentition.[3]

The etiology of third molar agenesis is multifactorial and includes genetic, epigenetic, environmental, and developmental influences. [4,5] Reduction in jaw size, changes in dietary habits, and disturbances during odontogenesis have all been implicated in the progressive absence of third molars.[3] Since third molars are the final teeth to develop, they are considered particularly susceptible to developmental alterations.[6]

Clinically, third molars are associated with several pathologic conditions including impaction, pericoronitis, dental caries, periodontal disease, odontogenic cysts, tumors, and root resorption of adjacent teeth.[7] At the same time, third molars continue to retain contemporary clinical importance in oral surgery, orthodontics, prosthodontics, and forensic dentistry. In recent years, human third molars have also gained increasing interest as a potential source of dental pulp stem cells with applications in regenerative medicine and tissue engineering. [8,9]

The prevalence of third molar agenesis varies considerably among different ethnic and geographic populations worldwide. Previous studies have reported prevalence rates ranging from approximately 10% to 35%, with differences observed according to sex, jaw distribution, and population characteristics. [1,10] Recent Indian studies have suggested an increasing prevalence of third molar agenesis among

younger populations born in the twenty-first century.[2]

Despite several international studies, regional Indian data regarding the prevalence and radiographic patterns of third molar agenesis remain limited. Understanding such patterns is important not only from developmental and anthropological perspectives but also for contemporary clinical and regenerative considerations. Therefore, the present study was undertaken to evaluate the prevalence and radiographic patterns of third molar agenesis in an institutional population using digital orthopantomographic analysis.

AIMS AND OBJECTIVES

To estimate the prevalence of third molar agenesis using digital orthopantomographs.

To analyze the distribution of third molar agenesis according to jaw involvement and number of missing teeth.

To assess the association of third molar agenesis with gender.

To evaluate the laterality and tooth-specific pattern of third molar agenesis.

MATERIALS AND METHODS

Study Design

A cross-sectional radiographic study was conducted using digital orthopantomographs (OPGs).

Study Sample

A total of 1000 digital orthopantomographs (OPGs) obtained from the institutional database were included in the study. Good quality digital OPGs of subjects within the selected study age group and with clearly visible third molar regions were included. OPGs with poor image quality, history of third molar extraction, presence of syndromes or craniofacial anomalies associated with hypodontia, and incomplete patient records were excluded from the study.

Ethical Clearance

Ethical approval for the study was obtained from the Institutional Ethical Committee of Sri Ramakrishna Dental College and Hospital (IEC No: EC/2023/0908/CR-68). Patient confidentiality was maintained throughout the study, and patient identity was not disclosed. Institutional ethical guidelines for retrospective radiographic studies were strictly followed.

Methodology

Each digital orthopantomograph (OPG) was evaluated for the presence or absence of third molars in all four quadrants. The findings were recorded based on sex, jaw involvement, number of missing third molars, laterality, and tooth-specific absence pattern. The absence of a third molar without radiographic evidence of extraction was considered as agenesis.

Statistical Analysis

Data were tabulated and analyzed using descriptive statistical methods. Frequencies and percentages were calculated for prevalence and distribution patterns.

RESULTS

Third molar agenesis was observed in 39.4% of the study population. Females showed a slightly higher prevalence (53.8%) compared to males (46.2%) (Table 1).Among the agenesis cases, absence of two third molars was the most common pattern (79.5%), while absence of all four third molars was observed in 20.5% of cases (Table 2).Bilateral agenesis (59.0%) was more common than unilateral agenesis (41.0%) (Table 3).Jaw-wise distribution showed involvement of both jaws in 46.2% of cases, followed by maxillary-only involvement (35.9%) and mandibular-

only involvement (17.9%) (Table 4).Tooth-specific analysis demonstrated higher absence rates in maxillary third molars. Tooth 18 showed the highest frequency of agenesis (31%), followed by tooth 38 (29%), tooth 28 (19%), and tooth 48 (17%) (Table 5).

DISCUSSION

Third molars are regarded as the most evolutionarily unstable teeth in the human dentition and frequently exhibit variations in eruption, morphology, impaction, and congenital absence. Third molar agenesis has therefore gained increasing importance in dental anthropology, evolutionary biology, oral pathology, and regenerative medicine. The present institutional radiographic study evaluated 1000 digital orthopantomographs to assess the prevalence and distribution patterns of third molar agenesis based on gender, jaw involvement, laterality, and tooth-specific absence patterns.

The present study demonstrated a prevalence of 39.4%, indicating that nearly two out of five individuals in the study population lacked at least one third molar. This prevalence is comparatively higher than several previously reported global studies and supports the growing evidence of increasing third molar agenesis among younger populations.

Carter and Worthington, in a systematic review and meta-analysis, reported a global pooled prevalence of approximately 22.6%.[1] Similarly, Jadhav et al. reported a prevalence of 35.05% among young Indian individuals born in the twenty-first century.[2] Turkish population studies conducted by Erzincan et al. and ICOMMEH conference reports demonstrated prevalence rates ranging between 33% and 35%.[11,12] The comparatively higher prevalence observed in the present study may suggest a continuing reduction in third molar development in contemporary populations.

From an evolutionary perspective, reduction in jaw size and masticatory demands has been proposed as a major contributing factor for third molar agenesis.[3] Dietary transition from coarse fibrous foods to softer processed diets may have reduced functional demands on the jaws, resulting in gradual reduction of craniofacial dimensions over generations. Third molars, being the final teeth to develop, are considered particularly susceptible to such developmental and evolutionary changes.

The present study demonstrated a slight female predominance, with females accounting for 53.8% of agenesis cases (Table 1). Similar findings have been consistently reported in previous literature.[1] Earlier studies have suggested that females exhibit comparatively smaller jaw dimensions and earlier completion of craniofacial growth, which may contribute to a higher frequency of third molar absence.

Among agenesis cases, absence of two third molars was the most common pattern, accounting for 79.5% of cases (Table 2). This finding is consistent with previous studies reporting that partial agenesis is more common than complete absence of all four third molars.[13] This supports the concept that reduction in third molar development may represent a gradual evolutionary process influenced by both genetic and environmental determinants.

The present study also demonstrated predominant bilateral involvement (59.0%) (Table 3), indicating a tendency toward symmetrical expression. Similar symmetrical patterns have been reported in studies evaluating developmental dental anomalies and tooth

agenesis.[13] Bilateral occurrence supports the concept that strong genetic influences may regulate third molar development. Trakinienė et al. demonstrated significant genetic influence in third molar agenesis, further supporting hereditary control over third molar formation.[4]

Jaw-wise analysis revealed greater maxillary involvement (35.9%) (Fig-1) compared with mandibular involvement (Table 4). Tooth-specific evaluation demonstrated that tooth 18 (Fig-2) exhibited the highest frequency of agenesis, followed by tooth 38 (Table 5). Previous investigations have similarly demonstrated higher prevalence of maxillary third molar agenesis. [1,2] The exact reason for this pattern remains unclear; however, differential developmental timing and spatial limitations within the jaws have been proposed as possible explanations.

Third molars have traditionally been associated with various pathologies including impaction, pericoronitis, periodontal disease, dental caries, odontogenic cysts, tumors, and resorption of adjacent teeth.[7] Campbell reported that impacted third molars frequently demonstrate radiographically detectable pathologic changes, emphasizing the clinical burden associated with third molars.[7] Consequently, evolutionary reduction or absence of third molars has often been interpreted as a beneficial adaptive response that minimizes eruptive and pathologic complications.

Despite this evolutionary interpretation, third molars continue to retain modern clinical relevance. They may serve as potential abutment teeth in prosthodontics, replacement teeth in cases of molar loss, and valuable indicators in forensic age estimation. More importantly, recent advances in regenerative medicine have identified human third molars as important sources of dental pulp stem cells. [8,9]

Dental pulp stem cells derived from third molars possess multilineage differentiation potential and have demonstrated applications in bone regeneration, neural repair, angiogenesis, dentin-pulp complex regeneration, and tissue engineering. [8,9] These findings introduce a contemporary biologic dimension to third molars beyond their conventional perception as vestigial or problematic teeth.

Based on this evolving perspective, the present study proposes an exploratory hypothesis that third molar agenesis, although evolutionarily adaptive, may theoretically represent a reduction in available autologous regenerative resources. This concept may be described as a potential "regenerative opportunity loss." However, this hypothesis is conceptual and does not challenge current clinical protocols regarding prophylactic extraction or management of third molars.

Rather, the findings encourage reconsideration of third molars from a broader biologic perspective integrating developmental biology, evolution, regenerative dentistry, and personalized medicine. Future multicentric studies incorporating genetic analysis, craniofacial morphometry, and stem cell research may further clarify the developmental and regenerative implications of third molar agenesis.

"Based on the observed patterns and the regenerative relevance of dental pulp stem cells derived from third molars, we propose the hypothesis that third molar agenesis, although evolutionarily adaptive, may represent a potential reduction in available autologous regenerative biologic resources. This concept warrants further investigation through longitudinal and

regenerative studies. However, this hypothesis does not challenge existing clinical guidelines regarding third molar management."

CONCLUSION

The present study demonstrated a high prevalence of third molar agenesis with predominant bilateral and maxillary involvement, supporting ongoing evolutionary changes in human dentition and possible genetic influence on third molar development. Although third molar agenesis may represent an adaptive evolutionary trend, the emerging regenerative relevance of third molars as sources of dental pulp stem cells highlights the need to reconsider their biologic significance beyond traditional epidemiologic and evolutionary interpretations. While this concept does not challenge existing clinical guidelines, it provides a broader framework for future regenerative and developmental research.

LIMITATIONS OF THE STUDY

Institutional study design may limit generalization of findings.

Genetic analysis was not performed.

Longitudinal developmental assessment was not included.

FUTURE DIRECTIONS

Multicentric population-based studies with larger sample sizes.

Genetic and epigenetic correlation studies.

Evaluation of associations between third molar agenesis and craniofacial morphology.

Exploration of regenerative implications related to dental pulp stem cell availability.

REFERENCES

1. Carter K, Worthington S. Morphologic and demographic predictors of third molar agenesis: A systematic review and meta-analysis. J Dent Res. 2015;94(7):886-94.
2. Jadhav AN, Shaikh SS, Shushma G. Agenesis of third molar among the younger population of India born in twenty first century. Natl J Maxillofac Surg. 2024;15(2):302-6.
3. Wu L, Xianglong Z. The degeneration of third molars and its significance to human evolution. Acta Anthropol Sin. 1996; 15:185-99.
4. Trakinienė G, Šidlauskas A, Andriuškevičiūtė I, et al. Impact of genetics on third molar agenesis. Sci Rep. 2018; 8:8307.
5. Li C, Cui Y, Zhou C, Sun J, Zhou X. Epigenetics in odontogenesis and its influences. Curr Stem Cell Res Ther. 2018;13(2):110-7.
6. Vastardis H. The genetics of human tooth agenesis: New discoveries for understanding dental anomalies. Am J Orthod Dentofacial Orthop. 2000;117(6):650-6.
7. Campbell JH. Pathology associated with the third molar. Oral Maxillofac Surg Clin North Am. 2013;25(1):1-10.
8. Shi X, Mao J, Liu Y. Pulp stem cells derived from human permanent and deciduous teeth: Biological characteristics and therapeutic applications. Stem Cells Transl Med. 2020;9(4):445-64.
9. Al Madhoun A, Sindhu S, Haddad D, Atari M, Ahmad R, Al-Mulla F. Dental pulp stem cells derived from adult human third molar tooth: A brief review. Front Cell Dev Biol. 2021; 9:717624.

10. Polder BJ, Van't Hof MA, Van der Linden FP, Kuijpers-Jagtman AM. A meta-analysis of the prevalence of dental agenesis of permanent teeth. Community Dent Oral Epidemiol. 2004;32(3):217-26.
11. Erzincan A, et al. Prevalence of third molar agenesis among Turkish children. 2023.
12. ICOMMEH Conference Proceedings. Third molar agenesis among Turkish children. 2023.
13. Scheiwiller M, Oeschger ES, Gkantidis N. Third molar agenesis in modern humans with and without agenesis of other teeth. PeerJ. 2020;8: e10367.

TABLES

Table 1: Gender Distribution of Third Molar Agenesis

Gender	Percentage
Female	53.8%
Male	46.2%

Table 2. Distribution According to Number of Missing Third Molars

Number of Missing Third Molars	Percentage
Two third molars missing	79.5%
All four third molars missing	20.5%

Table 3. Distribution According to Laterality

Laterality	Percentage
Bilateral agenesis	59.0%
Unilateral agenesis	41.0%

Table 4. Jaw-wise Distribution of Third Molar Agenesis

Jaw Involvement	Percentage
Both jaws	46.2%
Maxillary only	35.9%
Mandibular only	17.9%

Table 5: Tooth-specific Distribution of Third Molar Agenesis

Maxillary third molars demonstrated higher absence rates compared to mandibular third molars.

Tooth	Percentage Absent
18	31%
28	19%
38	29%
48	17%

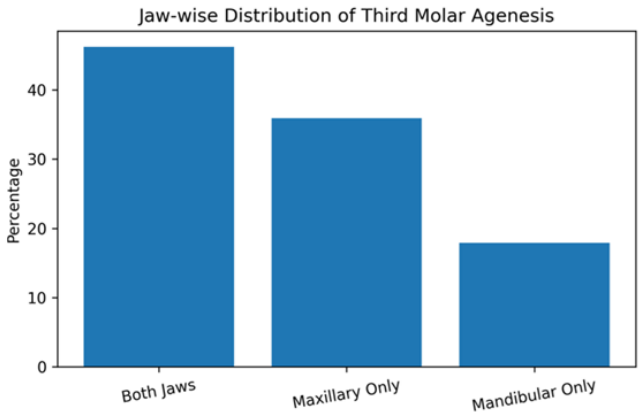

Figure 1:

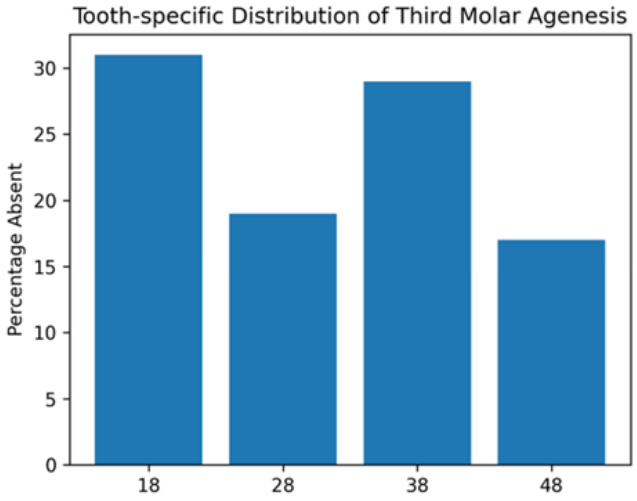

Figure 2:

Figure Legends

Figure 1: Greater involvement was observed in both jaws and maxillary arches.

Figure 2: Tooth 18 showed the highest frequency of agenesis.