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RADIOGRAPHIC ASSESSMENT OF THIRD MOLAR AGENESIS PATTERNS IN YOUNG ADULTS- A DIGITAL PANORAMIC STUDY

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Abstract

Third molars are the teeth that are frequently congenitally absent, which may be related to evolutionary changes altering the size of the jaw and teeth. Orthopantomogram (OPG) is a radiographic modality that is routinely employed in dental practice to detect pathologies of both the dentition and jawbones. The aim of the study was radiographic assessment of 400 third molars for agenesis in young adults of age 12-20 years with orthopantomogram. This retrospective study was performed on 400 archived digital panoramic radiographs retrieved from the department of Oral medicine and radiology for the comparative evaluation of third molars agenesis between the genders, maxillary and mandibular arches and between the right and left sides. A total of 400 panoramic radiographs were included in the study, in which 79 exhibited agenesis of third molars in males while 65 showed agenesis in females. Maxillary third molar (128) showed a higher prevalence of agenesis than mandibular third molars (77), while right quadrant showed 128 and left quadrant show 126 third molar agenesis. It was concluded that isolated third molar agenesis is part of a developmental mechanism resulting also in craniofacial size reduction. This might be the effect of an evolutionary process observed in humans.

INTRODUCTION

The process of evolution has resulted in a gradation of changes in the ecosystem, including humans. Evolution leads to gradual changes in the anatomical and functional dimensions in species leading to the concept

of rudimentary or a vestigial organ. The concept of natural selection forms the basis of evolution, which selectively eliminates the rudimentary structures. In the maxillofacial region, the third molar teeth are considered vestigial in nature, in addition to small tendinous muscles and muscles of the ear. On the other hand, third molars' role cannot be underweighted as an important tool in forensic investigations. (Singh N et al 2017). Agenesis refers to complete lack of development of an organ due to missing primordial tissue during embryo-genesis, growth and development. Tooth agenesis refers to congenital absence of one. more primary or permanent teeth. It is a common craniofacial anomaly may be caused by genetic variation or/and environmental factors. (Ganesan N et al 2023). There is great variation in the timing of development, calcification, and eruption of third molars or wisdom teeth. Development of wisdom teeth may begin as early as 5 years or as late as 6 years, with the peak formation period at 8 or 9 years. Calcification can start at age 7 years in some children and as late as 16 years in others. Enamel formation is normally completed between 12 and 18 years, and root formation is normally completed between 18 and 25 years. Hence, the particular age group is considered in the present study. (Chugh A et al 2021). The relationship of the third molar with the adjacent second molar is an additional concern for developing pathologies. In fact, a very common culprit of such malposition is pericoronitis. Several authors have attempted to evaluate the position of third molar impaction and the development of pericoronitis, with conflicting conclusions. Another common condition is periodontal disease; from increased probing depth to increased flora associated with periodontal disease, potentiated by the difficulty for proper hygiene measures due to abnormal positioning, all increase periodontitis risk for the second molar. (S.Neeta et al 2021)

Additionaly, dental caries, odontogenic tumors, odontogenic cysts and even mandibular fractures may be associated with retained M3; the prevalence of cysts and tumors in association with M3 ranges between 0.8% to 6.2% and such risk increases especially with mandibular impacted M3 in older patients (S. Neeta et al 2021). Orthopantomogram (OPG) is a radiographic modality that is routinely employed in dental practice to detect pathologies of both the dentition and jawbones. Third molars are the teeth that are frequently congenitally absent, which may be related to evolutionary changes altering the size of the jaw and teeth . (R. Bachar 2021). Hence, the present study was undertaken to access third molar agenesis in young adults of age between 12-20 years. The objective was to compare the prevalence of third molar agenesis between arches, quadrants and genders.

MATERIAL AND METHODS

This retrospective study was performed on 400 archived digital panoramic radiographs of patient between 12 to 20 years was included in the study. Radiographs of patients who underwent panoramic radiographic examination from February 2025 to August 2025 was retrieved from the department of Oral Radiology. An approval from the institutional ethical committee was obtained prior the study. Radiographs showing the presence of any jaw pathology such as cysts/tumors or fractures was excluded from this study. Also, radiographs with ghost images, artefacts was excluded from the study. The orthopantomograms was procured using VATECH OPG machine under standard exposure parameters of 76 kV, 5 mA, and an exposure time of 9.3 s using EZdent i software by a trained radiographer. To accurately determine the third molar agenesis, the dental digital panoramic radiographs was viewed on a computer display under optimum viewing conditions and they were evaluated for identification of third molar agenesis was

made by the observer. The data were entered in a Microsoft Excel spreadsheet and statistical tests were done using SPSS Statistics for Windows, version 25 (IBM Corp., Armonk, NY, USA). The gathered data was correlated with the sex, the quadrant of agenesis, and the total number of quadrants having agenesis of M3 tooth for each radiograph. A p-value of <0.05 was considered statistically significant. Categorical variables were compared using the Chi-square test.

RESULT

Agenesis of third molars is more commonly observed in the maxillary arch, with 128 cases of agenesis and 272 cases where third molars were present. In contrast, the mandibular arch had fewer agenesis cases, with 77 individuals lacking third molars and 323 showing their presence. The statistical analysis yielded a highly significant p-value of 0.000, indicating a statistically significant difference in third molar agenesis between the two arches (Table 1). This suggests that third molar agenesis is significantly more prevalent in the maxillary arch compared to the mandibular arch.

Table 1- Prevalence and Comparison of agenesis of third molars between arches

Arch		Agenesis		p Value
		Absent	Present	
Maxillary Arch	Count	272	128 (32%)	.000
Mandibular Arch	Count	323	77 (19.25%)	

On the right side, 128 individuals exhibited third molar agenesis, while 272 had their third molars present. Similarly, on the left side, agenesis was observed in 126 individuals, and 274 had third molars present. The p-value associated with this comparison is 0.211, which is statistically

non-significant (Table 2). This indicates that there is no meaningful difference in the prevalence of third molar agenesis between the right and left quadrants, suggesting that agenesis occurs almost equally on both sides of the oral cavity

Table 2- Prevalence and Comparison of agenesis of third molars between right left quadrant

Quadrant			Agenesis		p Value
			Absent	Present	
Quadrant	Right	Count	272	128 (32%)	.211
	Left	Count	274	126 (31.5%)	

Among males, 79 exhibited agenesis of third molars, while 121 had third molars present. In females, 65 showed agenesis, and 135 had third molars present. Although there appears to be a slightly higher prevalence of agenesis in males compared to females, the p-value is 0.088, which is above the conventional threshold of statistical significance ($p < 0.05$) (Table 3). This indicates that the difference in third molar agenesis between genders is not statistically significant and may be due to chance.

Table 3- Prevalence and Comparison of agenesis of third molars between male female

			Agenesis		p Value
			Absent	Present	
Gender	Male	Count	121	79 (39.5%)	.088
	Female	Count	135	65 (32.5%)	

For **bilateral maxillary third molar agenesis**, 44 males and 39 females were affected, with a p-

value of 0.538, showing no meaningful gender disparity. Similarly, **bilateral mandibular third molar agenesis** was observed in 31 males and 21 females, with a p-value of 0.137, which is also not statistically significant (Table 4). Overall, the findings indicate that there are no significant differences in the prevalence of third molar agenesis between males and females across any quadrant or bilateral regions.

Table 4- Comparison of agenesis of third molars between males and female's quadrant wise

QUADRANT	GENDER	AGENESIS PRESENT	P VALUE
Right Maxillary Molar	**Male**	60	.186
	Female	51	
Right Mandibular Molar	**Male**	35	.413
	Female	29	
Left Maxillary Molar	**Male**	53	.132
	Female	47	
Left Mandibular Molar	**Male**	36	.503
	Female	31	
Bilateral maxillary third molar	**Male**	44	.538
	Female	39	
Bilateral mandibular third molar	**Male**	31	.137
	Female	21	

DISCUSSION Agenesis or failure of development of a

missing tooth is a condition where a tooth fails to develop during the period of growth and development. The reason for agenesis M3 is unclear, and it could probably represent evolutionary changes in the jaw size of humans. Studies have shown that the third molar calcification starts from 7 to 10 years of age and is completed by 12 to 16 years of age. Hence, in line with these studies, we included patients above 12 years of age in this study. Panoramic radiographic procedure was selected over the intraoral periapical radiographs, due to its advantage of being a fast process and where in the view of the entire maxilla-mandibular region on a single film could be obtained. The procedure is convenient to patient and requires little expertise of the radiologist. The main advantages of this procedure are that the status of developing third molars can be viewed, their relation to inferior alveolar dental canal, type of impaction, and site of the third molar can be easily revealed. In our study Maxilla (32%) has more predilection for M3 agenesis than mandible (19.2%) which is similar to the study done by Rahardijo et al and Kaur et al where maxilla (50%) show more third molars agenesis than mandible (29.0%). Goyal et al. (2016) examined 700 orthopantomograms for third molar agenesis in a Sriganganagar population ; they found the prevalence rate to be 34.1%, slightly higher than ours. Male (39.5%) predilection is slightly more than females (32.5%) in our study as similar to reported by studies of Kaur et al (51.4%) in 2012, Mishra et al (61.1%) in 2017 and Neeta et al (53.6%) in 2021. While the studies conducted by Ganesan et al (32.6%) in 2023, Chugh et al (50.2%) in 2020 and Nisha et al (56.6%) in 2017 reported more cases of M3 agenesis in females. In our study there is no significant difference of third molar agenesis is seen between right and left quadrant similar to the study by Patil et al (2024). We observed overall prevalence of third molar

agenesis is 36% in our study. The lowest prevalence of third molar agenesis reported so far was 10.1% for African-Americans and the highest prevalence was 41% for the Koreans.

CONCLUSION

In conclusion, the present study affirms that isolated third molar agenesis is part of a developmental mechanism resulting also in craniofacial size reduction. This might be the effect of an evolutionary process observed in humans, leading to fewer and smaller teeth, as well as smaller facial structures and also change driven by modern, softer diets and cooking methods that have occurred over time. So, Routine monitoring of the development and eruption of third molars is recommended that helps track evolutionary trends.

CONFLICT OF INTEREST -The authors declare no conflicts of interest**.**

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