Original Article

Agenesis of third molar among the younger population of India born in twenty first century

ABSTRACT

Objectives: The objective of this study was to find the prevalence of agenesis of third molar among the younger population of India.

Materials and Methods: A cross-sectional study was conducted, and a younger population (13–21 years) born in the twenty-first century were included. Individuals who required an orthopantomogram, for any reason, were recruited in the study.

Results: A total number of 850 orthopantomograms were studied, and 298 (35.05%) individuals showed the agenesis of at least 1 or more third molars. The most common pattern of agenesis was the missing of both maxillary third molars, followed by the agenesis of all third molars. The frequency of agenesis was 18 >28 >48 >38. The study showed a significant predilection in the maxilla as compared to the mandible. There was no statistically significant gender predilection for agenesis of third molar.

Conclusion: The prevalence of third molar agenesis is increasing rapidly with time, with no significant gender predilection and changing trends of patterns of agenesis.

Keywords: Agenesis, prevalence, third molar

INTRODUCTION

The human body is continually evolving, and this can be seen in the head and neck regions where the sizes of the maxillary basal bone and teeth have both decreased. Third molars (M3) that are congenitally absent, referred to as agenesis of the third molar, are frequently discovered in young people all over the world. This is regarded as a component of human evolution. The literature on the agenesis of M3 describes a number of etiologic factors. The most frequently discussed are a hereditary component, developmental disease, delayed growth, and the amount of space available in the jaw. The third molar is the final tooth in the dentition to develop and erupt, and it is the tooth most sensitive to changes in the environment.[1] Whatever the cause, it is inevitable that M3 will disappear from the dentition in the coming generations.

Agenesis, pericoronitis, impaction, dental caries, periodontitis, abscesses, dentigerous cysts and other odontogenic cysts and tumors, injury to the inferior alveolar nerve, dental caries and/or root resorption of the second molar,[2] and, in some cases, angle fracture[3] are the common pathologies in the jaw that can be observed in the area of third molar. When possible, some clinicians want to carry on the third molar as a salvage tooth for a fixed prosthesis in the future. Additionally, because it is the most atypical tooth, the dentist is baffled as to whether to extract it or undergo root canal therapy.[4]

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However, as the prevalence of third molar agenesis is rising over time, these issues might no longer be clinical entities in the future. According to Carter K's most recent study and meta-analysis, the average rate of M3 agenesis worldwide is 22.63%, with a maxillary predilection of 18.97% and a mandibular predilection of 15.25%, with a 14.02% higher inclination in females than males. In the same study, the results for maxillary and mandibular M3 agenesis of at least 1 M3 were separated, with the maxilla having a 35.97% greater rate than the mandible.[1] Other investigations showed that M3 agenesis is becoming more common over life and generation by generation.

The study's objective was to determine the prevalence of third molar agenesis in the younger population born in the twenty-first century in the central Maharashtra state of India. Being a rapidly growing industrial location, the population of this area is made up of individuals from different communities that hail from all over India, making this sample a very accurate representation of the Indian population.

MATERIALS AND METHODS

The study was approved by the Institutional ethical clearance committee with Reference no. 25/20-21/20-12-2020, dated 20.12.2020. A cross-sectional study was performed at the department of dentistry of our institute. The younger population born after January 1, 2001, and living in the central region of Maharashtra were included. Patients or individuals who required an orthopantomogram, either for orthodontic treatment purpose or for third molar study reason or for prophylactic routine checkup, were considered for recruitment in the study. The minimum age criteria were decided based on the study of Zandi *et al.*, and they revealed that 95% of individuals show Demirjian's stage A, at the age of 12.5 years, which means the mineralization of third molar has already started. Therefore, we determined the minimum age limit of 13 years.[5]

Study Design: Cross-sectional

Sample size: A total of 850 patients or individuals

Inclusion criteria

1. Young individuals with an age range of 13 to 21 years.
2. Medical, dental, or other students willing to participate in study.

Exclusion criteria

1. Patients with congenital anomaly or diagnosed dental or facial skeletal pathology
2. Patients with conditions such as presence of ectodermal dysplasia, anodontia, odontogenic tumors, or cysts of jaw
3. Patients with a history of tooth extraction, jaw fractures, and jaw surgery

All the data were collected and analyzed to observe the failure of genesis of third molar and other concomitant findings such as missing teeth other than M3 or presence of supernumerary teeth.

RESULTS

A total number of 850 orthopantomograms were included in the study. There were 414 male and 436 female individuals.

A total of 3400 (850 × 4) third molars were studied to investigate agenesis, of which 711 (20.91%) third molars showed agenesis.

Broadly, of 850 participants 298 (35.05%) individuals showed agenesis of at least 1 or more third molars. Among these, 142 (16.70%) were male and 156 (18.35%) were female, indicating slight predilection in females [Table 1].

Pattern of agenesis

The most common pattern of agenesis of third molar was the missing of both maxillary third molars (9.52%), followed by the agenesis of all third molars (9.05%). Interestingly, in both these cases there was no sex predilection.

The least common pattern of agenesis of third molar was the agenesis of mandibular left third molar (1.05%), followed by the agenesis of mandibular right third molar (1.29%). Again, in both these cases there was no significant difference between males and females.

Table 1: Different patterns of agenesis of third molar

Patterns of agenesis of third molar (M3)	No. of cases		Total (%)
	Male	Female	
Agenesis of maxillary right M3 (18)	12	18	30 (3.52%)
Agenesis of maxillary left M3 (28)	8	17	25 (2.94%)
Agenesis of both maxillary M3 (18, 28)	43	38	81 (9.52%)
Agenesis of mandibular left M3 (38)	4	5	9 (1.05%)
Agenesis of mandibular right M3 (48)	4	7	11 (1.29%)
Agenesis of both mandibular M3 (38, 48)	6	11	17 (2.00%)
Agenesis of all M3 (18, 28, 38, 48)	43	34	77 (9.05%)
Agenesis of one maxillary and one mandibular M3	4	8	12 (1.41%)
Agenesis of any three M3	18	18	36 (4.23%)
Total no. of participants with agenesis of M3	142	156	298 (35.05%)
No. of cases without agenesis of any M3	272	280	552 (64.94%)
Total no. of participants in the study	414	436	850

If we consider the agenesis of individual third molar, the most frequent pattern of agenesis was 18 >28 >48 >38; that is, the maxillary right third molar showed the highest incidence of agenesis, while the mandibular left showed the least.

Gender predilection

The overall view indicates that the agenesis of M3 has a slight predilection for females (156) as compared to males (142), and the Chi-square test was carried out, but statistically it was not significant (*P* value = 0.65).

Interestingly, in all different patterns of agenesis of third molar we did not find a statistically significant difference for gender predilection.

Jaw predilection

This study showed a statistically high significant predilection of agenesis of third molar in the maxilla (136) as compared to the mandible (37), calculated by the Chi-square test ($P = 0.0001$).

Side predilection

There was no statistically significant side predilection for agenesis of third molar in this study. On the right side, there were 48 missing third molars, and on the left side, 40 third molars were missing.

DISCUSSION

Third molars, commonly known as wisdom teeth, are the last teeth to erupt in the oral cavity. However, their formation begins (crypt formation) at the age of 7–8 years, while calcification initiates at 8 years of age; the mean age of crown completion is 14–15 years, and the apex closure completes at the age of 17–22 years.[6]

It is a well-documented and learned fact that third molars had a vital function in mastication for the complete breakdown of cellulose of uncooked fibrous and dense raw plants and meat in Neanderthals, hunters, and gatherers phases of human evolution. This leads to significant and early wear of first and second molars; thus, the third molar acted as the replacement tooth for the same,[7] but in agriculturists and modern Homo sapiens altered food habits such as consuming more refined, well-cooked food resulted in less wear of first and second molars along with the lesser force of mastication. During evolution, this reflected as reduced jaw size and diminished necessity of third molar, suggesting that the third molar may now be vestigial in modern civilization.[8] Contrarily, third molars may still provide an essential function to modern civilization in the form of extra chewing surface area and power, in addition to the replacement of worn down or loss of first and second molars owing to poor oral hygiene, increased susceptibility to caries, and poor genetics.[9] Although opinion regarding the vestigial nature of third molar varies according to different studies and thoughts, three competing hypotheses exist to explain the evolution of third molar agenesis. The first is agenesis as the result of selection against impaction, the second is developmental delay, and third is probable mutation of genes responsible for the development of dentition.[10]

The prevalence of agenesis of third molar varies according to country of origin, environment, and ethnical background with a wide range of 10% to 41% among different parts of the world.[11] The lowest values were found in black Africans and Indians, exhibiting a prevalence of 10–11%, while the Iranian population showed the prevalence of 34.8% and the highest prevalence rate of third molar agenesis was found in Koreans approaching 41%. Table 2 compares the prevalence of agenesis of third molar among different parts of the world.[12] In the current study, the prevalence of agenesis of M3 was 35.05%, which has significantly increased as compared to previous studies in India.

In India, the prevalence of third molar agenesis varies among different zones and states, owing to variable ethnic and cultural backgrounds [Table 3]. The lowest value was found in the Tamilian population,[13] demonstrating a value of 6%. The young population of Punjab were found to have M3 agenesis ranging from 11.5%, 26%, and 35.4% in three different studies.[14] The population of Karnataka[15] showed 18.67% prevalence of M3 agenesis, while Gujaratis[16] exhibited 22.9% and 34% prevalence rates in two different studies. The population of Kerala[17] also demonstrated almost the similar range of M3 agenesis approaching 23.63%. A study performed among mixed south Indian population revealed the highest prevalence rate of M3 agenesis, which was around 56%.[18] All the above studies considered one common criterion of

Table 2: Comparison of prevalence of third molar agenesis among different countries

Country	Sample size	Prevalence of agenesis of third molar (%)
America	1700	10.1
Mexico	500	32.4
England	2500	12.7
Germany	2061	20.7
Australia	662	22.7
New Zealand	821	28
Korea	1129	41
Israel	228	5.83
Japan	391	26.1
Malaysia	300	30
Bangladesh	5923	38.4
India (current study)	850	35.05

Table 3: Comparison of prevalence of third molar agenesis among different studies carried out among the Indian population

Authors	Year	Sample size (population from)	Prevalence of M3 agenesis (%)
Singh N, Sandhu KS and Kaur M	2005	100 (Punjab)	11.5
Byahatti *et al*.	2011	150 (Karnataka)	18.67
Bansal	2012	400 (Punjab)	26
Kaur and Sheikh	2012	500 (Punjab)	35.4
Raloti *et al*.	2013	350 (Gujarat)	22.9
Bhowmik	2013	268 (mixed Indian population)	14.36 (1072/154)
Shah and Parekh	2014	100 (Gujarat)	34
Ren and Senthil Kumar	2014	50 (South Indian)	56
		50 (Malaysian)	24
Pillai	2014	1100 (Madhya Pradesh)	11.10 (490/4400)
Saravakumar and S George	2015	100 (Tamil Nadu)	6
Prashant Patil and Sarah Nazir	2018	55 (Kerala)	23.63
		52 (Bhutan)	35.29
Dr. Jadhav *et al*. (current study)	2021	850	35.05

at least one missing third molar in one patient, similar to the criterion in the current study. In our study, 35.05% of individuals demonstrated agenesis of at least one third molar.

Jacob *et al*. found that the most frequent pattern of third molar agenesis was 18 >28 >38 >48. However, Alam *et al*. reported a higher agenesis rate of 48 than 38.[12] In the current study, the most frequent pattern of third molar agenesis was 18 >28 >48 >38, which is in favor of Jacob *et al.* but in contrast with Alam *et al*.

Another interesting fact revealed in the current study is that the prevalence of agenesis of all third molars (9.05%) is considerably increased as compared to the most common pattern of agenesis of both maxillary third molars (9.52%), and this is in contrast to the literature that documented this later as the most common pattern.

Bhowmik *et al.*[19] studied 268 mixed Indian young individuals and found that of 1072 of the total third molars 154 (14.36%) were missing congenitally. Pillai studied 1100 young individuals in Madhya Pradesh and revealed that of 4400 of the total third molars 490 (11.10%) had agenesis.[20] The current study revealed that among 850 participants, of 3400 of the total third molars 711 (20.91%) molars were missing. Again, this is significantly amplified as compared to Bhowmik *et al.* and Pillai. This indicates that with time the prevalence of agenesis of third molars is increasing rapidly and so it can be expected that in the future very few individuals will have third molars or no one will have a third molar.

Factors affecting agenesis of third molar in individuals not having any systemic syndrome or craniofacial syndrome or anomalies are environmental factors, systemic diseases, genetic polymorphism, masticatory function, and dietary habits.[12] These factors further play a vital role in the occurrence of various dental anomalies such as macrodontia, microdontia, anomalous teeth, and ectopic tooth eruption in addition to agenesis of tooth, which is the most frequently occurring anomaly. Racial variations, environmental effects, and genetic inheritance can be explained by the fact that there are variations among different countries and races of human being, as revealed by the literature. In the current study, these effects were also experienced as dietary habits are drastically changing from rough raw food to more finely processed soft food.

Gkantidis *et al.*[21] demonstrated that with one or more missing third molars, there is a significant decrease in jaw size along with the entire facial configuration. With each missing third molar, there is approximately 2.5 mm reduction in the mesiodistal length of jaw. In the current study, we have not studied jaw length because we think that jaw length effects of missing third molars should be studied after an individual attains complete growth.

In the current study, the presence of other dental anomalies in individuals among agenesis of more than three third molars also had agenesis of one or more teeth; the most common was the second premolar, and its prevalence was 3.7%, which is comparable with Celikogalu *et al.* as discussed by Shah *et al.*[16] The overall percentage of the presence of other dental anomalies was 5.05%. These included hypodontia (3.70%), microdontia (2.1%), supernumerary teeth (0.5%), and peg-shaped lateral (1%).

However, this study was mainly focused on calculating the frequency of prevalence of third molar agenesis among the younger population born in the twenty-first century, to set a baseline for future studies that preferably should be carried out after 20 years among population samples from the same area. Such sequential studies will help to create a tool to study the rate of increasing prevalence of agenesis of third molar.

CONCLUSION

In conclusion, there is a sharp rise in the prevalence of third molar agenesis in the Indian population. Third molar agenesis trends are also evolving throughout time. Additionally, the current research finds no appreciable gender bias, contrary to earlier study findings. In addition, contrary to earlier research, the current study found that the pattern of agenesis of all third molars is nearly identical to that of agenesis of both maxillary third molars.

Third molar agenesis is becoming more common, which will ostensibly lower the incidence of various pathologies and problems related to them, but at the expense of the benefits of third molars, such as increased chewing surface area and power, as well as the replacement of worn down or lost first and second molars.

To observe the increased prevalence of third molar agenesis, which will assist in estimating how quickly the third molar evolved, we advise repeating the same study with an identical sample 20 years from now.

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Conflicts of interest

There are no conflicts of interest.

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