

**PREVALENCE OF THIRD MOLAR AGENESIS IN AN ORTHODONTIC POPULATION WITH SKELETAL CLASS II PATTERN**

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Abstract: Third-molar agenesis with respect to race, sex, number of missing third molars, malocclusion patterns and jaw dimensions is a topic of special interest to paleoanthropologists and to the orthodontists. The present paper is to study the prevalence of third molar agenesis in an orthodontic patient population with skeletal class II pattern.

Key words: Molar Agenesis; Third Molar Agenesis; Skeletal Class II Pattern; Mandibular Length; Prevalence Of Third Molar

INTRODUCTION

The third molar agenesis is a condition where one or more of the teeth are missing because they have never formed. The third molars show wide range of variability in the time of its formation¹. Only a limited number of studies have been carried out on third molar agenesis in different skeletal patterns in orthodontics patient populations. The present study is undertaken to study molar agenesis in skeletal class II patients.

MATERIAL AND METHODS

This cross sectional study was conducted in the Department of Orthodontics, Government Dental College Trivandrum in January 2013. Pretreatment orthopantomograms of 108 subjects with skeletal class II pattern in the age group 14 to 24 years who reported to the Department for orthodontics for treatment were examined for presence or absence of third molars. Inclusion criteria were age 14 to 24 years; with no history of previous orthodontic treatment and exclusion criteria were presence of congenital deformities like cleft lip and palate, poor radiographic quality and with no history of extraction of one or more third molars.

The cephalograms of the patients were analyzed to establish the skeletal class II pattern. The sagittal skeletal relationships of maxilla and mandible were assessed using Wits and ANB angle measurements. The Wits value (point BO located well behind point AO), with ANB angle value more than 5 degree were categorized skeletal class II, whereas those with ANB 0 to 4 degree and wits value + 1 mm are categorized as skeletal class I.

The OPG available with the patient as diagnostic records for treatment purpose were examined. When there was no evidence in records that third molar have been extracted and when there was no sign of mineralization of third molar crown in OPG, it

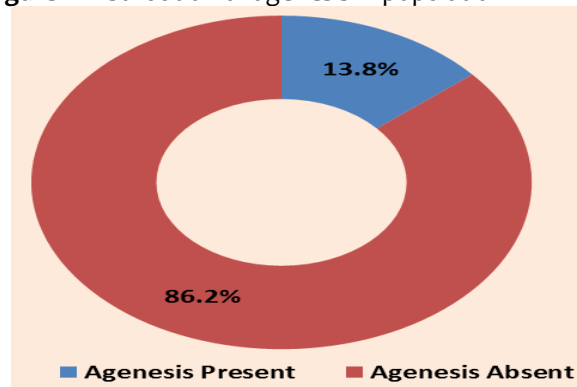
was considered as third molar agenesis. Data was tabulated and analyzed.

RESULTS

Out of the 108 orthopantomograms analyzed, 13.8% of cases showed molar agenesis. Table 1, Figure 1. Third molar agenesis was present in 13% of the males and 14.5% of the females. Table 2.

Table 1: Total agenesis of third molar

Total number	Agenesis	Percentage of agenesis
108	15	13.8%

Figure 1: Distribution of agenesis in population**Table 2:** Total number & percentage of third molar missing among gender

Gender	Number of patients	Patients with missing molars	Missing Molar			
			Upper right maxillary (18)	Upper left maxillary (28)	Lower left mandibular (38)	Lower right mandibular (48)
Male	46	6 (13%)	6	5	0	0
Female	62	9 (14.5%)	5	5	4	4
Total	108	15 (13.8%)	11 (10.1%)	10 (9.3%)	4 (3.7%)	4 (3.7%)

P_Value: 0.0786

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Figure 2: Percentage of third molar missing among gender

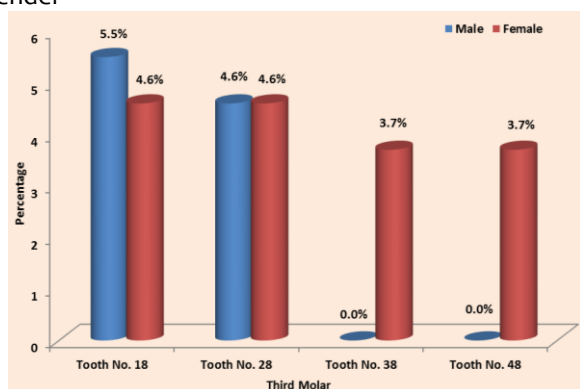


Figure 3: Percentage of teeth agenesis in maxilla and mandible according to age

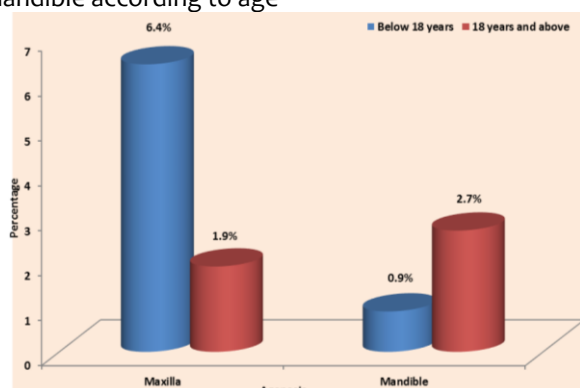


Table 3: Agenesis of maxillary and mandibular third molars

Agenesis	Males (N=46)	Females (N=62)	Total (N=108)
Total missing molars			
Agenesis of 18 and 28 (maxilla) patient's both upper right and left maxillary third molars	5 (10.8%)	4 (6.5%)	9 (8.3%)
Agenesis of patient's both lower right and left mandibular third molars 38 and 48 (mandible)	0	4 (6.5%)	4 (3.7%)
Agenesis of all the maxillary and mandibular third molars 18, 28, 38 and 48	0	0	0

Upper right third molar agenesis was seen in 10.1% of total study population, upper left third molar agenesis was seen 9.25% of the study population, lower left third molar agenesis was seen 3.7% of the study population, lower right third molar agenesis was seen 3.7% of the study population (Table 2).

Upper third molar was not present in 8.3% of total population, and this was 60% of the population with molar agenesis, Lower third molar agenesis was present in 3.7% of total population, this was 26.6% of the population with molar agenesis (Table 3).

Out of the 13.8% of molar agenesis cases, 73.3%, 66.6%, 26.6% and 26.6% of cases presented with agenesis of upper right, upper left, lower left and lower

right respectively. The percentage of missing third molars among males and females is presented in Figure 2.

In the age group 14 to 17 years, a total of 7.4% of molar agenesis was present in total study group; out of which 6.4% was in the maxilla and 0.92% in the mandible. In the age group 18 to 24 years, a total 4.6% of molar agenesis was present in total study group; out of which 1.87% was in the maxilla and 2.7 in the mandible. (Figure 3).

DISCUSSION

Dental anomalies affect the dental occlusion. Dental agenesis is a dental anomaly causing alteration in the number of teeth. Cameron and Sampson² (1996) defined Tooth agenesis as the 'congenital lack of one or more of the deciduous or permanent teeth – the one not erupted in the oral cavity, and also not visible in a radiograph', they described this as 'one of the most frequent human dental anomalies'. The teeth that are most often congenitally missing are the third molars.

Incidence of third molar development was reported in literature in 1934 by Banks³. Hellman⁴ in 1936 reported on the eruption, presence and absence of our third molar teeth. Agenesis of the third molar in man was reported in 1954 by Nanda⁵. Garn, Lewis, and Vicinus⁶ (1962) also reported on third molar agenesis. Craniofacial Morphology and third molar agenesis, investigated by Sanchez, Vicente and Bravo⁷ was reported in 2009. According to Bredy Erbring and Hübenthal⁸ (1991), tooth agenesis is the most common developmental anomaly in the human dentition, it is seen in 25% of the population. The third molar is the tooth most affected with agenesis⁹, the prevalence being 20.7%².

Third molar in orthodontic treatment: Significance of late third molar genesis in orthodontic treatment was studied by Richardson¹⁰ (1980). Richardson¹¹ (1989) reported on the role of the third molar in late lower arch crowding. Clinical observations on the development of third molars were made by Daito, Tanaka and Hieda¹² (1992). The frequency of agenesis of third molar teeth in orthodontic patients was reported by Celikoglu et al¹³ in 2010. Endo et al.,¹⁴ (2006) concluded that when orthodontic treatment was to be performed on patients with hypodontia, the number and also the distribution of missing teeth should be taken into consideration. Celikoglu, Bayram, and Nur¹⁵ (2011) concluded that microdontia of maxillary lateral incisors, permanent tooth agenesis, and total dental anomalies were more frequently associated with agenesis of four third molars. Nadia et al.,¹⁶ (2014) investigated the correlation of hypodontia

in orthodontic patients with third molar agenesis and compared them to patients without agenesis of third molar; and statistically established a significant correlation between third molar agenesis and reduced number of other teeth. Study reports¹⁷ in Malaysian Malay and Chinese population suggested that sagittal jaw dimensions and the ANB angle were significantly correlated with third molar presence/agenesis.

Prevalence: Tooth agenesis, the most common developmental anomaly of the human dentition, occurs in approximately 25% of the population.¹⁸ and the Third molars is the most affected tooth, prevalence of is agenesis being 20.7%.¹⁸ Many authors Nanda⁵1954, Eidelman¹⁹ 1973, Rozkovcova²⁰ 2004 and Harris²¹ 2009 reported that third molar agenesis incidence range between 18-25%

Third molar agenesis was found in 31% of Malaysian Malay and Chinese (Mohammad Khursheed Alam et al.,¹⁷), 31.5% of American white subjects (Harris and Clark²²), 32.4% of the Mexican subjects (Rosario and Gonzalez²³), 33.2% in the Finland subjects (Eloma and Eloma²⁴) and 32% of Malaysian Chinese subjects (Jacob et al.,²⁵). A wide range has been observed by Garcia-Hernandez et al.,²⁶ (2008) in the prevalence of this anomaly which can be attributed to the racial origin, age and sex distribution of the subjects, and also due to differences in the methods of sampling.

Third-molar agenesis among patients from the East Anatolian region of Turkey was taken up by Kazanci et al.¹⁶. Agenesis of third molar germs and sagittal maxillary jaw dimensions in orthodontic patients in Japan is reported in the work of Kajii et al.²⁷. A retrospective radiographic study of congenitally absent third molars in 12 to 16 year old in Singaporean Chinese patients was done by Mok and Ho²⁸. The study data from Barka et al.,^{29, 30} (2013) provide a reference for the third molar genesis in Greeks. The percentage of persons with one or more third molars missing ranges from 9 to 20% (Richardson), up to 30% in some populations. In Loredana and Gabriela's³¹ (2012) study, 28% of the sample had one or more missing third molar. One or more molars were missing in 25.7% of the Malay population³²; it was comparable with study results of John et al.,³³ (2012); it was 28.5% in Chinese Singaporeans (Mok and Ho²⁸, 1996) and 11.5% in Asian-Indian students (Sandhu and Kaur³⁴, 2005); a higher incidence of 30% was seen among Koreans (Chung et al.,³⁵, 2008) and of 51.1% among the Japanese (Daito et al.,¹², 1992)

Results of Mevlut Celikoglu's and Hasan Kamakb's³⁶ study showed 22.7% subjects with third-molar agenesis, with no statistically significant gender difference; and third-molar agenesis more common in

the maxilla than in the mandible. Usually, the maxillary third molars are most frequently missing (Mok and Ho²⁸ 1996; Sandhu and Kaur³⁴, 2005; Celikoglu and Kamak³⁶ 2012; Mani, Mohsin and John³², 2014). Majority of the molar agenesis were reported in the maxilla, by Hattab et al.,³⁷ Sandhu and Kaur³⁴, Barka et al.,²⁹ and Jacob et al.,³² all these showed greater predilection for the maxilla over the mandible. The results of the present study are in agreement with these reports in that molar agenesis was more common in the maxilla than in the mandible; Upper third molar was not present in 8.3% of total population; Lower third molar agenesis was present in 3.7% of total population of this present study (Table 3). Out of the 13.8% of molar agenesis cases, 73.3%, 66.6%, of cases presented with agenesis of upper right, upper left; where as 26.6% and 26.6% of cases presented with agenesis of lower left and lower right respectively. But in reports of Mohammad Khursheed Alam's¹⁷ study, no significant difference was reported in the frequencies of at least one third molar missing in the maxilla and the mandible.

Results of Mevlut Celikoglu, Hasan Kamakb³⁶ showed that the third-molar agenesis was significantly higher in subjects with Class III malocclusion than in subjects with Class I or Class II malocclusion. The prevalence was similar among the hyper-divergent (24.5%), normal (23.8%), and hypodivergent (19.2%). Mohammad Khursheed Alam's¹⁷ study reports evidenced for higher prevalence of third molar agenesis in Class III malocclusion in Malaysian Malay population but in Malaysian Chinese population, it was relatively higher in Class II malocclusion cases. Celikoglu and Kamak³⁶ and Kajii et al.,^{27, 50} found the prevalence of those with presence of all the four third molars in Class III malocclusion to be lower than in subjects with Class II malocclusions. In this present study, the prevalence of third molar agenesis was found to be 13.8%, and no comparison was made with Class III malocclusion subjects. Athari Al-Amri et al.,³⁸ concluded that agenesis tended to be more common in Class II malocclusion than in other types of malocclusion.

Prevalence of tooth agenesis in orthodontic populations was studied by Endo et al.,¹⁴ 2006; Varela et al.,³⁹ 2009 and Vahid-Dastjerdi et al.,⁴⁰ 2010. Vahid-Dastjerdi et al., reported a higher hypodontia is their orthodontic population. Upadhyaya's⁴¹ study on agenesis of 3rd molar in an orthodontic population from Nepal showed that agenesis of one to four third molars was present in 63 out of the 94 males included in the study. 13.8% of cases of the orthodontic population from Trivandrum included in the present study showed molar agenesis; Upper third molar were not present in 8.3% of total population and Lower third molar was not

present in 3.7% of total population. Mohammad Khursheed Alam¹⁷ had concluded that in their orthodontic population from Malaysian Malay and Chinese, the third molar agenesis was 30% and 33% respectively. Georgia Barka²⁹ 2012 reported agenesis in 20.9% of their orthodontic group from northern Greek and no significant difference was reported in the frequencies of third molar presence on the right and left sides, both in the maxilla and in the mandible. Nadia et al.,¹⁶ (2014) investigated the correlation of hypodontia in orthodontic patients with third molar agenesis and compared them to patients without agenesis of third molar; and statistically established a significant correlation between third molar agenesis and reduced number of other teeth.

Many authors reported third molar agenesis incidence to range from 18% to 25%; the percentage of one or more third molar agenesis ranges from 9 to 20%; according to Richardson¹⁰(1980), 9 to 20% of persons of the sample of European population had one or more third molars missing. 13.8% of cases included in the present study showed molar agenesis, this is in agreement with the reports of Richardson. In Golovcencu and Geletu's³¹ study showed at least one third molar missing in 28% of the study sample. In Nadia et al.,¹⁶ (2014) study, 31.7% of the sample had at least one third molar missing. Studies in Asian populations reported the prevalence of third molar agenesis closer to the value in Nadia et al.,¹⁶ (2014) study with a range of 27.2% in Jordanians to 36.4% in Turkish; Western studies reported a lower percentage of third molar agenesis with a maximum percentage of 24%.

Lynham⁴² conducted a radiographic survey of hypodontia in Australians (1990). The status of third molars in the Asian-Indian students was evaluated by Sandhu and Kaur³⁴ in 2005. Fekonja⁴³ reported on hypodontia in orthodontically treated children (2005). Third-molar development with respect to chronologic age was reported by Sisman et al.,⁴⁴ in Turkish subjects (2007) and Chung³⁵ in 2008 reported on the prevalence of hypodontia among Koreans. Most often third molars are the congenitally missing teeth.

Golovcencu and Geletu³¹ investigated into the frequency of dental anomalies in orthodontic patients with third molar agenesis. Garn and Lewis¹ (1962) and Garib¹⁸ (2009) showed a significant association of third molar agenesis with agenesis of other teeth, particularly the second premolars and the lateral incisors.

Third molar and jaw dimensions: There have been many investigations over years on whether there is a relationship between third molars and crowding, whether the presence or absence of the third molars

relates with posterior crowding; and also to study on third molar agenesis and different skeletal malocclusion patterns, sagittal jaw dimensions and craniofacial morphology. A study in the Japanese (2004) reported that agenesis of third molar germs does not depend on anteroposterior dimensions of the mandible but depends on anteroposterior dimensions of the maxilla in Japanese orthodontic patients. Mevlut Celikoglua's and Hasan³⁶ Kamakb's (2012) study concluded that the agenesis of the third molar depends on sagittal and not on the vertical patterns of the skeletal malocclusions in their study of orthodontic patient population. Nurgül Kömerik⁴⁵ (2014) reported that the third molar agenesis, in both jaws, appeared to be related to the jaw relations in sagittal and vertical planes.

The genetics in the etiology of dental anomalies is reported in various studies; new discoveries for understanding dental anomalies based on genetic studies were attempted. Studies by Grahnen⁵¹ (1956), Vastardis⁴⁶ (1996) and Stockton⁴⁸ (2000) have furnished evidence that genes play a critical role in the etiology of tooth agenesis. Also, the role of genetics has been recognized in recent years with respect to dental anomalies such as tooth agenesis (Heleni Vastardis⁴⁷, 2000). With the use of "the family study" method, evidence was produced showing that other genetic defects also contributed to the wide range of phenotypic variability of tooth agenesis. 'The orthodontist decoding the genetics which regulates the dental development disturbances' in the associated dental anomalies can be observed in the work of Garib et al.,¹⁸ (2010). The clinical implication is that an early detection of a dental anomaly can make timely orthodontic intervention possible. Galluccio and Pilotto⁴⁹ (2008) concluded that the agenesis of anterior teeth might depend on genes, and that posterior teeth agenesis was sporadic. Tooth agenesis has a genetic basis, as can be seen from Grahnen⁵¹; Vastardis⁴⁷ et al., mode of transmission could be by a single autosomal dominant gene with incomplete penetrance. Vastardis⁴⁷ (2000) reported that the Third molar agenesis cannot be explained in the majority of cases with a simple model of autosomal dominant transmission.

Race and Sex: Loredana and Gabriela's³¹ (2012) study findings were similar to those of Bishara⁵² in gender distribution, they found a ratio of 3:2 among females and males with agenesis of third molars; a lower prevalence of agenesis in Blacks when compared to Whites, and an increased prevalence of agenesis in Asians was observed in epidemiological studies; also, women are more affected than men. Regarding gender distribution, Golovcencu and Geletu's findings are

similar to Bishara's reports in which a ratio of 3:2 between female and male with third molar agenesis.

CONCLUSION

- In this paper undertaken to study molar agenesis in skeletal class II patients in an orthodontic population from Government Dental College Trivandrum, third molar agenesis was seen in 13.8% of the subjects included in the study. 13% of the males and 14.5% of the females had third molar agenesis.
- Upper third molar agenesis was present in 8.3% of total population; this was 60% of the population with molar agenesis. Lower third molar agenesis was present in 3.7% of total population which was 26.6% of the population with molar agenesis.
- Upper right third molar agenesis and upper left third molar agenesis was seen in 10.1% and 9.25% of the study population respectively. Lower left third molar agenesis was present in 3.7% of the study population; lower right third molar agenesis was also seen to be 3.7% in the study population.
- Out of the 13.8% of third molar agenesis cases, 73.3%, 66.6%, 26.6% and 26.6% of cases presented with agenesis of upper right, upper left, lower left and lower right third molars respectively.
- In the age group 14 to 17 years, a total of 7.4% of molar agenesis were present in total study group; out of which 6.4% was in the maxilla and 0.92% in the mandible.
- In the age group 18 to 24 years, a total 4.6% of molar agenesis was present in total study group; out of which 1.8% was in the maxilla and 2.7% in the mandible.

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