

## Prevalence of Tooth Agenesis in Patients Visiting a Dental College in UAE- A Retrospective Study

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### Abstract

Agenesis comprises of the most common developmental anomaly of the human dentition, and is seen to affect at least about 25% of the population. The aim of this study was to determine the prevalence of agenesis of third molars, mandibular second premolars and maxillary lateral incisors in the patients visiting a dental college in United Arab Emirates.

Orthopantomograms (OPGs) of 945 dental patients aged 6 years -30 years were examined for the agenesis of teeth. Bilateral agenesis was considered and unilateral missing teeth were excluded from the study. Descriptive statistics were used to describe the percentages and frequencies were calculated using chi square test and the level of significance was considered if p value was <0.05.

The prevalence of bilateral agenesis or congenitally missing teeth within the selected 945 OPGs were at 8.99%. The most common bilateral agenesis or congenitally missing teeth were the third molars (31.7%) followed by mandibular second premolar (10.5%) and maxillary lateral incisors (8.2%).

The most common tooth presenting with agenesis was the third molars. The agenesis was more in the males than females and also it was more common in the mandibular arch than in the maxillary arch.

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### Introduction

The term Agenesis refers to a condition wherein certain teeth have failed to develop and are not present or have not erupted within the oral cavity at their designated times of eruption as per literature.<sup>1</sup> Agenesis or missing teeth is a relatively common phenomena known to dentistry. Several terms have been used to enumerate missing teeth dependent upon the number of teeth involved. The complete absence of teeth is known as Anodontia. Partial Anodontia or Oligodontia implies the number of missing teeth to be six or more. When the number of

missing teeth is less than six then it is referred to as Hypodontia.<sup>1,2</sup> The etiology of agenesis could be attributed to environmental factors, genetic polymorphisms, systemic diseases, dietary habits and masticatory function.<sup>3,4</sup> The genetic etiology is usually attributed to mutation of some genes (PAX9 AND MSX1), in addition to some other etiological reasons in the prenatal and postnatal periods.<sup>4</sup> Studies which compared the gender predilection suggested that the prevalence of agenesis was more in women than men.<sup>5,6</sup> Racial comparisons revealed that there is a lesser rate of prevalence in the black race when compared to the whites and that Asians showed an increased prevalence of agenesis.<sup>7,8</sup>

Agenesis comprises of the most common developmental anomaly of the human dentition, and is seen to affect at least about 25% of the population.<sup>9</sup> This phenomena is observed more in the permanent dentition when compared to the primary dentition.<sup>10</sup>

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The most commonly missing teeth are the third molars, mandibular second premolars and the maxillary lateral incisors in order of occurrence, though there have been some studies which have reported higher prevalence of maxillary lateral incisors when compared to mandibular second premolars.<sup>9,10</sup>

Agenesis or complete absence of teeth can result in asymmetries of occlusion, discrepancies in arch length and may pose difficulties in orthodontic treatment decision making. If agenesis is present in the anterior region of the maxilla or mandible, it becomes even more evident and noticeable.<sup>10</sup>

The agenesis of teeth can affect a person both psychologically and functionally especially in his youth. This is even more of significance when this congenitally missing tooth is in the anterior, esthetic or functional region of the mouth.<sup>8</sup> An early determination and diagnosis of hypodontia can have minimal esthetic, psychological or functional complications to deal with for the patient. The plausible treatment option that one has for agenesis includes orthodontic space closure, fixed partial denture, implants or orthodontic space re-distribution thereby enabling more functional prosthetic treatment.<sup>9,10</sup>

The present study was designed to understand the prevalence of bilateral agenesis or congenitally missing third molars, mandibular second premolars and maxillary lateral incisors.

### Materials and methods

This was a retrospective, observational study conducted at RAK College of Dental Sciences (RAKCODS), RAK Medical and Health Sciences University (RAKMHSU), RAK, UAE. The objective of the study was to understand the type and prevalence rate of tooth agenesis in the population visiting the college. This research was approved by the Research and Ethics committee of the university and the RAK Research and Ethics Committee, Ministry of Health, (Proposal number: RAKMHSU: REC: 119-2019-UG-D).

Orthopantomograms (OPGs) available at the oral radiology center of the university was used, a total of 945 OPGs were selected for the study from the total 18500 OPGs. These 945 OPGs were selected based upon the age group, clarity of the OPG, presence of details in the OPG and E file of the patient on the Hospital Information Management System (HIMS).

Patients with syndromes or other special needs patients as per the E-file records on HIMS (Hospital Information Management System) were excluded from the study and also edentulous patients were not included. Also those patients who had periapical X-rays on their files which showed a possible extraction of these (third molars, mandibular second premolars and maxillary lateral incisors) teeth were excluded from the study. Once these 945 OPGs were selected then a second level of inclusion and exclusion criteria in terms of evaluating for bilateral agenesis was implemented to understand true agenesis.

The age group of the patients of whom the OPGs were selected was between 6years to 30years of age. OPGs which showed bilateral agenesis of the teeth (third molars, mandibular second premolars and maxillary lateral incisors) were included. Since a clinical examination of these patients was not possible only those OPGs which showed bilateral absence were considered to be true agenesis and were included in the present study.

### Statistical Analysis

Data observed in this study was described using descriptive statistical analysis. To evaluate the frequency of agenesis between the sexes (males/females), and between the maxillary and mandibular where applicable chi-square statistical test was applied, the level of significance was set at  $P < 0.05$ .

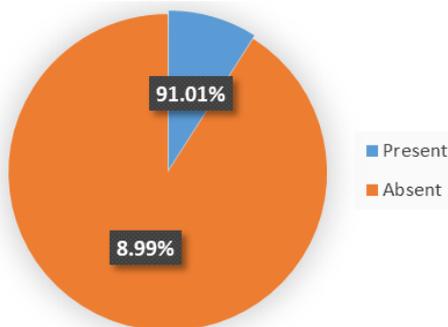
### Results

A total of 945 OPGs were initially included in the study which were available for review in the dental radiology center of the university. These OPGs were selected based on the initial selection criteria of age group and other simple inclusion criteria.

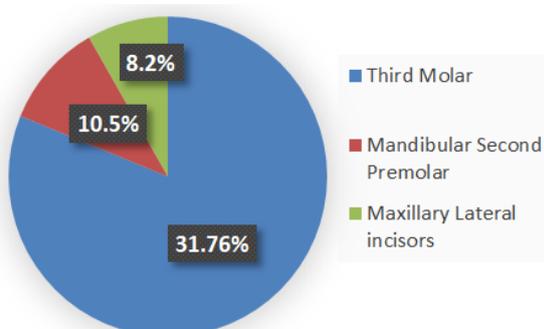
Once these 945 OPGs were selected then bilateral agenesis was sought for. To ensure that the authors were including true agenesis and that there was no false positive or false negative diagnosis a two-step procedure was included. Firstly, to ensure that there is a agenesis, a single tooth missing was not considered as agenesis and only bilaterally missing teeth were considered to be true agenesis and in the second step the authors cross checked with the E-file of the patient within HIMS (Hospital Information Management System) to rule out syndrome or

special need patients and also to ensure that no tooth that was being sought for the study was extracted (3<sup>rd</sup> molars, mandibular second premolars and maxillary lateral incisors) for any reason.

The prevalence of bilateral agenesis or congenitally missing teeth within the selected 945 OPGs were at 8.99% (85 OPGs showed bilateral agenesis) (Figure 1). The 85 OPGs which showed bilateral agenesis comprised of 44 males and 41 females.



**Figure 1.** Prevalence of bilateral agenesis or congenitally missing teeth.



**Figure 2.** Prevalence percentage of bilateral agenesis or congenitally absent 3<sup>rd</sup> Molars, Mandibular Second Premolars and Maxillary Lateral Incisors.

The prevalence of bilateral agenesis or congenitally missing teeth was seen more in males (51.8%) than females (48.2%) (Table 1) within these 85 OPGs, the results were however not statistically significant ( $X^2 = 0.80$ ,  $P = 0.34$ ).

The prevalence of bilateral agenesis or congenitally missing teeth was more in the mandibular arch (37.6%) than maxillary arch (34.1%) while the presence of bilateral agenesis in both arches was at 28.2% (Table 2) within these 85 OPGs, these results were also not statistically significant ( $X^2 = 1.32$ ,  $P = 0.24$ ).

Total	Male	Female	X <sup>2</sup> (Chi Square)	Sig p Value
85	44	41	0.80	0.34
100 %	51.8%	48.2%		

P> 0.05 Not Significant (ns)  
 P<0.05 Significant (s)  
 P<0.01 Highly Significant (hs)  
 P<0.001 Very Highly significant (vhs)

**Table 1.** Prevalence of bilateral agenesis or congenitally missing teeth between males and females.

Total	Maxillary Arch	Mandibular Arch	X <sup>2</sup> (Chi Square)	Sig p Value
85	29	32	1.32	0.26
100 %	34.2%	37.6%		

P> 0.05 Not Significant (ns)  
 P<0.05 Significant (s)  
 P<0.01 Highly Significant (hs)  
 P<0.001 Very Highly significant (vhs)

**Table 2.** Prevalence of bilateral agenesis or congenitally missing teeth between maxillary and mandibular arches.

The most common bilateral agenesis or congenitally missing teeth were the third molars (31.7%) followed by mandibular second premolar (10.5%) and maxillary lateral incisors (8.2%) (Figure 2).

### Discussion

Dental anomalies such as tooth agenesis are usually observed during routine dental examinations. Tooth agenesis can affect both primary and permanent dentition alike, however agenesis of teeth is more prevalent in the permanent dentition when compared to the primary dentition. These anomalies are genetic in origin and hereditary in nature most of the times.<sup>5</sup> Tooth agenesis currently the most common dental anomaly in humans is at times associated with other anomalies, structural malformations, delayed eruption, crowding and juxtaposition.<sup>6</sup> Approximately 25% of the population seems to be affected by agenesis of teeth.<sup>7</sup>

The present study was designed to determine the overall prevalence of bilateral agenesis or congenitally missing teeth among all non-syndromic patients visiting RAKCODS clinic. In the present study, a tooth was diagnosed as congenitally missing or having agenesis when there was no mineralization of its crown on the OPG, and no evidence of its extraction on both

the OPG and also on the patients E-file on HIMS. In this study we kept the age group between 6years-30years of age so as to avoid any kind of false positive or negative diagnosis of agenesis. The calcification of third molars can begin as early as at the age of 7 years or can be delayed until the age of 16-17 years in some individuals and eruption was completed by the age of 25-26years.<sup>6, 11</sup> As seen in similar studies in the past, the age group in the present study was also kept at this wide range to ensure there is no missing data.<sup>11</sup>

The prevalence of bilateral agenesis or congenitally absent teeth found in this study was at 8.99%. It is to be understood that this study took into account only the bilateral agenesis of the three specific teeth, third molars, mandibular 2<sup>nd</sup> premolars and maxillary lateral incisors. However studies done worldwide had a prevalence rate ranging from 3.4% to as high as 46% but then most of these studies<sup>16, 18, 19</sup> had taken all the missing teeth into account and moreover did not use the criteria of bilateral agenesis which was used as a selection criteria in the present study. Also many studies were done exclusively on orthodontic patients and therefore the prevalence rates varied.<sup>12, 13</sup>

#### **Prevalence of bilateral agenesis or congenitally missing teeth**

In the present study, the prevalence of bilateral agenesis or congenitally missing teeth is at 31.7% for the third molars followed by mandibular second premolars at 10.5% and maxillary lateral incisors at 8.2%.

#### **Agenesis of Third Molars**

The high prevalence of third molar agenesis seen in the present study can be due to the reduced number of OPGs which were included in the present study which were only 945 in number, however yet the percentage remains high. There are studies which have reported high percentages ranging from 24.75% to 41%.<sup>20</sup> Genetics seem to play an important role in this high prevalence rates usually found in studies. Bone morphogenetic protein-4, produced early in dental epithelial development, regulates mesenchymal tooth-specific gene expression, including that of the MSX1 gene.<sup>21, 22</sup> A missense mutation in the MSX1 gene at chromosome 4p16.1 appears to be responsible for the third molar agenesis.<sup>22</sup> The synergistic effects of both the genetic influence and the corresponding growth factors is possibly

associated with agenesis of teeth.<sup>21, 22</sup> Maxillary tooth agenesis and decreased maxillary jaw size were also associated with tooth agenesis.<sup>21</sup>

#### **Agenesis of Mandibular Second Premolars**

The prevalence rate of mandibular second premolars being at 11% is lower when compared to with other studies which were ranging between 14%- 23%.<sup>14, 16, 18</sup> In most of the prevalence studies done previously it is seen that the mandibular second premolars are most missing after the third molars, this is also found in our study though the rate of prevalence is lower when compared to other studies.<sup>14, 16</sup> It is to be understood that the mandibular second premolars are usually the teeth which show highest variability of initial calcification and odontogenesis in general.<sup>23</sup> In the present study the lower age limit of the population included was at 6years which could have resulted in a lower prevalence rate considering that some studies showed odontogenesis of this tooth to have completed towards the end of 5 or 6years of age.<sup>23</sup> Therefore we could have missed some odontogenesis in certain cases in which it would have been seen later on the OPGs as the child would have grown beyond the ages of 6 and 7 years. However the prevalence rate is yet higher than the maxillary lateral incisors.

#### **Agenesis of Maxillary Lateral Incisors**

The prevalence of maxillary lateral incisor agenesis was at 8%, this was lower when compared to previous studies done elsewhere.<sup>2</sup> Many of the studies found the prevalence rate of maxillary lateral incisor agenesis between 2.6%-35.6%.<sup>2, 14, 18</sup> However one plausible reason for lower prevalence rate in our study could be due to the reason that we only evaluated for the presence of bilateral agenesis in the present study when compared to other studies where only unilateral agenesis was recorded.

#### **Gender Predilection**

The prevalence for bilateral agenesis or congenitally missing teeth was seen more in males (51.8%) than females (48.2%) (Table 1). The result of our study was similar to a study where a prevalence of 10.9% in males and 10.8% in females was reported.<sup>14</sup> However there are studies which have reported higher prevalence in females.<sup>10, 11</sup> There were studies which were done in Korea and Mexico which showed an equal prevalence between males and females.<sup>2, 17</sup> The majority of the studies however

showed an increased prevalence rate in females when compared to males. These differences as seen in different parts of the world in various studies can be a result of genetic and racial differences which are considered to be one of the most important reasons for agenesis.

#### Arch Predilection

The prevalence of bilateral agenesis or congenitally missing teeth was more in the mandibular arch (37.6%) than maxillary arch (34.1%) while prevalence of bilateral agenesis or congenitally missing teeth in both the arches was at 28.2% (Table 2). A similar prevalence rate was found in a Swedish study done by Backman et al.<sup>15</sup> However there are other studies which have shown a higher rate of prevalence of congenital absence of teeth in the maxillary arch when compared to the mandibular arch.<sup>4,12</sup> The reason provided for a higher prevalence in the maxilla was suggested to be due to the presence of different innervations.<sup>16</sup> In the present study though there was a higher prevalence in the mandibular arch but it was not statistically significant and we have no plausible reason to be suggested as a cause for this finding.

In the present study we found that third molars had the highest prevalence rates followed by the mandibular second premolars and then the maxillary lateral incisors. Researches should be done on a larger sample size and also there should be an equal distribution of gender to determine the accurate prevalence rate of individual tooth agenesis and also to understand the gender predilection. It needs to be also understood that genetics and ethnic origin or race will also have a defining role to play in the type of prevalence rates. Therefore more studies should focus on a larger sample size and also genetic causes of agenesis should be sought for which can provide us with a deeper understanding on agenesis of teeth.

#### Conclusions

In the present study we found that

1. The most common bilateral agenesis or congenitally missing tooth was the third molar followed by mandibular second premolar and maxillary lateral incisors.
2. The bilateral agenesis or congenitally missing tooth was found to have a high prevalence in males when compared to females.

3. The bilateral agenesis or congenitally missing tooth was found to be more common in the mandibular arch when compared to the maxillary arch.

#### Declaration of Interest

The authors report no conflict of interest.

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