

# Prevalence of Congenitally Missing Permanent Teeth in a Group of Yemeni Population: A Radiographic Study

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## Abstract

**Objective:** This study aims to estimate the prevalence of congenitally missing permanent teeth in a group of 5100 dental patients in Yemen. **Methods:** A total of 5100 digital panoramic radiographs were retrospectively examined for the presence of congenitally missing permanent teeth. The radiographs were obtained from the archival records of patients attending a local dental centers, and colleges of dentistry at the provinces of Ibb, Tamar, and Sana'a in Yemen. **Results:** A total of 293 congenitally missing teeth were observed in 165 patients (136 females and 29 males); the overall prevalence of congenitally missing teeth in permanent dentition was 3.23% (2.23% in males, 3.58% in females). Congenitally missing teeth was more prevalent in the maxilla (55%) than in the mandible (45%) and in the right side of the jaws (52.6%) than in the left side (47.4%). The most common congenitally missing permanent tooth was the maxillary lateral incisor (44.48%), followed by the mandibular 2nd premolar (34.48%), the maxillary 2nd premolar (15.51%), the mandibular lateral incisor (5.17%), and the maxillary canine (0.7%). Certain anomalies were co-existed along with tooth agenesis in 66 (40%) patients. Canine impaction was the most common among 29 (17.58%) patients followed by microdontia among 27 (16.37%) patients. Other anomalies present were transposed teeth among 4 (2.43%) patients, ectopic eruption among 4 (2.43%) patients and supernumerary among 2 (1.21%) patients. Canine impaction was commonly seen in relation to the lateral incisor agenesis followed by microdontia. The present study results give a clue of the magnitude of the problem, but further studies are required to identify the etiology of dental agenesis in Yemen.

**Keywords:** Agenesis, Congenitally missing teeth, Hypodontia, Tooth absence.

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## INTRODUCTION

Dental treatments are rather expensive health services and the combination of different modalities such as orthodontic, prosthodontics, and surgical treatments can put a heavy burden on the average family's health budget. Some frequent dental anomalies need quite expensive treatments. One of them is congenitally missing teeth (CMT), congenital absence of teeth, congenital dental aplasia, or dental agenesis [1].

Congenitally missing teeth is the most common developmental dental anomalies in humans [2]. Tooth agenesis refers to the failure of a tooth formation and could be classified into anodontia or partial anodontia [3]. Anodontia is the total absence of tooth development in primary, permanent or both dentitions. Partial anodontia is the lack of development and absence of one or more teeth. Partial hypodontia may be further subdivided into oligodontia which is the

congenital absence of more than six teeth (third molars are not included) and hypodontia which is the congenital absence of one to six teeth (third molars are not included) [2].

Developmental dental anomalies can be diagnosed clinically and treatment planning is important for such reasons: anomalies are often associated with some problems such as caries, poor oral hygiene, orthodontic and aesthetic concerns. In addition, when these anomalies are observed, especially if they are multiple, some syndromes may be considered. For such reasons the prevalence and distribution of dental anomalies become important. Also the prevalence of dental anomalies can provide important information for both the anthropological and clinical management of patients, and are essential to understanding the differences within and between populations [4]. Many studies have been carried out on the frequency of dental agenesis in different populations and the data provided

so far for tooth agenesis in either genders varies between 0.3 per cent and 11.3 per cent, excluding the third molars [5].

A meta-analysis made by Polder [6] in 2004, showed that the dental agenesis is usually 1.37 times more frequent in females than in males. The missing teeth were more often absent on the maxillary arch than on the mandibular arch [7] and on the right side than on the left side within the dental arch [5]. Although any tooth can be susceptible to agenesis, lateral incisors and second premolars show a great probability of agenesis [6]. The most common teeth reported missing varies among different ethnicities. The maxillary lateral incisors were the most common in the Malaysian [5], Turkish [9], Romanian [10], Spanish [11], and American [12] populations, while the mandibular second premolars were the most common in the the Jordanian [13], Iraqi [14], Indian [15] and European [6] populations. However, a higher incidence of missing mandibular incisors is observed in Chinese [16], Korean [17], and Japanese [18] populations than in Caucasian populations.

Teeth develop from the dental lamina, and then commence interactions with the epithelia and underlying mesenchyme. As tooth development advances, enamel knots mediate crown size and cusp formation [19]. Dental anomalies can occur due to disturbance of these processes by genetic factors, environmental (local or systemic) factors, or both [20]. It is reported that local factors may lead to congenitally missing teeth depending on the reasons such as squeezing in germ formation in the relevant region, ruptures occurring in dental lamina, the lack of space in the region, functional anomalies in dental epithelium, problems occurring in the formation of mesenchymal tissue or the ruptures occurring during embryonic fusion of the upper jaw and the medial nasal process [21]. With respect to environmental factors, it is reported that trauma, chemotherapy, radiotherapy, thalidomide derivative drugs by mother during her pregnancy and insufficient nourishment of the mother, trauma, infections (rubella, syphilis), osteomyelitis, radiation and hormonal changes may cause congenitally missing teeth [22]. Dental agenesis can also occur as a symptom of more generalized systemic conditions such as ectodermal dysplasia, cleft lip and palate, Down syndrome, Oto-palato-digital syndrome, Ocluo-Facial-Cardio Syndrome, and Reigre syndrome [23, 22]. Although tooth agenesis is caused by environmental factors in the majority of cases, it has a genetic basis. A familial hypodontia is an autosomal dominant inheritance with incomplete penetrance and variable expressivity. An autosomal recessive mode of inheritance is also possible [24, 25].

Tooth agenesis is often accompanied by other tooth anomalies such as microdontia, ectopic eruption, and impaction [26]. According to Ben-Bassat and Brin

[27], it has been suggested that patients with congenitally missing teeth have specific characteristics of craniofacial morphology and growth patterns. Also, they have found that patients with congenitally missing teeth had a shorter maxilla, a more prognathic mandible, a smaller mandibular plane angle, and greater retroclination of the maxillary and mandibular incisors, and these characteristics were reported to be affected by the severity of congenitally missing teeth, and are probably caused by underdevelopment of the apical base due to the absence of tooth buds. Also, it was reported that this dental agenesis may cause disorders in speech, aesthetic and muscle functions in people [28].

Recent studies realized that hypodontia may be an indicator of susceptibility to developing cancer [9]. Hypodontia was reported more common [8:1] in women with epithelial ovarian cancer than women without epithelial ovarian cancer [29].

In orthodontics, hypodontia due to agenesis of certain teeth greatly affects a patient's function and aesthetic, especially the upper lateral incisors [30]. The incidence of hypodontia in the anterior segments requires great need for orthodontic and prosthodontics. Orthodontic treatment should be in harmony with modern medical thought: "It is better to prevent than to cure". We should not treat the symptom; we should treat the cause. Therefore, early recognition of a tooth agenesis is helpful in order to provide good treatment and prevent a developing malocclusion, also with early detection of hypodontia, alternative treatment modalities can be planned and performed with multidisciplinary team approach restoring the esthetic and function [31].

The treatment options available for cases with congenitally missing teeth are the maintenance of the primary teeth, orthodontic space closure, and space maintenance, restoration with adhesive or fixed denture, tooth transplantation, dental implant or orthodontics space redistribution to facilitate the prosthetic treatment [32].

People with multiple missing teeth deserve the same opportunities for getting a good oral health and appearance as the other human beings [33], therefore, to improve oral health in a population we should begin with collection of data which will help us to understand the needs of the community, to identify high risk groups, and to plan treatment and prevention strategies and monitor the development of the situation over a period of several years [34].

With regard to Yemeni population, the result of a PubMed search was conducted in January 2018 about the prevalence of missing permanent teeth revealed no published data for them. Also, with the recent fast-growing community demand for orthodontic treatment and the paucity of pertinent orthodontic data,

such information related to clinical orthodontic practice in Yemen is of vital importance and needs to be addressed. Therefore, the current study will be designed to create baseline information on the prevalence and distribution of congenitally missing permanent teeth among a group of Yemeni population (in relation to the site, jaw, tooth type and gender.), to record the associated dental anomalies, and to draw attention to pediatric dentist-pediatrician cooperation in the early diagnosis of congenitally missing teeth

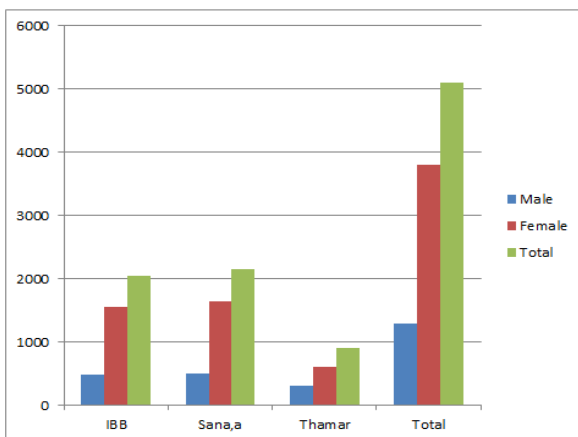
## MATERIALS AND METHODS

### Study sample

A total number of 5100 panoramic radiographs for Yemeni dental patients ( 3800 females (74.5%) and 1300 (25.5%) males) aged between 9 and 25 years (mean age was 15 years) were collected from the archives of the Faculties of dentistry, and private dental clinics in Sana'a, Ibb, and Thamar provinces, Yemen between May 2011 and October 2018.

**Table-1: Gender distribution of sample population**

Gender	No.	%
Male	1300	25.5
Female	3800	75.5
Total	5100	100



**Fig-1: Number and distribution of sample population**

### type Study

The present study was a cross sectional retrospective descriptive study conducted based on the clinical records and panoramic radiographs of the patients who attended to the dental clinics for evaluation of their dental problems.

### Inclusion and exclusion criteria

The inclusion criteria for this study were patients of Yemeni origin, patients with no history of medical problems, patients with no history of any syndrome, presence of high quality panoramic radiograph (with proper record of name, date of birth and sex), and patients between 9 and 25 years of age. The exclusion criteria were patients with missing teeth for decay processes, avulsions or extracted for

orthodontics or other reasons, panoramic radiography of Non-Yemeni patients, patients with facial clefts and craniofacial syndromes, and poor image quality of panoramic radiographs. Study protocol and ethical approval.

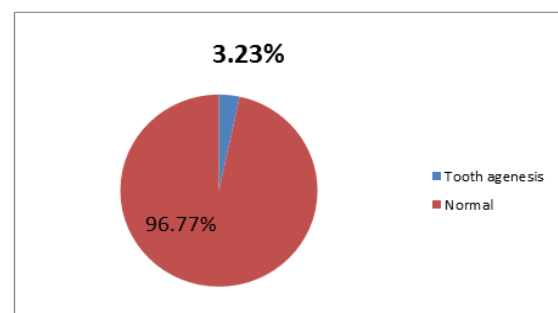
The operator analyzed the available records, the medical history, and the panoramic images of the patients, considering the exclusion and inclusion criteria, to identify the presence of dental agenesis (excluding third molar). The panoramic images were examined by two experienced examiners in a standardized manner under good lighting conditions. The absence of a tooth was considered congenital, if it did not show up on the radiograph (the mineralization of its crown could not be identified on the radiograph), and anamnestic data confirmed that the tooth was not extracted or lost by trauma. Ethical approval for the study would be approved by the Research Committee of the faculties of dentistry Sanaa, Ibb, and Thamar universities.

## STATISTICAL ANALYSIS

Statistical analysis was performed using statistical package software system, version 13 (SPSS 13.0®), and descriptive statistical analysis (mean, standard deviation) will be calculated. Pearson's chi-squared test, Fisher's exact test and Student's t-test will perform for statistical analysis of differences in gender, site, jaw and tooth type. The statistical significance for all the analyses was set at ( $P < 0.05$ )

## RESULTS

Evaluation of the panoramic radiographs of 5100 dental patients showed a total of 165 patients with at least one missing permanent tooth. Results are represented in Figure 2. The majority of the patients (99) had two congenitally missing permanent teeth (60%), followed by one congenitally missing permanent tooth (57 patients) (34.55%). More than three missing teeth were observed among nine patients (5.5%). When the percentage of patients with tooth agenesis was compared to the number of missing teeth, a statistically significant difference was noted, indicating that tooth agenesis with one or two missing teeth is more common than multiple missing teeth ( $p < 0.05$ ).



**Fig-2: Percentage of tooth agenesis (CMT)**

Out Of 165 patients with tooth agenesis, female patients were 136 (82.3%) and male patients were 29 (17,7%). The prevalence of congenitally missing teeth in males was 2.23% and in females was 3.58% Table (2). Chi-square test revealed significant association between gender and tooth agenesis ( $P < .05$ ) Table (3).

**Table-2: Prevalence of tooth agenesis according to gender**

Gender	Tooth agenesis	Normal
Male	2.23%	97.77%
Female	3,58%	96.42%

**Table-3: Association between agenesis and Gender**

Gender	Normal%	Agenesis%	Total%	p-value
Male	1271(97.77)	29(2.23)	1300(100)	
Female	3664(96.42)	136(3.58)	3800(100)	
Total	4935(96.77)	165(3.23)	5100(100)	<0.05

Another table issue is the fact that bilateral toothagenesis is more common than for the unilateral and was found in 6545.% of the affected patients.

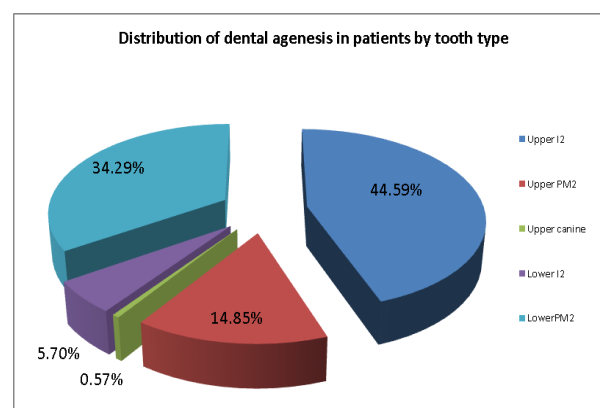
**Table-4: Prevalence of unilateral and bilateral tooth agenesis**

	n(prevalence)	p-value
Unilateral	57(1.12)	
Bilateral	108(2.11)	
Total	165(3.23 )	<0.05

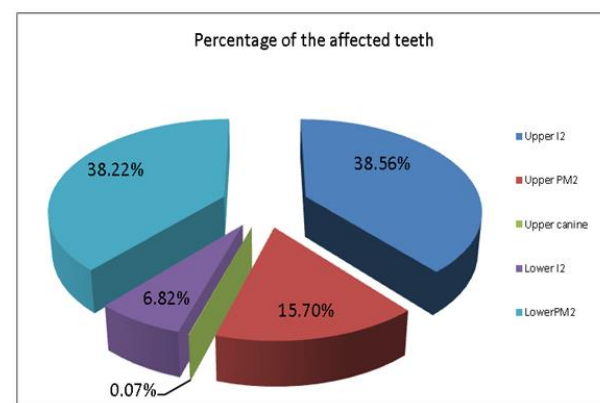
293 absent teeth were reported. The maxillary lateral incisor was found to be the most affected tooth (78 patients- 113 missing teeth), followed by the mandibular second premolar (60 patients- 112 missing teeth), maxillary second premolar (26 patients- 46 missing teeth), mandibular lateral incisor (10patients- 20 missing teeth), and the maxillary canine (1patients- 2missing teeth). The percentage of dental agenesis varied according to the tooth type (Figure 3) and (Figure 4). - 34.29% of the patients had at least one missing mandibular second premolar - 38.22% of the absent teeth were mandibular second premolars; - 44.58% of the patients had at least one missing maxillary lateral incisor - 38.56% of the absent teeth were maxillary lateral incisors; - 14.85% of the patients had at least one missing maxillary second premolar - 15.70% of the absent teeth were maxillary second premolars; - 5.7% of the patients had at least one missing mandibular lateral incisor - 6.82% of the absent teeth were mandibular lateral incisors; - 0.57% of the

patients had at least one missing maxillary canine - 0.7% of the absent teeth were maxillary canines.

In terms of locations, congenitally missing maxillary lateral incisors in 64 patients were found in the right side and 49 in the left side, While congenitally missing lateral incisor was found bilaterally among 35 patients. Maxillary second premolar a genesis in 23 patients was found in the right side and 23 in the left side, while maxillary second premolar agenesis was found bilaterally in 20 patients. Maxillary canine agenesis was found only in one patient bilaterally. Mandibular lateral incisor agenesis was found in 10 patients bilaterally. Mandibular second premolar agenesis in 56 patients was found in the right side and 56 in the left side, while mandibular second premolar agenesis was found bilaterally among 52 patients.



**Fig-3: Distribution of dental agenesis in patients according to tooth type**



**Fig-4: Percentage of affected teeth**

**Table-5: Distribution of CMT in the maxillary and mandibular arches according to location and gender**

	Maxillary arch			Mandibular ach		
Congenitally missing teeth	male	female	total	male	female	total
Right lateral incisor	12	52	64	0	10	10
Left lateral incisor	8	41	49	0	10	10
Right canine	0	1	1	0	0	0
Left canine	0	1	1	0	0	0
Right 2 <sup>nd</sup> premolar	2	21	23	14	42	56
Left 2 <sup>nd</sup> premolar	2	21	23	14	42	56



Also, there were 161 CMT in the maxillary arch and 132 CMT in the mandibular arch figure (5).

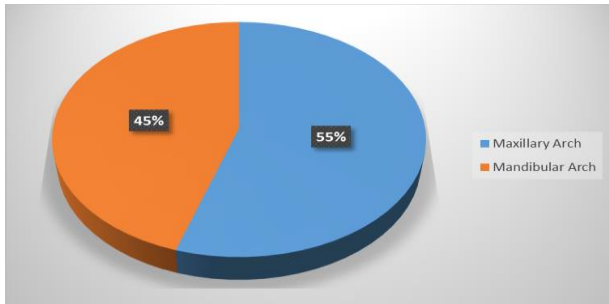


Fig-5: Distribution of CMT in the maxillary and mandibular arch

Of the 293 CMT, 154 were in the right side and 139 were in the left side figure (6).

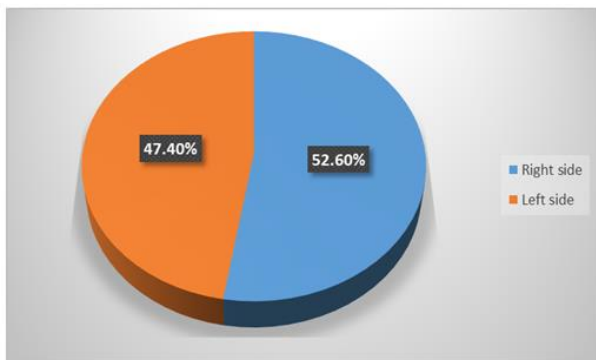


Fig-6: Distribution of CMT in the right and left side

The prevalence of anomalies that were coexisted along with teeth agenesis was (40%) in 60 patients. From all co-existing anomalies, impaction was the most common among 29 (17.58%) patients followed by microdontia among 27 (16.37%) patients. Other anomalies present were transposed teeth among 4 (2.43%) patients, ectopic eruption among 4 (2.43%) patients and supernumerary among 2 (1.21%) patients. The other anomalies are summarized in Table (6).

Table-6: Prevalence and types of other anomalies

Characteristic	(Frequency (n	% Percent
Gender		
No anomalies	99	%60
Impaction	29	%17.58
Microdontia	27	%16.37
eruption Ectopic	4	%2.43
Transposition	4	%2.43
Supernumerary	2	%1.21

All of the coexisted other anomalies were encountered in the anterior region in association with the maxillary and mandibular lateral incisor agenesis as follow:

- 27 of the patients with unilateral maxillary lateral incisor agenesis (43) have also a microdontia of the

contralateral one, of which 21 (48.8 per cent) were on the right and 6 (14 per cent) on the left side ( $P > 0.05$ ).

- 21 of the patients with bilateral maxillary lateral agenesis have also bilateral canine impaction.
- 5 of the patients with unilateral maxillary lateral incisor agenesis have also unilateral canine impaction in the same side
- 3 of the patients with bilateral mandibular lateral incisor agenesis have also bilateral mandibular canine impaction
- 4 of the patients with bilateral maxillary lateral incisor agenesis have also bilateral buccally erupted canine
- 4 of the patients with maxillary lateral incisor agenesis have also canine transposition with first premolar
- 2 of the patients with bilateral maxillary lateral incisor agenesis have also supernumerary tooth between central incisors (mesiodens)
- Another notable issue was that the primary tooth retention was found among 61 (35%) of the patients with congenitally missing teeth. The percentage of primary tooth retention according to tooth type was as follow:
- In those patients with developmental absence of the upper lateral incisors ( $n = 78$ ), the primary tooth was retained in 14 cases (20 per cent). This retention was bilateral in seven individuals (8.9 %), and unilateral in the other seven, with the upper right being retained in four (5.1 %), and the upper left in three (3.8 %).
- In those patients with mandibular lateral incisor agenesis ( $n=10$ ), the primary tooth was retained in 3 patients. This retention was bilaterally among the three patients.
- In those patients with mandibular second premolar agenesis ( $n =60$ ), the primary tooth was retained in 40 (66.7%). This retention was bilateral in 38 patients (63.3%) and unilateral in the other two (3.4%), with the lower right being retained in one patient and the lower left in one patient.
- In those patients with maxillary second premolar agenesis ( $n= 26$ ), the primary tooth was retained in 4 patients (15.38 %). This retention was bilateral among the 4 patients.

## Representative panoramic radiographs



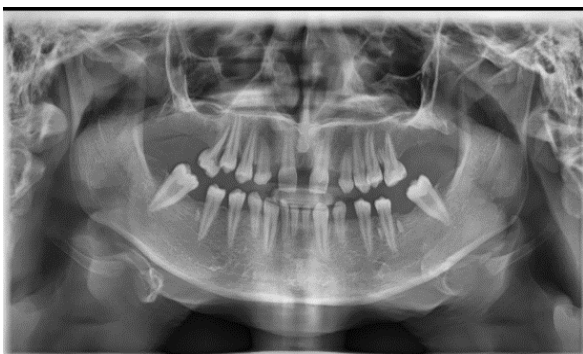
A) Panoramic radiograph depicting unilateral mandibular 2nd premolar agenesis



B) Panoramic radiograph depicting bilateral maxillary and mandibular second premolar agenesis



C) Panoramic radiograph depicting maxillary lateral incisors agenesis associated with diastema and canine impaction



D) Panoramic radiograph depicting multiple tooth agenesis in the maxillary and mandibular arches



E) Panoramic radiograph depicting bilateral maxillary lateral incisor and 2nd premolar agenesis



F) Panoramic radiograph depicting bilateral maxillary and mandibular 2nd premolar agenesis

**Fig-7: Panoramic radiographs depicting tooth agenesis**

## DISCUSSION

Oral health plays a crucial role in public health [35]. It has strong biological, psychological and social projections, because it affects aesthetics and communications, and the quality of life is affiliated with oral health status [36]. Dental treatments are rather expensive health services and the combination of different modalities such as orthodontic, prosthodontics, and surgical treatments can put a heavy burden on the average family's health budget. Some frequent dental anomalies need quite expensive treatments. One of them is congenitally missing teeth (CMT), congenital absence of teeth, congenital dental aplasia, or dental agenesis [1].

In orthodontics, hypodontia due to agenesis of certain teeth greatly affects a patient's function and aesthetic, especially the upper lateral incisors [30]. The incidence of hypodontia in the anterior segments requires great need for orthodontic and prosthodontics treatment. Orthodontic treatment should be in harmony with modern medical thought: "It is better to prevent than to cure". We should not treat the symptom; we should treat the cause. Therefore, early recognition of a tooth agenesis is helpful in order to provide good treatment and prevent a developing malocclusion, also with early detection of hypodontia, alternative treatment modalities can be planned and performed with multidisciplinary team approach restoring the esthetic and function [30].

In human dentition, maxillary and mandibular incisors are important from an esthetic as well as a functional point of view when they are present in their normal position. One only needs to look at the contribution of the maxillary lateral incisor to the upper face to sense its importance; its absence cause either diastema between centrals, midline shifting, collapsing anterior maxilla leading to class III skeletal relationship, or causing canine impaction which complicate the situation.

Although the percentage of dental agenesis has been reported in many countries, there has been no data published among Yemeni population about the prevalence of tooth agenesis in the permanent dentition. The present study aimed to determine the overall prevalence of CMT in a sample of Yemeni dental patients at Sana'a, Ibb, and Tamar provinces.

The prevalence of tooth agenesis ranged between 2.66% and 12.6% (Table 7). However, in the present study, the overall prevalence of tooth agenesis was found to be 3.23%. The observed discordance can be attributed to the genetic and racial differences as well as to the sample size of the examined group. Many authors have suggested that it is more appropriate to compare any such data obtained from a specific group to those drawn from other similar ethnic groups of the same area living in different geographic locations. Since our current data were drawn from Yemenis - inhabitants of the Arabian Peninsula - who are considered, historically speaking, to be the origin of all Arabs, we believed that it would be interesting to compare our results with those of other arabian groups living in the same geographic area and then with other racial groups.

It was interesting to find out a real gradual increase in dental agenesis prevalence from south to north, with Yemenis (south part) showing the lowest tooth agenesis prevalence, followed by Saudis (middle part) and Jordanians (north part). In the literature, the lowest percentages of tooth agenesis were reported by Abu-Affan and serorin asample of 2401 sudanese (2.6%) ,Al-Emran [37] in a sample of 500 Saudis male children (4%) and by Celikoglu *et al.* [9] who examined Turkish orthodontic patients (4.6%), and the highest percentages of tooth agenesis were reported by Behr *et al.* [38] in a sample of 1353 Germany orthodontic patients, and by Young HA [39] in a sample of 3055 Korean orthodontic patients (11.3%).

The present study analyzed the prevalence of tooth agenesis in a large sample of dental and orthodontic patients. The nature of the examined subjects usually influences prevalence rates of the examined anomalies. The prevalence reported by this study falls short of most of the published data from studies on tooth agenesis in orthodontic populations. Higher prevalence rates have been reported in the latter because patients with hypodontia are usually more

motivated to seek orthodontic treatment to restore their dental and/or facial aesthetics [13, 35, 38, 40, 18].

A high prevalence of CMT was found in the maxillary arch compared to the mandibular arch; this was coincident to the findings of Vahid-Dastjerdi *et al.* [7] who obtained a higher prevalence of CMT in the maxillary arch among Iranian orthodontic patients. Also this result corresponds with the analysis performed by Peker *et al.* [42], as well as Fekonja [5] and Wong *et al.* [41] who found missing teeth considerably more frequently in the upper arch than in the lower arch in orthodontic patients. However, Kirzioglu [43] found more missing teeth in the mandible than in the maxilla. Gomes [44] found maxillary hypodontia in 59.2% of patients and in the mandible of 40.8% with an overall ratio of 1.45:1 in orthodontic patients.

The prevalence of CMT in the right side of the jaw was found to be more frequent than in the left side in our study; this was in agreement with the findings of Ferkonja [5] who reported a higher prevalence on the right side of the jaw among 212 orthodontically treated children. No gender dimorphism in the prevalence of CMT was reported among different populations. In the present study, this prevalence was statistically different. These findings dis coincide with those of previous studies. However others recorded a high prevalence of hypodontia among females. On the other hand Nganga *et al.* reported that in Kenyan population hypodontia was more predominant among males than females.

Bilateral agenesis manifested a frequency of 2.11% in our study. The most common bilaterally missing teeth were the mandibular lateral incisor and the maxillary second premolar. Goya *et al.* [17] found that symmetry of congenitally missing teeth was predominant (74.6%), and Kirzioglu *et al.* [43] observed that bilaterally missing teeth was 73.2%. Moreover, symmetrical hypodontia was predominant, being found in both the contralateral and antagonistic quadrant, possibly suggesting a strong genetic pattern of hypodontia. It was demonstrated also that permanent tooth agenesis, maxillary lateral incisor microdontia, palatally displaced canines, and distoangulation of mandibular second premolars were frequently associated with maxillary lateral incisor agenesis, providing additional evidence of a genetic interrelationship in the causes of hypodontia [45]. Moreover, a significant decrease in maxillary transversal and sagittal size was demonstrated in patients with dental agenesis [46].

It was claimed that missing maxillary incisors were significantly more frequent in girls; however, the relationship could not be explained. However, it is emphasized that the cause may be dimorphism based on the sex origin occurring during growth and development [47]. In our study, the lack of upper incisors was found to be significantly higher in girls,



supporting these results. Interestingly, the lack of bilateral lateral incisors in girls was also found to be quite high. It is also claimed that the lack of bilateral upper incisors is due to genetic origin while unilateral missing is due to a developmental anomaly, therefore, the tooth formed on one side is usually conical or microdontia [48]. Our study also supports these results.

The most frequently missing tooth in our study was the maxillary lateral incisor. This finding was in agreement with the findings of studies in the Malaysian [8], Turkish [9], Romanian [10], Spanish [11], and American [12] populations. In contrast to our finding, the mandibular second premolars were the most common in the the Jordanian [13], Iraqi [14], Indian [15] and European [6] populations. However, a higher incidence of missing mandibular incisors is observed in Chinese [16], Korean [17], and Japanese [18] populations than in Caucasian populations.

In this study, canine impaction was seen in 29 patients while microdontia was found in 27 patients. It has been reported that the existence of associations between various dental anomalies is clinically relevant, as early diagnosis of one dental anomaly might indicate an increased risk for others [49]. A general consensus has been reached in finding that there exists a significant correlation between tooth agenesis(maxillary lateral) and either maxillary canine impaction or microdontia of maxillary lateral. Sacerdoti and Baccetti [50] reported an increased prevalence of maxillary canine impaction in a sample of subjects with maxillary lateral incisor agenesis, compared with a control group. Moreover, Camilleri [52] observed 106 subjects with maxillary canine impaction and stated a strong connection with hypodontia. The most important findings of this study were about the association between tooth agenesis and maxillary canine impaction: it was statistically attributable only at the lack of maxillary lateral incisor, whereas the mandibular second premolar or other types of agenesis did not show any significant association. The presence of a substantial relationship between agenesis of maxillary lateral incisors and maxillary canine impaction could be explained by the guidance theory. If the lateral incisor is absent, the canine will not find the guidance that would enable it to descend along its normal eruption path and move down in a more palatal path until it comes close to the periosteum of the medial aspect of the alveolar process [52]. According to our results, several studies reported that maxillary canine impaction and agenesis of lateral incisors could be a strong predictor of maxillary canine impaction [53].

The etiology and exact mechanism of dental agenesis is still unclear, although, number of genetic and environmental factors has been suggested. One proposed mechanism for tooth agenesis occurrence is a combination of genetic susceptibility and environment factors. Thus, in the presence of gene defect (defects in the genes responsible for tooth formation), the environmental factors can affect tooth formation process, resulting in tooth agenesis and other dental anomalies.

Ovarian cancer, known as the silent killer in women, is difficult to diagnosis due to a lack of effective early screening markers for this disease. Without improvements in the current early detection protocols, over 75% of women diagnosed with ovarian cancer will be identified in late stage of disease with a significantly reduced chance of survival. Lopes *et al.*[54] reported that anomalies of the teeth may be present in many diseases and dentists may be the first to notice them particularly through the preventive children screening programmes. Previous studies have demonstrated that the genes that control the tooth development may have an important function in other organs and cancer diseases [55, 56]. Zhai *et al.* [57] indicated in their study that  $\beta$ -catenin and TCF plays a vital role in the activation of AXIN2 expression in colon and ovarian cancer cells. Lammi *et al.* [55] reported about evidence of the expression of association AXIN2 in colorectal tissue leading to carcinoma and hypodontia in a Finnish family. It is interesting that one gene mutation can cause tooth agenesis and predispose to colorectal cancer. Therefore, by estimation of the prevalence of hypodontia, we can predict the degree of danger and susceptibility to developing cancer in those patients having hypodontia (it serve as a marker for potential risk of cancer), therefore the dentists should take this information in to their considerations, especially when dealing with women. Therefore, the community health programs should be targeted to get rid of the possible causes and risk factors of hypodontia. Furthermore, Womens with hypodontia may have or may develop ovarian cancer speccially if they have chronic inflammations in the ovarian endothelium, therefore, the dentist can help in the diagnosis and/or pevention of cancer development.

The knowledge gained from this study will assist dental practitioners to better understand tooth agenesis and design treatment plans that address the esthetic and functional needs of affected individuals and to improve quality of the provided treatment outcome



**Table-6: Prevalence of CMT of permanent dentition in different studies**

Author	country	sample size	prevalence	The most common CMT
Behr[38]	Germany	1353	%12.6	
Muller [12]	America	14,940	%3.5	maxillary lateral incisor
Gonzalez[58]	Portugal	2888	6.1%	mandibular 2nd premolar
Mammon [59]	Jordan	3660	8.85%	
Young Ho [39]	korea	3055	11.3%	mandibular 2nd premolar
Vahid [7]	Iran	1751	9.1%	maxillary lateral incisor
Cantekin[48]	Turkey	1291	%6.2	
Tallon [11]	Spain	1518	9.48%	
Celikoglu[9]	Turkey	3341	4.6%	maxillary lateral incisor
Mani [8]	Malysian	834	%4.2	maxillary lateral incisor
Gomes[44]	Brazil	1049	6.3%	maxillary lateral incisor
Al-Ajwadi [14]	Iraq	389		maxillary lateral incisor
Sisman [60]	Turkey	2413	7.54%	maxillary lateral incisor
Albashaireh and Khater, [61]	Jordan	1045	5.5%	mandibular 2nd premolar
Goren [62]	Israel	226	5.3%	maxillary lateral incisor
Fekonja[5]	Slovenia	212	11.3%	maxillary lateral incisor
Goya[17]	Japan	2072	9.4%	mandibular 2nd premolar
Ng'ang'a et al. [63]	kenya	615	6.3%	mandibular 2nd premolar
Bernadette[10]	Romania	946	%6.34	maxillary lateral incisor
Al-Emran[37]	KSA	500	4%	mandibular 2nd premolar
Nordgarden[57]	Norway	9532	%4.5	
Davis [16]	China	1093	6.9%	mandibular incisor
Rolling[64]	Denmark	8138	7.39%	mandibular 2nd premolar
Magnussom[65]	Iceland	1116	6.7%	mandibular 2nd premolar
Ajami [15]	India	600	%10.6	maxillary lateral incisor
Al-Moherat [13]	Jordan	1726	%7.12	maxillary lateral incisor
Affan[14]	Sudan	2401	2.66%	mandibular lateral incisor
Ziad Ali	Yemen	5100	3.23%	maxillary laterl incisor

## CONCLUSION

The prevalence of congenitally missing teeth was 3.21% and there was significant difference in the prevalence among male and females. Agenesis occurred more bilaterally than unilaterally. The most common missing tooth was the maxillary lateral incisor. Maxillary canine impaction and maxillary lateral incisor microdontia have a high significant association with maxillary lateral incisor agenesis.

Dentists or pediatric dentists are the first to diagnose congenital tooth agenesis. Determining tooth agenesis in dentition early increases the potential for functional, aesthetic and stable outcomes. However, considering that hypodontia is often associated with a familial, syndromic or non-syndromic condition, the medical conditions related with the situation can also be diagnosed during the routine examinations of pediatricians. At this point, in cases where congenital tooth agenesis is considered, pediatricians should work in cooperation with dentists or pediatric dentists. Moreover, in addition to hundreds of syndromic conditions related with hypodontia, non-syndromic cases should also be investigated in terms of familial history and dental anamnesis should be obtained, and if needed, contact with a pediatric dentist might be helpful in early diagnosis. Future studies including larger

samples are needed to evaluate the etiology of hypodontia and tooth agenesis in Yemen.

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