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The prevalence and distribution pattern of hypodontia among orthodontic patients in Southern Iran

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ABSTRACT

Objectives: To evaluate the pattern and prevalence of hypodontia and its association with different malocclusions among orthodontic patients in southern Iran. **Materials and Methods:** In this study, a total of 494 records of orthodontic patients (162 males, 332 females) were evaluated. To investigate percent of hypodontia pertinent information of patients was evaluated. Chi-square and Fisher's exact tests were used for statistical analysis. **Results:** The prevalence of tooth agenesis was 7.66%. Thirty-eight patients were found to have at least one tooth missing. Number of patients having hypodontia was the most in class III patients, whereas the number of missing teeth was more in class II sample. However, it was not statistically significant ($P = 0.569$). Upper lateral incisor (27.95%), lower second premolar (21.51%), and upper first premolar (12.9%) were respectively the most frequently absent teeth. There was not statistically significant difference between sexes ($P = 0.580$). Hypodontia observed to be more bilaterally, in the upper arch and in the left side. **Conclusion:** The pattern and prevalence of hypodontia is different among races and ethnic groups. In our study population, hypodontia was found to be 7.66%. Higher prevalence of hypodontia in the maxillary arch and in class III patients may be considered as an etiologic factor.

Key words: Hypodontia, malocclusion, orthodontics, tooth agenesis

INTRODUCTION

Dental agenesis is the most common developmental anomaly in human.[1] The absence of one to six teeth, excluding third molars is called hypodontia.[2,3] The term oligodontia is generally used to describe the absence of more than six teeth, excluding third molars,[4,5] and complete failure of dentition to develop is called anodontia.[6]

Agenesis of the third molars is the most common form of tooth agenesis. It has been reported that in 20% to 30% of the population, at least one of the third molars is absent.[7] The prevalence of agenesis of other permanent teeth have been reported in different races and countries.[8-14] After third molars, agenesis of lower second premolars and upper lateral incisors are the most common types of hypodontia.[15-17] The reported prevalence of hypodontia in orthodontic patients have been different between studies, ranging from 2.7%[16] to 11.3%.[17]

The etiology of hypodontia can be a combination of genetic and environmental factors, and it can occur as an isolated condition (non-syndromic hypodontia) or can be associated with a systemic condition or syndrome (syndromic hypodontia).[18-20] The agenesis of permanent teeth represents clinical problems and requires a multidisciplinary approach to cover the needs of the patients. Aesthetic problems, periodontal damage, malocclusion, and alveolar bone deficiency are some of complications following hypodontia.

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Some studies stated that also anterior hypodontia has a significant effect on skeletal relationships.[21] However, each of these problems can be an indication for orthodontic treatment. For example, agenesis of maxillary lateral incisor impairs dental aesthetics and function from a very young age.[22]

Hence, investigating the prevalence of tooth agenesis is of significant clinical value in terms of early diagnosis and effective treatment planning.[5,16]

Although the prevalence of hypodontia has been studied in other countries, it has not been well documented in studies of Iranian population. Therefore, the aim of this study was to investigate the prevalence, characteristics, and sex distribution of hypodontia as well as its association with different malocclusions among orthodontic patients in Shiraz, Iran.

MATERIALS AND METHODS

In this descriptive retrospective cross-sectional study, a total of 494 records of patients (162 males, 332 females) including dental casts, intraoral photographs, panoramic and lateral cephalometric radiographs were evaluated. Patients with any syndrome or cleft lip/palate, those with previous loss of teeth due to caries, periodontal diseases, trauma or orthodontic extraction were excluded from the study. Poor image quality or incomplete patient files were considered as exclusion criteria as well.

Age range of patients was 10-18 years old. Two expert clinicians evaluated all radiographs, and the radiographic findings were checked with recorded information of the patients to assure that the tooth had not been extracted. Third molars were not included in this study. Pertinent information including age, gender, clinical findings written in the file, the type of malocclusion, number and type of missing tooth, the site of the agenesis (maxilla or mandible, right or left side), being unilateral or bilateral was determined.

To diagnose and categorize the type of malocclusion, we used the ANB angle from the cephalometric radiographs. ANB angle between 2 and 4 degrees were categorized as class I occlusion/malocclusion. Accordingly, higher and lower ANB angles were categorized as class II and class III malocclusions, respectively. The findings from the ANB angle were checked to be consistent with photographs and clinical findings documented in the patient file, and if there was any doubt about the accuracy of the ANB angle, Wit's appraisal measurement was used to accurately categorizing. Wit's appraisal of 0 to –1 were classified as class I, those with positive Wit's measurements were classified as class II and negative Wit's measurements more than –1 as class III.

Statistical analysis

All comparative statistical analyses were performed using the SPSS software (Version 12.0, SPSS Inc., Chicago, IL, USA). To compare the difference between different malocclusions, Chi-square test and to evaluate the difference between male and female patients, the Fisher's exact test was performed. The level of significance was set at 0.05.

RESULTS

The distribution of tooth agenesis according to the gender in different malocclusion groups is shown in Table 1. From the total cases examined, 32.59% were males and 67.41% were females. Class II malocclusion was the most frequent malocclusion among study patients. Congenital absence of one or more teeth was observed in 38 out of 494 patients, with a frequency of 7.66%. Also, from all of the 38 patients with hypodontia, 63.15% had class II, 23.7% were class I, and 13.15% had class III malocclusions [Table 1]. We calculated the percentage of patients with hypodontia within each group separately. In this regard, class III patients showed the highest rate of hypodontia (9.6%) followed by class II and class I patients (8.3% and 5.84, respectively). Hypodontia was found to be statistically insignificant among different malocclusion groups.

Also, from all of the patients with missing teeth, 22 (58%) were females and 16 (42%) were males.

Table 1: Distribution of different malocclusions in our study sample

	Class I *n* (%)	Class II *n* (%)	Class III *n* (%)	Total *n* (%)	*P* value
Male	49 (9.92)	93 (18.62)	20 (4.05)	162 (32.59)	
Female	104 (21.25)	196 (39.68)	32 (6.48)	332 (67.41)	
Patients with hypodontia	9 (5.84)	24 (8.3)	5 (9.6)	38 (7.66)	0.569

Table 2: Distribution of hypodontia according to gender

Study sample	Female *n* (%)	Male *n* (%)	Total *n* (%)	*P* value
Total sample	332	162	494	0.552
Patients with hypodontia	22 (6.62)	16 (9.8)	38 (7.66%)	

However, this difference was not statistically significant (Fisher's exact, $P = 0.552$) [Table 2].

There were a total of 93 missing teeth in our examined patients. Of all 93 missing teeth, the most (50.54%) was observed in class II group, and the least amount belonged to class I group (22.58%). However, there was no statistical significant difference between different malocclusions in the number of missing teeth. (Chi-square test, $P > 0.05$).The most and the least affected teeth were upper lateral incisor (27.95%) and upper second molar (1.07%), respectively. Fifty four percent of all missing upper lateral incisors and 50% of all missing lower second premolars were found in class II patients. Thus, the most prevalent missing tooth types were found more in class II patients, and interestingly, tooth types that were absent less frequently, were found more in class III patients. Girls had more number of absent teeth (60.23%). Most of all missing teeth were found in the maxilla, and only 40.87% of absent teeth belonged to mandible. This higher frequency of hypodontia in the upper arch was observed in all types of malocclusions [Table 3].

There was a higher frequency of missing teeth in the left side in all types of malocclusions (55.91). Bilateral absence was seen to be more than unilateral type [Table 4].

Among 38 patients with missing teeth, only 7 patients (18.4%) had missing of more than one tooth type, and 73.68% had 1 or 2 missing teeth, and 21 patients (55%) had more than one missing tooth.

DISCUSSION

As tooth agenesis is the most common anomaly in the development of the human dentition, many studies are found on the prevalence of hypodontia in different ethnic groups.[3,4,8-10]

The etiology consists of environmental and genetic factors including infection, trauma, and medicines, as well as genes associated with certain syndromes.[1,5] Early diagnosis and suitable intervention seems to be necessary and can play an important role on prevention of its serious aesthetical, physiological, functional, and even emotional complications.

The patients' age might confound the results. Beginning of calcification of some teeth may occur after the age 9 or 10. Mineralization of premolars may be even delayed.[4] Therefore, detection of missing teeth before age 10 might cause false and unreliable results. Disruption of the findings in terms of the most frequently missing teeth can also affects the results

Table 3: Prevalence of various tooth type agenesis in different mallocclusions and genders

Missing teeth	Malocclusion			Gender		Total
	Class I *n* (%)	Class II *n* (%)	Class III *n* (%)	Male *n* (%)	Female *n* (%)	
Upper lateral incisor	6 (6.45)	14 (15.05)	6 (6.45)	14 (15.05)	12 (12.90)	26 (27.95)
Lower second premolar	7 (7.53)	10 (10.75)	3 (3.23)	7 (7.53)	13 (13.98)	20 (21.51)
Upper First premolar	2 (2.15)	4 (8.60)	2 (2.15)	2 (2.15)	10 (10.75)	12 (12.90)
Upper second premolar	4 (4.30)	6 (4.30)	2 (2.15)	3 (3.23)	7 (7.53)	10 (10.75)
Lower central incisor	-	5 (6.45)	-	4 (4.30)	2 (2.15)	6 (6.45)
Lower lateral incisor	-	5 (5.38)	-	1 (1.07)	4 (4.30)	5 (5.38)
Lower second molar	-	-	4 (4.30)	2 (2.15)	2 (2.15)	4 (4.30)
Lower first molar	1 (1.07)	-	2 (2.15)	1 (1.07)	2 (2.15)	3 (3.23)
Upper canine	1 (1.07)	-	1 (1.07)	-	2 (2.15)	2 (2.15)
Upper central incisor	-	-	2 (2.15)	2 (2.15)	-	2 (2.15)
Upper first molar	-	-	2 (2.15)	-	2 (2.15)	2 (2.15)
Upper second molar	-	-	1 (1.07)	1 (1.07)	-	1 (1.07)
Total	21 (22.58)	47 (50.54)	25 (26.8)	37 (39.77)	56 (60.23)	93 (100)
P value		0.210				

Table 4: Prevalence of missing teeth in different types of malocclusions with respect to the affected jaw and side

Type of malocclusion	Upper dental arch	Lower dental arch	Left	Right	Unilateral	Bilateral
	n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Class I	13 (13.98)	8 (8.60)	13 (13.98)	8 (8.60)	5 (5.38)	16 (17.20)
Class II	26 (27.95)	21 (22.58)	26 (27.95)	21 (22.58)	17 (18.28)	30 (32.26)
Class III	16 (17.20)	9 (9.68)	13 (13.98)	12 (12.90)	3 (3.23)	22 (23.65)
Total	55 (59.13)	38 (40.87)	52 (55.91)	41 (44.09)	25 (26.89)	68 (73.11)

due to delayed development of premolars. That's why higher prevalence of premolar missing has been reported in some studies.[15,23] Considering this matter, patients less than 10 years old were excluded from our study. In addition we also excluded any patient with extraction histories.

Agenesis differs by continent and ethnicity. Results of a meta analysis showed that the prevalence for both sexes was higher in Europe and Australia than for North American Caucasians.[4]

Present study carried out among orthodontic patients in southern Iran, Shiraz, and showed 7.66% prevalence for hypodontia. In a previous study, prevalence of hypodontia was reported to be 9.1% in an Iranian orthodontic population[14] that is higher than that of our study. Iran is a vast country with various ethnic groups living in different parts. That might be the reason for such an epidemiologic difference. Prevalence of hypodontia in our study is comparable to the results of Sisman *et al*.[15] (7.54%), Topkara *et al*.[24] (6.77%), and Cantekin *et al*.[12] (6.2%) in orthodontic populations, and is higher than that reported in a pediatric orthodontic population in Venezuela (4%).[13] However, prevalence of hypodontia in our population is within range of Asian populations reported in different studies.[3,4,12,15,23,25]

Some authors such as Fekonja,[17] Gomes *et al*.,[26] Endo *et al*.,[9] Celikoglu *et al*.,[27] Medina,[13] and Cantekin *et al*.[12] observed higher prevalence of hypodontia in females. The prevalence of tooth agenesis in females was also reported to be 1.37 times higher than in males in North American Caucasians.[4] It has been mentioned that this higher prevalence of hypodontia in females might be associated with biological differences and makes a greater orthodontic treatment need, that increases their seeking for treatment due to aesthetical concerns. However, several investigations found higher prevalence in males[15,28] and some reported no difference between gender.[10] Nevertheless, according to the our results, dental agenesis was more common in males.this study as well as some others did not find a statistically significant difference between hypodontia prevalence in males and females.[3,9,14,28]

In our study, 9.6% of class III patients had hypodontia; while 8.3% of class II patients and 5.84% of class I patients showed this anomaly. This higher prevalence of hypodontia (although not significant) in class III patients is in accordance with some of previous studies.[10,14,21] Although, Celikoglu *et al*., found more prevalence of hypodontia in their class I study sample.[27] Also, the prevalence of hypodontia in the maxillary arch was higher than in mandibular arch, that is consistent with most of the previous studies.[14,21,27] However, there are studies which had found a greater missing rate in the mandible.[10]

This higher prevalence of hypodontia in the maxillary arch and in class III patients is an interesting finding that might demonstrate an association between these two findings and may be considered as etiologic factor.

Consistent with the findings of several studies,[13-15] the most prevalent missing teeth types in our study were upper lateral incisor (27.95%) followed by lower second premolar (21.25%) and maxillary first and second premolar. In most previous studies, either upper lateral incisor or lower second premolar has been reported as the most prevalent. Nevertheless, in the results of some other investigations the mandibular second premolar was introduced as the most prevalent absent tooth.[3,10,11] Another interesting finding of our results was that the most prevalent missing tooth types (upper lateral incisor and lower second premolar) were more found in class II patients, while other missing tooth types were observed more in class III patients. Garib *et al*. found that patients with maxillary lateral incisor agenesis had a significantly increased prevalence rate of permanent tooth agenesis. They observed the frequencies of maxillary second premolar agenesis, mandibular second premolar agenesis, microdontia of maxillary lateral incisors, and distoangulation of mandibular second premolars were significantly increased.[29] However, we did not search for such associations in our patients.

The missing teeth were more often absent bilaterally (73.11%), and only 26.89% were unilaterally missed, with a tendency of higher prevalence in the left side. Goya *et al*.,[3] Endo *et al*.,[9] Medina,[13] Sisman *et al*.[15] and Silva meza[16] also reported that missing teeth are mostly found bilaterally, whereas Fekonja[15] observed more prevalence of missing teeth in right side.

From all of the patients with tooth agenesis, only 18.4% had missing of more than one tooth type. Thus, finding shows that most of the hypodontia patients had only one missing tooth type.

By early detection of tooth agenesis, a multidisciplinary

team approach can be performed in order to establish an esthetic and functional dentition and to minimize the complications of hypodontia in the future.

CONCLUSION

The pattern and prevalence of hypodontia is different among races and ethnic groups. The prevalence of hypodontia in our orthodontic patients was 7.66% that showed no significant difference between males and females. The maxillary lateral incisor was the most frequently missing tooth. Tooth agenesis in the upper arch was more prevalent than in the lower arch.

Percent of patients with class III malocclusion was the most amongst the malocclusions. However, this finding was not statistically significant. Higher prevalence of hypodontia in the maxillary arch and in class III patients may be considered as an etiologic factor.

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