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Research Paper: Radiographic Evaluation of Dental Development in Patients With Tooth Agenesis

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ABSTRACT

Introduction: Hypodontia is one of the most common developmental anomalies. This study aimed to evaluate the variations of radiographic dental development in a group of Iranian children with dental agenesis.

Materials and Methods: This study evaluated 1230 Orthopantomographs (OPGs) for agenesis of permanent teeth obtained from the patients aged between 8 and 18 years. Then the difference between Dental Age and Chronological Age (DA-CA) of the samples with full dentitions and affected with dental agenesis were compared. Dental age was characterized by root and crown development according to Häävikko's method and the chronological age was determined by subtracting the date of birth from the date of acquiring the OPG. The obtained data were analyzed using Independent t test.

Results: The prevalence of tooth agenesis was 3.57% in study sample (59.10% females and 40.90% males). The mean (SD) of the difference between DA-CA of the hypodontia and control groups were 1.74(1.53) and 2.12(1.81), respectively. Regarding the results of Independent t test, there was no significant difference between hypodontia and control groups in terms of DA-CA (P>0.05). The Spearman test showed no correlation between delayed tooth development and hypodontia severity.

Conclusion: The development of permanent teeth in children with dental agenesis was similar to children with normal dental development. Also, there was no correlation between hypodontia severity and delayed tooth developments.

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1. Introduction

Hypodontia or tooth agenesis is defined as the absence of one to six teeth excluding the third molars [1, 2]. The prevalence rates of this disorder in European, North American, and Asian populations are 5.5%, 3.9%, and 6.9%, respectively [3, 4]. The most commonly involved teeth are the maxillary lateral incisors and mandibular second premolars [2, 5]. Based on the study population, several studies reported higher prevalence of hypodontia in females [6, 7].

According to the literature, various inheritance patterns are associated with familial form of this anomaly. Regarding the evidence, non-syndromic hypodontia is associated with mutations in several genes, like *PAX9* and *MSX1* [8, 9]. Moreover, some dental anomalies, including microdontia, dental impaction or transposition, taurodontism, and delayed dental development, are highly prevalent [1, 2, 10].

There is a multitude of studies regarding delayed dental development in children with hypodontia; however, a limited number of studies were conducted on the prevalence of hypodontia among Iranian children. Therefore, this study aimed to compare development of permanent teeth in children with dental agenesis and unaffected children.

2. Materials and Methods

This descriptive, retrospective, and cross-sectional study was conducted to evaluate Orthopantomographs (OPGs) obtained from healthy subjects aged between 8 and 18 years. A total of 1230 high-quality OPGs, taken at routine examination at the Dental Faculty of Ardabil University of Medical Sciences were evaluated for the investigation of hypodontia excluding the third molars. We excluded the patients with developmental anomalies (e.g. ectodermal dysplasia, as well as cleft lip and palate), history of trauma, or tooth extraction.

The study population consisted of 643 females and 588 males, 44 of whom (27 females and 17 males) presented with hypodontia involving one or more permanent teeth. The control group was gender- and age-matched with the hypodontia group. Dental age was assessed by two examiners using the Häävikko's method, which evaluates the dental development stages of four reference teeth and convert the results into numbers (ranging from 1 to 12); all the scores are transformed into dental age using the Häävikko reference tables. Furthermore, the chronological age of the subjects was determined by subtracting the date of birth from the date of obtaining the OPGs. The hypodontia and control groups were compared in terms of difference in Dental Age and Chronological Age (DA-CA) using the Independent t test.

The Spearman correlation coefficient test was applied to determine the correlation between hypodontia severity and DA-CA in the hypodontia group. Reliability analysis was used to establish inter-rater agreement regarding DA-CA.

3. Results

In this study, 1230 OPGs collected from the children aged between 8 and 18 years were evaluated for hypodontia. Moreover, the prevalence of hypodontia in the permanent dentition was 3.57% including 26 females (59.10%) and 18 males (40.90%). In addition, most of the involved teeth were the maxillary lateral incisors (50%) and mandibular second premolars (34.09%), and most of the subjects had one (81.8%) or two (15.9%) missing teeth. Out of the 44 cases, seven subjects were excluded from the study because their chronological age was not available. Table 1 presents the mean and standard deviations of DA-CA in the hypodontia group. The Kolmogorov-Smirnov test reflected that all the variables were normally distributed (P>0.05). The Cronbach α coefficient approved the inter-examiner reproducibility (α=0.9).

Scatter plots were constructed to compare the DA-CA between the control and hypodontia groups. There was no significant difference between the males and females in terms of the prevalence of hypodontia (Table 1) (P>0.05). As demonstrated in Table 2, independent samples t test showed no significant difference between

Table 1. Descriptive statistics for the missing group

Missing Group	Gender	N	Mean	SD	Sig.
DA-CA*	Male	14	1.6579	1.09025	0.786
	Female	23	1.8026	1.77710	

* Difference between dental age and chronological age

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Table 2. Independent t test results

Group		N	Mean	SD	Sig. (2-tailed)
DA-CA*	Missing group	37	-1.7478	1.53761	0.310
	Control group	48	-2.1279	1.81877	

*Difference between dental age and chronological age

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the groups concerning DA-CA (P>0.05). Moreover, the Spearman correlation coefficient test revealed no significant correlation between hypodontia severity and DA-CA (r=-0.320, P=0.053).

4. Discussion

According to the study results, there was no significant difference between the groups regarding the prevalence of delayed dental eruption. Different results were reported by various studies conducted on the correlation between hypodontia and dental development. Our results were in line with those of studies performed by Odagami et al., Lozada, and Infante, who did not report significant delayed dental development in patients with hypodontia [12, 13].

Ruiz-Mealin compared the radiographic development of permanent teeth between children with hypodontia and unaffected ones. In the mentioned study, the dental age of the participants was estimated by the 12 stages of Häävikko and the 8 stages of Demirjian and Goldstein. In Ruiz-Mealin study, the prevalence of delayed dental development was significantly higher in the children with hypodontia in comparison to the control group [14].

Lebbe used Demirjian stages for age estimation methods and explained patients with agenesis have a delayed development compared to patients in the control group [15]. This inconsistency might be due to various factors, including different dental age estimation methods, sample sizes, the age of the participants and their races, and statistical methods.

According to the findings of the studies conducted by Uslenghi et al. and Ruiz-Mealin, the prevalence of delayed dental development increased along with chronological age in both groups, which was in congruence with our results [15, 16]. As it is unfeasible to estimate dental age when the apical foramen of tooth closes, older children have fewer teeth to evaluate. This might undermine the acceptability of the measurement technique with increasing age.

Hypodontia is classified into three categories according to the number of absent teeth; mild (one to two teeth), moderate (three to five teeth), and severe (six or more teeth) [1, 2]. In this study, only one patient missed four teeth including two maxillary lateral incisors and two mandibular first premolars. Consistent with the study conducted by Sen Tunc, there was no significant correlation between hypodontia severity and the prevalence of delayed dental eruption [17]. This result was inconsistent with the findings of Odagami et al. and Uslenghi et al., who found a significant correlation between hypodontia severity and delayed dental age [13, 16].

According to the literature, the prevalence of hypodontia in permanent teeth is dependent on the study population [3, 4]. In this study, the prevalence of hypodontia was 3.57%, while Saberi reported the prevalence of 1.11% in southeast of Iran and 10.9% in 8 provinces of Iran [18, 19]. The reason for this discrepancy might be the different study settings. Considering the evidence, the prevalence of hypodontia was higher in females compared to males; the results of the present study indicated no significant difference in terms of the prevalence of hypodontia between males and females, but the female to male ratio was 1.44:1 [20].

In this study, the most frequently affected teeth were the maxillary lateral incisors and the mandibular second premolar. In various studies, there is controversy surrounding the most common missing tooth; for instance, Bäckman, Polder, and Mattheeuws reported that the most frequently missing tooth is the mandibular second premolar, whereas other studies claimed that the permanent maxillary lateral incisor was the most affected one [3,17, 20-22].

Further information regarding dental development in children with hypodontia is valuable because they have malocclusions, as well as functional and aesthetic problems, especially when the anterior teeth are missing. Dental implants and or orthodontic space closure are considered as the treatment modalities in these patients. Age assessment methods are appropriate for the patients with hypodontia receiving orthodontic treatments and

provide a reference when a birth certificate is not available for forensic purposes. However, the results of this study showed no significant correlation between dental development and hypodontia, and diversity in the study populations could explain these disparate results.

5. Conclusion

The development of permanent teeth in children with dental agenesis was similar to the control group. Also, there was no correlation between hypodontia severity and delayed tooth developments.

Ethical Considerations

Compliance with ethical guidelines

Due to the lack of communication with the patients and the financial cost, ethical code for this research was not obtained.

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Conflict of interest

The authors declared no conflict of interest.

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