

Non-syndromic Hypodontia in Jordanian Orthodontic Patients and its Management

Ibrahim Al-Shorman BDS, Nabeel Shdefat BDS**, Ayman Al-Hyasat BDS***

ABSTRACT

Objectives: To study the pattern and management of hypodontia in the permanent dentition, excluding the third molars, in a sample of Jordanian orthodontic patients.

Methods: A total of 1200 orthodontic patients (600 females and 600 males) was examined for evidence of hypodontia at Prince Rashid Ben Al- Hassan Hospital during the period between July 2008 and September 2010. Intraoral examination, pre treatment records, and orthopantomographic study were used for the diagnosis of tooth agenesis. Our study group comprised 116 non-syndromic hypodontic patients (74 females and 42 males), with an age range of 10-25 years (mean age 17 years 8 months).

Results: A hypodontia prevalence of 9.7% was found for the total study group (6.2% for females and 3.5% for males) with a statistically significant difference between both gender ($P < 0.05$). The most frequently missing teeth were the maxillary lateral incisors (41.1%), followed by the mandibular second premolars (28.5%). Hypodontia was found more often in the maxilla (62%) and symmetrical hypodontia was predominant. Most patients (82.8%) had hypodontia of one or two teeth, whereas oligodontia was found in 3.5%.

Conclusions: Accurate diagnosis of hypodontia is the key to orthodontic treatment planning and eventual treatment itself. Furthermore, additional knowledge of dental development will contribute valuable insights for novel therapeutic regimens in the future so that we can move from a mode of diagnosis and treatment to one of prediction and prevention.

Key words: Hypodontia, Oligodontia, Orthopantomographic study, Pretreatment records

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Introduction

Tooth agenesis or hypodontia, is the most common human malformation with widely varying frequencies from (2.6% to 11.3%), excluding third molars. The prevalence of hypodontia among different ethnic participants in the same population was estimated to be 4.8%, with a higher incidence in females than in males.⁽¹⁾

Hypodontia is often used as a collective term for congenital absence of primary or secondary teeth, although specifically it describes the absence of one to six teeth excluding third molars. Oligodontia refers to the absence of more than six teeth, excluding third molars, while anodontia represents the loss of all teeth.⁽²⁾ Although it is not a serious public health problem, hypodontia may cause masticatory and

From the Departments of Dentistry

*Prince Rashid Ben Al-Hassan Hospital, Irbid-Jordan

**King Hussein Medical Center, (KHMC), Amman-Jordan

Correspondence should be addressed to Dr. N. Al-Shdyfat, (KHMC), E-mail: nshdyfat@yahoo.com

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speech dysfunctions and create esthetic problems with orthodontic and prosthetic implications.⁽³⁾ Hypodontia has a multifactorial aetiology involving genetic, epigenetic and environmental factors. Recent advances in genetic research have focused on transcription factors, particularly MSX1, PAX9, and AXIN2 in families with multiple dental agenesis. The condition may appear as syndromic, in which tooth agenesis is a regular feature in conjunction with other congenital anomalies, or nonsyndromic, encountered in healthy, apparently normal people as a primary condition.^(3,4) Hypodontia is frequently associated with other dental anomalies,^(1,4-6) and recently, a statistical association between hypodontia and epithelial ovarian cancer was observed, that warrants further investigation.⁽⁷⁾

Methods

The subjects of the present study were 116 non-syndromic hypodontic patients, 74 females and 42 males (ages 10-25 years, the mean age was 17 years 8 months), were diagnosed from a total sample of 1200 orthodontic patients (600 females and 600 males), at Prince Rashid ben Al- Hassan hospital during the period between July 2008 and September 2010. The study protocol for our study was approved by the Human Research Ethics Committee at the Royal Medical Services. Detailed medical history, intraoral examination, panoramic radiographs and pretreatment records were used for identification and recording permanent tooth agenesis (excluding third molars). Exclusion criteria included: previous orthodontic treatment, head or neck trauma, head or neck surgery, history of craniofacial disorder, and previous loss of teeth due to accidents, extraction or other contributing causes. Chi-square test was used to investigate the difference in the prevalence and distribution of hypodontia between genders. The data were analyzed using SPSS software version 17 for statistical analysis (Statistical Package for Social Sciences, SPSS Inc., Chicago, Illinois, USA), the level of significance tested was ($P < 0.05$).

Results

Of 1200 examined orthodontic patients, 116 (74 females and 42 males) demonstrated an agenesis of one or more teeth. The 116 hypodontic

patients comprised 74 (63.8%) females and 42 (36.2%) males. The prevalence of hypodontia was 9.7% (6.2% for females and 3.5% for males) for this sample of Jordanian orthodontic patients, with a statistically significant difference in gender ($P = 0.0018$). The distribution of patients by gender is shown in Table I.

Table II, shows a total of 253 permanent teeth were missing. Agenesis of maxillary lateral incisors was observed in 104 patients (41.1%), 55 on the left side (52.9%) and 49 on the right side (47.1%), 68 females (58.62%) and 36 males (31%). Unilateral and bilateral location was almost equally represented. Agenesis of second premolars was observed in 95 patients (37.5%), of which 23 (24.2%) were missing from the maxilla and 72 (75.8%) from the mandible. Agenesis of all four second premolars was observed in eight patients (9.89 %). In addition, 18 upper canines, 15 lower central incisors, six upper first premolars, four lower lateral incisors and two lower second molars were identified as missing. Most missing teeth (62%) were in the maxilla.

The majority of patients (82.8%) were missing one or two teeth while oligodontia was found in 3.5% (Table III). In total, 130 (51.38%) teeth were absent on the left side and 123 (48.62%) on the right side. Table IV, shows the relationship between Angle's classification of malocclusion and the number of missing teeth. Patients with more severe hypodontia showed a tendency to a Class III relationship. The space was orthodontically closed in 84.5% of the patients, while in the other 15.5% the space was maintained (Table V).

Discussion

Hypodontia of permanent teeth was found in 116 patients (74 females and 42 males) from a total sample of 1200 orthodontic patients. The present study revealed a hypodontia prevalence of 6.2% for females, 3.5% for males, and 9.7% for both genders combined, excluding third molars. A hypodontia present in 9.7% for orthodontic patients is higher than the 4.8% reported by Küchler *et al.* for a normal population with a wide ethnic variation,⁽¹⁾ and corresponds to the values 6.5%, 7.54%, 8.5%, 9.11%, 11.3% reported for orthodontic patients in Spain, Turkey, Japan, Iran, Slovenia,

Table I: Distribution of the study participants by gender

Gender	Patients with hypodontia n(%)	Patients without hypodontia n(%)	Total n(%)
Male	42 (3.5)	558 (46.5)	600 (50)
Female	74 (6.2)	526 (43.8)	600 (50)
Total	116 (9.7)	1084 (90.3)	1200 (100)

Table II: Distribution of hypodontia by tooth number ≠

Tooth number ≠	Male n (%)	Female n (%)	Total n (%)
11	0	2 (0.79)	2 (0.79)
12	17 (6.72)	32 (12.64)	49 (19.37)
13	1 (0.39)	8 (3.16)	9 (3.56)
14	2 (0.79)	1 (0.39)	3 (1.18)
15	3 (1.18)	8 (3.16)	11 (4.35)
16	1 (0.39)	0	1 (0.39)
17	0	1 (0.39)	1 (0.39)
21	0	1 (0.39)	1 (0.39)
22	19 (7.50)	36 (14.23)	55 (21.74)
23	2 (0.79)	7 (2.77)	9 (3.56)
24	2 (0.79)	1 (0.39)	3 (1.18)
25	3 (1.18)	9 (3.56)	12 (4.74)
27	0	1 (0.39)	1 (0.39)
31	3 (1.18)	4 (1.58)	7 (2.77)
32	0	2 (0.79)	2 (0.79)
33	0	1 (0.39)	1 (0.39)
35	14 (5.53)	24 (9.48)	38 (15.02)
37	0	1 (0.39)	1 (0.39)
41	3 (1.18)	5 (1.98)	8 (3.16)
42	2 (0.79)	0	2 (0.79)
43	1 (0.39)	1 (0.39)	2 (0.79)
45	12 (4.74)	22 (8.7)	34 (13.44)
47	0	1 (0.39)	1 (0.39)
Total	85 (33.6)	168 (66.4)	253 (100)

≠ Federation Dentaire International Notation

Table III: Distribution of the patients by gender and number of missing teeth

	One tooth n (%)	Two teeth n (%)	Three teeth n (%)	Four teeth n (%)	More than four teeth n (%)	Total n (%)
Male	17 (14.65)	19 (16.37)	2 (1.72)	3 (2.59)	1 (0.86)	42 (36.20)
Female	22 (18.96)	38 (32.75)	5 (4.31)	6 (5.17)	3 (2.59)	74 (63.79)
Total	39 (33.62)	57 (49.14)	7 (6.03)	9 (7.76)	4 (3.49)	116 (100)

Table IV: Relationship between the number of missing teeth and Angle's classification

Angle's classification	One tooth n (%)	Two teeth n (%)	Three teeth n (%)	Four teeth n (%)	More than four teeth n (%)	Total n (%)
CI I	29 (25)	35 (30.17)	4 (3.49)	4 (3.49)	1 (0.86)	73 (63.79)
CI II	6 (5.17)	12 (10.34)	1 (0.86)	3 (2.59)	0	22 (18.96)
CI III	4 (3.49)	10 (8.62)	2 (1.78)	2 (1.78)	3 (2.59)	21 (18.10)

Table V: Distribution of orthodontic treatment option

	Space opening n (%)	Space closure n (%)	Total n (%)
Male	12 (10.34)	30 (25.86)	42 (36.21)
Female	6 (5.17)	68 (58.62)	74 (63.79)
Total	18 (15.52)	98 (84.48)	116 (100)

respectively.⁽⁸⁻¹²⁾ Extraordinarily, a hypodontia present in 9.4% in permanent teeth of Japanese pediatric patients (not orthodontic sample) was reported by Goya *et al.* which confirms that hypodontia is common in Japanese.⁽¹³⁾ Several authors report a little but not significant predominance of hypodontia in females.^(1,8,10,12) Sisman *et al.* reported a higher female

hypodontia prevalence with statistically significant differences in gender for the tooth number ≠ "14", "12" and "11" (≠ Federation Dentaire International Notation).⁽⁹⁾ However, our study revealed the prevalence of hypodontia was higher in females (6.2 %) than in males (3.5 %) defining the ratio male: female at 1 : 1.76 with a statistically significant difference in gender ($P <$

0.05). In our study most (82.75%) people with hypodontia were missing just 1 or 2 teeth (51.7% for females, 31% for males). The average number of missing teeth per subject was 2.2. These findings coincided with previous studies.^(1,9,10,12)

The distribution of hypodontia by tooth number indicates a significantly higher incidence of missing maxillary lateral incisors. In our study, the most frequently missing tooth was the maxillary lateral incisor that accorded with the findings of previous studies,^(9,11,12,14) followed by the mandibular second premolars (28.5%). Hypodontia of the maxillary lateral incisors was observed in (41.1%) of the total sample, however, this incidence is significantly higher than that reported in previous studies. In contrast with our findings, the most commonly missing teeth were the lower second premolars, reported in many previous studies (excluding third molars).^(1,8,10,15) The two basic orthodontic options for treating patients with congenitally absent maxillary lateral incisors were space opening to replace the missing tooth or space closure and substitute the canine for the missing lateral incisor. The need to maintain space until the end of growth for a permanent restoration is undesirable. Space closure is definitely a more attractive solution in adolescent patients because of the permanence of the finished result. However, treatment decisions should depend on the basic orthodontic diagnosis. Arch-length deficiency, facial profile, the existing malocclusion, and the size and esthetics of the canine must all be evaluated. Agenesis of second premolars would have a risk of anchorage loss, as it might alter the treatment planning and modify the mechanotherapy as well. Often this anomaly is associated with retained and infraoccluded primary molars and with clinical sequelae, such as reduced alveolar height, supraeruption of opposing teeth, tipping of first molars with space loss, and, in some cases, impaction of the first premolar. Treatment considerations for congenitally absent mandibular second premolars depend on the patient's age, the stage of development of the adjacent teeth, and the condition of the deciduous predecessors with regard to root resorption and infraocclusion. Some early decisions that the orthodontist makes for a patient whose mandibular second premolars

are congenitally missing will affect his / her dental health for a lifetime. Therefore, the correct decision must be made at the appropriate time. In our study, hypodontia was found more often in the maxilla (62%), in agreement with previous studies,^(9,11,12) with a remarkable similarity in the distribution of missing teeth between the left and right sides (51.38 and 48.62 %) respectively.^(9,10) Most individuals with oligodontia (75%) demonstrated a tendency to Angle's Class III malocclusion and Class III skeletal relationship, consistent with the results of previous studies.^(11,12,16) Elimination of the arch length imbalance caused by congenitally missing teeth necessitates formation of a comprehensive treatment plan which considers the possibility of orthodontic space closure and/or a prosthetic restoration. In the present study, in order to improve the scheme of the occlusion and to avoid any detrimental alterations to the occlusion and the facial profile, the space was orthodontically closed in (84.5%) of the patients, while in the other (15.5%) the space was maintained for an eventual restoration. The keys during orthodontic treatment are to create the correct amount of space and to leave the alveolar ridge in an ideal condition for a future restoration. There are other treatment options, like, osseointegrated implant or autotransplantation of a tooth. In a growing child, osseointegrated implants cannot adapt to growth and developmental changes in the oral region.⁽¹⁷⁾ Autotransplantation of premolars has been reported to be a useful treatment modality in cases of agenesis or traumatic loss of teeth.⁽¹⁸⁾ Hypodontic patients presented a higher risk of having various dental abnormalities.^(4,5,6) The possible explanation is that a certain genetic mutation might cause a series of different phenotypic expressions. Uslenghi *et al.* reported that there was on average a 1.51-year delay in dental development for children with hypodontia and the severity of hypodontia was directly linked with the extent of delayed dental development.⁽⁵⁾ Therefore, hypodontia will delay the onset and modify the orthodontic treatment planning. In addition, skeletal features may differ significantly among patients with and without multiple missing teeth. As a consequence, restorative treatment can be comprehensive, requiring an interdisciplinary approach.^(19,20)

Conclusion

In the present study, the overall presence of hypodontia, as well as the characteristics of the most frequently missing teeth, were in accordance with the findings of most studies conducted in other countries. Accurate diagnosis of hypodontia is the key to orthodontic treatment planning and eventual treatment itself. Furthermore, additional knowledge of dental development will contribute valuable insights for novel therapeutic regimens in the future so that we can move from a mode of diagnosis and treatment to one of prediction and prevention.

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