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Hypodontia in orthodontically treated children

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SUMMARY The frequency of hypodontia in orthodontically treated children, both male and female, and the association between tooth type, the upper or lower arch, the affected side and Angle's classification were studied using interviews, oral, study cast and panoramic radiographic examinations of 212 patients with a mean age of 12 years 7 months.

A hypodontia frequency of 11.3 per cent was found for the total sample. This was higher than the incidence of hypodontia reported in other studies of orthodontically treated children. The most frequently missing teeth were the maxillary lateral incisors, and maxillary and mandibular second premolars. The missing teeth were more often absent on the right (54.2 per cent) than on the left (45.8 per cent) side, in both males and females. One tooth was absent in 29.2 per cent of patients, two in 58.5 per cent, but seldom three or more. Orthodontic space closure was the treatment of choice in 87.5 per cent of the subjects.

Introduction

Missing teeth (tooth agenesis) is one of the most common developmental problems in children. The congenital absence of teeth results from disturbances during the initial stages of tooth formation: initiation and proliferation (Šutalo, 1994).

Missing teeth may occur in isolation, or as part of a syndrome. Isolated cases of missing teeth can be familiar or sporadic in nature. Familiar tooth agenesis is transmitted as an autosomal dominant, autosomal recessive, or X-linked genetic condition (Castaldi, 1966; Stewart and Poole, 1982; Graber, 1987; Slavkin, 1999). Monozygotic twins have been reported to show a significantly higher concordance rate for hypodontia than dizygotic twins (Borochov and Green, 1971; Marković, 1982a).

In addition, tooth agenesis has been associated with more than 49 syndromes. Various dental abnormalities, particularly hypodontia, have a much higher prevalence in certain groups. These dental anomalies have frequently been reported in children who also have a cleft lip, cleft palate or both (Shapira *et al.*, 2000), ectodermal dysplasia (Kerwetzki and Homever, 1974; Marković, 1982b; Parsche *et al.*, 1990), and Down, Rieger and Book syndrome (Uthoff, 1989).

Specific terms are used to describe the nature of tooth agenesis. Hypodontia is most frequently used when describing the phenomenon of congenitally missing teeth in general. Many other terms to describe a reduction in the number of teeth appear in the literature: oligodontia, anodontia, aplasia of teeth, congenitally missing teeth, absence of teeth, agenesis of teeth and lack of teeth. The term hypodontia is used when one to six teeth, excluding third molars, are missing, and oligodontia when more than six teeth are absent (excluding the third molars). Anodontia is an extreme case, denoting complete absence of teeth. There is no clear definition in the literature concerning the limits of these classes.

Anodontia or oligodontia, the absence of all or most of the teeth, is usually associated with an unusual but mild systemic abnormality, ectodermal dysplasia, or congenital syndrome. Anodontia and oligodontia are rare, but hypodontia is relatively common.

As a general rule, if only one or a few teeth are missing, the absent tooth will be the most distal tooth of any given type (Jorgenson, 1980; Schalk van der Weide *et al.*, 1994).

Hypodontia in the primary dentition is more common in the maxilla and is frequently associated with the lateral incisors. Studies suggest that this anomaly occurs in 0.1–0.9 per cent of the population, with equal frequencies in males and females. As a rule, when the primary tooth is missing, its permanent counterpart will also be absent (Hall, 1983).

Hypodontia of permanent teeth occurs with equal frequency in the upper and lower arches and usually affects the third molar. The type of permanent missing teeth and the population prevalence for the anomaly vary with racial group, although females are more frequently affected (Thilander and Myrberg, 1973; Rølling, 1980; Aasheim and Ögaard, 1993; Symons *et al.*, 1993).

In many populations it has been reported that, except for third molars, the most commonly missing teeth are the upper lateral incisor and lower second premolar. For Europeans, the mandibular second premolar is the tooth most frequently absent after the third molar, followed by the maxillary lateral incisor and upper second premolar (Jorgenson, 1980). Excluding the third molar, population prevalences across the world vary between 1.6 and 9.6 per cent. Absence of the third molar is commonly found in most population studies, with prevalences reported of 9–37 per cent. The incidence of missing permanent teeth, excluding the third molar, is 3.4 per cent in Swiss children, 4.4 per cent in American children, 4.6 per cent in Israeli children, 6.1 per cent in Swedish children, 8 per cent in Finnish

children, and 9.6 per cent in Austrian children (Thilander and Myrberg, 1973; Brook, 1974; Aasheim and Ögaard, 1993; Slavkin, 1999).

The treatment of anodontia or severe hypodontia in children is complex and should be undertaken in centres with access to paediatric dentistry, orthodontics, prosthodontics, and oral surgery (Bolton, 1968; Tuverson, 1980; Ögaard and Krogstad, 1995).

Any tooth in the arch can be congenitally absent. Orthodontic treatment for patients with congenitally missing teeth is a challenge to effective treatment planning. The two major alternatives, orthodontic space closure or space opening for prosthetic replacements, implant or autotransplantation, can both compromise aesthetics, periodontal health and function (Kristenson and Lagerström, 1991; Bothello *et al.*, 2000; Czochrowska *et al.*, 2000). Autotransplantation of teeth, if carried out successfully, ensures that alveolar bone volume is maintained due to physiological stimulation of the periodontal ligament. Because placement of osseointegrated implants in growing alveolar bone is contra-indicated, transplantation of available teeth remains a suitable choice for replacing missing units in young patients. Implant treatment is normally deferred until the jaws have stopped growing, to avoid related problems, typically in the very late teens or early 20s (Nordquist and McNeill, 1975; Ödman *et al.*, 1988; Oesterle *et al.*, 1993; Robertsson and Mohlin, 2000; Rosa and Zachrisson, 2001).

The aim of this study was to determine the frequency of hypodontia in orthodontically treated children to determine the association between tooth size, the upper or lower arch, the affected side and Angle's classification.

Materials and methods

The material for the present investigation included the records of 212 orthodontic patients who had undergone therapy from October 2002 to October 2003.

Of these, 24 patients (nine male and 15 female) had agenesis of one or more teeth. The mean age was 12 years 7 months. The type of permanent missing teeth, the affected side, the jaw and the type of orthodontic therapy were recorded.

Panoramic radiographs, dental casts and dental histories were used for identification and recording permanent tooth agenesis (excluding third molars). Children whose radiographs were not of diagnostic clarity were excluded.

The patients did not have any associated syndrome and had no previous loss of teeth due to trauma, caries, periodontal disease, or orthodontic extraction.

Results

Based on the type of permanent missing teeth, the patient's gender and the affected side and jaw were also recorded. In the total sample of 212 patients, who were orthodontically treated, hypodontia was found in 24 (11.3 per cent) children. The distribution of patients by gender is shown in Table 1.

In total, 48 teeth were absent (Table 2). Twenty-six (54.1 per cent) of these were maxillary lateral incisors, 15 on the right side and 11 on the left. Sixteen (33.4 per cent) missing teeth were second premolars, of which nine were missing from the maxilla and seven from the mandible. In addition, one upper canine, three lower central incisors, one upper first premolar and one lower second molar were identified as missing.

The majority of missing teeth (77.1 per cent) were in the maxilla. In total, 26 (54.17 per cent) teeth were absent on the right side and 22 (45.83 per cent) on the left. The majority of patients were missing one or two teeth, but rarely three or more (Table 3).

The relationship between the type of malocclusion according to Angle and the number of missing teeth (Table 4) was determined. Patients with more severe hypodontia showed a tendency to a Class III relationship and an increased overbite.

In 87.5 per cent of the children the space was orthodontically closed, while in the other 12.5 per cent the space was maintained (Table 5), in order to facilitate the aesthetics and function of the occlusion.

Discussion

The present study revealed a hypodontia prevalence of 11.3 per cent in this sample of orthodontically treated children,

Table 1 Distribution of the study participants by gender.

Gender	Patients with hypodontia [*n* (%)]	Patients without hypodontia [*n* (%)]	Total [*n* (%)]
Male	9 (4.2)	86 (40.6)	95 (44.8)
Female	15 (7.1)	102 (48.1)	117 (55.2)
Total	24 (11.3)	188 (88.7)	212 (100)

Table 2 Distribution of hypodontia by tooth type.

Tooth type*	Male [*n* (%)]	Female [*n* (%)]	Total [*n* (%)]
12	5 (10.4)	10 (20.8)	15 (31.2)
13	1 (2.1)	0 (0)	1 (2.1)
15	3 (6.3)	1 (2.1)	4 (8.4)
22	5 (10.4)	6 (12.5)	11 (22.9)
24	1 (2.1)	0 (0)	1 (2.1)
25	3 (6.3)	2 (4.1)	5 (10.4)
35	3 (6.3)	1 (2.1)	4 (8.4)
37	0 (0)	1 (2.1)	1 (2.1)
41	2 (4.1)	1 (2.1)	3 (6.2)
45	2 (4.1)	1 (2.1)	3 (6.2)
Total	25 (52.1)	23 (47.9)	48 (100)

*Federation Dentaire International notation.

Table 3 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	1 (4.1)	5 (21.0)	1 (4.1)	1 (4.1)	1 (4.1)	9 (37.5)
Female	6 (25.0)	9 (37.5)	0 (0)	0 (0)	0 (0)	15 (62.5)
Total	7 (29.2)	14 (58.5)	1 (4.1)	1 (4.1)	1 (4.1)	24 (100)

Table 4 Relationship between the number of missing teeth and Angle classification.

	One tooth [*n* (%)]	Two teeth [*n* (%)]	Three teeth [*n* (%)]	Four teeth [*n* (%)]	More than four teeth [*n* (%)]	Total [*n* (%)]
Class I	4 (16.7)	7 (29.2)	0 (0)	0 (0)	0 (0)	11 (45.9)
Class II	3 (12.5)	5 (20.9)	0 (0)	0 (0)	0 (0)	8 (33.4)
Class III	0 (0)	2 (8.4)	1 (4.1)	1 (4.1)	1 (4.1)	4 (16.7)
Overbite (mm)	0–3	1–3	4.5	5.5	5.5	

Table 5 Distribution of orthodontic treatment option.

	Space opening		Space closure		Total	
	n	%	*n*	%	*n*	%
Male	2	8.3	7	29.2	9	37.5
Female	1	4.2	14	58.3	15	62.5
Total	3	12.5	21	87.5	24	100

excluding third molars. This frequency is higher than the 1.6–9.6 per cent reported for a normal population, and while not statistically significant, it is considerably higher than the 8.1 per cent reported for orthodontically treated children in Magdeburg (Sterzik *et al.*, 1994).

Hypodontia was found more frequently in females than males (Table 1). Most authors report a small but not significant predominance of hypodontia in females (Schalk van der Weide *et al.*, 1994; Lavelle and Moore, 1996; Slavkin, 1999). Statistically significant differences have been found in some studies (Brook, 1974; Bergström, 1977).

Hypodontia distribution by tooth type indicates a significantly higher incidence of missing maxillary lateral incisors. Hypodontia of the maxillary lateral incisors was observed in 6.4 per cent of the total sample, which is significantly higher than the 2.2 per cent reported for a normal population. Similarly, the absence of 1.9 per cent of second premolars in this study is significantly lower than the 3.4–6.6 per cent in a normal population (Castaldi, 1966; Schalk van der Weide *et al.*, 1994).

Hypodontia was found more often in the maxilla, consistent with the results of previous studies (Symons *et al.*, 1993; Lavelle and Moore, 1996), and frequently more often on the right side than on the left (54.2 and 45.8 per cent, respectively).

Most individuals with hypodontia demonstrated a tendency to a Class III Angle relationship with an increased overbite.

In 87.5 per cent of children the space was orthodontically closed, while in the remaining 12.5 per cent the space was maintained.

In patients where the upper arch was crowded, the lateral incisor space was closed. The quality of the appearance depended on the shape of the canine, but recontouring of the canines to look more like lateral incisors was undertaken by reducing the cusp tip and adding composite mesio-incisally. When one or both upper lateral incisors were absent in an uncrowded arch and the excess space distributed as generalized anterior spacing, a fixed appliance was used to localize the space in the lateral incisor area prior to provision of bridgework or implants.

In patients with agenesis of one or both premolars in an arch without crowding, the primary second molar was left *in situ*, but with the risk of infra-occlusion or progressive root resorption, which may lead to eventual extraction. In such a case it may be replaced with an autotransplanted tooth or an implant. In patients with crowding, the missing premolar was used as one of the extraction spaces for arch alignment (Ödman *et al.*, 1988; Kristenson and Lagerström, 1991; Oesterle *et al.*, 1993; Czochrowska *et al.*, 2000; Bothello *et al.*, 2000).

Conclusion

The hypodontia prevalence of 11.3 per cent found in this sample of orthodontically treated children was statistically higher than that for a normal population. Hypodontia was found considerably more frequently in the maxilla than in the mandible, and the most frequently missing teeth were the upper lateral incisors, followed by the upper and lower

second premolars. The majority of patients had one or two teeth missing, but seldom three or more. Patients with more severe hypodontia showed a tendency to a Class III relationship and an increased overbite.

Congenital absence of permanent teeth has direct clinical implications. Early evaluation of the number of missing teeth and consideration of the size and the number of teeth remaining in both arches should aid the clinician in planning and managing treatment. The type of malocclusion, degree of crowding and facial profile are of prime concern in determining the final treatment plan.

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