International Journal of BioMedicine 3(3) (2013) 207-210

INTERNATIONAL JOURNAL OF BIOMEDICINE

DENTISTRY

Evaluation of the Mesiodistal Crown Sizes of the Remaining Dentition in Patients with Hypodontia, between 12 and 16 Years of Age

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Abstract

Objective: This study evaluated the mesiodistal crown sizes of the remaining dentition in patients affected with hypodontia, compared with the control group possessing complete dentition.

Methods: Panoramic radiographs of the patients treated in the Department of Orthodontics, Dental School - branch of Medical Faculty – University of Pristina, were reviewed to select a sample of 22 cases with agenesis of one or more permanent teeth, except the third molars (hypodontia group). A control group included 22 patients with complete dentition. Dental casts were measured for both groups. The patients ranged in age from 12 to 16 years. Mesiodistal crown dimensions were recorded by measuring all erupted teeth on study models with a manual caliper. Statistical calculation was performed using SPSS 15.0. Paired samples *t*-test was used to detect the statistical differences in tooth width measurements between the two groups. The significance level was predetermined at $\alpha = 0.05$.

Results: The mean age of the patients in the hypodontia group was 14.55±1.57 years, while that of the control group was 14.23±1.11. The most common congenital missing teeth were the upper lateral incisors (46.16%) followed by the upper first premolars (11.54%). We found significant differences between the groups in tooth size for the maxillary arch central incisors and the maxillary arch molar right quadrant, while in the left quadrant differences between the two groups were observed in the central incisor ($P<0.05$). However, we did not observe any significant differences between the groups with respect to tooth size for the lower jaw.

Conclusion: The reduced tooth size was evident except in the posterior segment right molar in the hypodontia group. This should be taken into consideration during treatment planning and deciding upon the treatment mechanics in order to achieve functional occlusion and an esthetic dentition at the culmination of the orthodontic treatment.

Keywords: *hypodontia; teeth; mesiodistal crown size.*

Introduction

The term 'hypodontia' refers to the congenital absence of teeth. Hypodontia is the most frequent dental anomaly observed in the population [1].

Hypodontia is generally defined as the developmental absence of one or more teeth, excluding the third molars, either in the primary or permanent dentition. Researchers employ a variety of terminology to describe this condition, such as a reduction in tooth number, tooth aplasia, congenital missing teeth, absence of teeth, agenesis of teeth, and lack of teeth. The prevalence of hypodontia has been estimated to occur in about 2 to 10% of the population in the permanent dentition, excluding the third molars [2]. The second premolars and upper lateral incisors are the most frequently missing teeth. Females are more often affected than males [1].

Hypodontia is not an isolated trait, and occurs in conjunction with other dental anomalies such as aplasia of the second premolars or the small size of the maxillary lateral incisors [3]. The precise etiology and pathogenesis of the congenital absence of teeth is still unclear [4, 5, 2]. However, it appears that it results from environmental, epigenetic or genetic factors or a combination of these causes [1], and suggests a multifactorial model in which polygenic factors play a major part, although environmental factors are also included. Recently, the etiology of dental anomalies was reviewed and the complexity of the dental development process was emphasized.

The process is, in addition, a long-term one and may be affected by various factors: genetic, epigenetic or environmental factors [6]. Variations in the size and shape of the remaining teeth have also been found to be associated with hypodontia [1, 7, 8].

Many studies have indicated an association between the anomalies in tooth number and form and other dental anomalies [1, 7, 8, 9]. These dental anomalies can create differences in the

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maxillary and mandibular dental arch lengths, which may result in malocclusion and complicate treatment planning. Orthodontic management of hypodontia patients requires multidisciplinary care, either to close the spaces where the teeth are missing or to open up these spaces and then replace the missing teeth to achieve esthetic and functional occlusion [10, 11]. Both options may require reshaping some teeth to alter their size and shape. Thorough knowledge of the size and the exact shape of each tooth (in 3D) in each category of hypodontia (mild, moderate, severe) will therefore help in correctly reshaping the teeth or in determining the distance to which the spaces need to be opened to allow for the restorative replacement of the missing teeth, in order to establish harmony in the intra- and inter-arch relationships. Furthermore, knowledge of the shape will offer additional insights to aid in the choice of the correct bracket prescriptions for hypodontia patients, as the present prescriptions are designed only for people having teeth of normal size and shape.

Several techniques have been proposed to quantify tooth size and shape. Some of these techniques involve the use of traditional morphometrics, such as linear measurements (MD and BL) and have revealed smaller tooth dimensions in patients with hypodontia than in the controls [12, 7, 8].

Another researcher measured sizes in two dimensions and found that patients with severe hypodontia (six or more teeth missing) had a slightly greater reduction in tooth size than the control subjects [1].

The aim of this study was to evaluate the mesiodistal crown sizes of the remaining dentition in patients affected with hypodontia, compared with the control group possessing complete dentition.

Material and Methods

Panoramic radiographs of the patients treated in the Department of Orthodontics Dental School - branch of Medical Faculty – University of Pristina, were reviewed to select a sample of 22 cases (15 women and 7 men) with agenesis of one or more permanent teeth, except the third molars (hypodontia group). A control group included 22 patients (8 women and 14 men) with complete dentition. Dental casts were measured for both groups. Mesiodistal crown dimensions were recorded by measuring all erupted teeth on study models with a manual caliper. The patients ranged in age from 12 to 16 years. The sample size was calculated using the Kelsey method with OpenEpi Sample Size Calculation with $\alpha = 0.05$ and a power of 90%. We used the similar criteria for methodology as in study of B.A. Ramazanzadeh et al [13].

The inclusion criteria for both groups consisted of the full eruption of all the permanent teeth, except the third molars, the availability of qualified dental casts and pre-treatment panoramic radiographs, minimal crowding, and the absence of any craniofacial syndromes. Patients with caries, interproximal restorations and ectopic tooth eruptions, as those with prior orthodontic treatment or possessing a history of permanent tooth extraction were excluded from the study. Panoramic radiographs were evaluated to confirm the presence of all the permanent teeth (excluding the third molars) in the control group and the congenital absence of at least one permanent tooth in the hypodontia group.

The mesiodistal dimension of each tooth in both the hypodontia and control groups was determined in the pretreatment study models. For this purpose, the maximum distance between the contact points on the two aproximal crown surfaces was measured parallel to the buccal surface with an accuracy of 0.01 mm, using a manual caliper.

Statistical calculation was performed using SPSS 15.0 (Statistical Package for Social Sciences, version 15.0). Paired samples *t*-test was used to detect the statistical differences in tooth width measurements between the two groups. The significance level was predetermined at $\alpha = 0.05$.

Results

The mean age of the patients in the hypodontia group was 14.55±1.57 years, while that of the control group was 14.23±1.11.

Table 1.

The distribution of agenesis by tooth type in the hypodontia group

Hypodontia		
Tooth position	N	%
UR2	6	23.08
UR4	2	7.69
UL2	6	23.08
UL4	3	11.54
LL1	2	7.69
LL5	2	7.69
LR1	2	7.69
LR2	1	3.85
LR5	2	7.69
Total	26	100

UR: upper right; UL: upper left; LR: lower right; LL: lower left; numbers in 'tooth position' column indicate the number of teeth in the Palmer system.

Table 1 shows the distribution of agenesis by tooth type in the hypodontia group. All the patients lacked one or two teeth. The most common congenitally missing teeth were the upper lateral incisors (46.16%) followed by the upper first premolars (11.54%). In addition, the two maxillary first premolars, the two mandibular central incisors, the two mandibular second premolars and one mandibular lateral incisor were missing in the sample. The most common pattern of hypodontia was the absence of the bilateral upper lateral incisors observed in 12 (46.16%) cases, while the absence of the unilateral upper first premolar was observed in three subjects (11.54%).

Statistical analysis by the two-sample t-test revealed significant differences between the groups in tooth size for the maxillary arch central incisors and the maxillary arch molar right quadrant ($P<0.05$; Table 2). In the left quadrant of the maxillary arch, statistical differences in tooth size measurements between the two groups were observed in the central incisor ($P<0.05$; Table 2). However, no significant differences were found between the groups in tooth size for the lower jaw. Generally, greater differences in tooth width measurements were seen in the anterior rather than in the posterior dentition.

Table 2.
The comparison of tooth width measurements (mm) in the hypodontia and control groups

Tooth position	Hypodontia	Control	Difference	P -value
UR1	9.0±1.0	8.43±1.04	0.57	**0.040**
UR2	6.4±1.3	6.82±0.59	-0.42	0.698
UR3	7.7±0.7	7.84±0.61	-0.14	0.487
UR4	7.1±0.7	7.19±0.63	-0.09	0.296
UR5	7.0±0.8	7.07±0.93	-0.07	0.365
UR6	10.2±1.0	10.73±0.88	-0.53	**0.011**
UL1	9.0±0.9	8.30±0.93	0.7	**0.008**
UL2	6.1±1.1	6.86±0.64	-0.36	0.082
UL3	7.7±0.5	7.66±0.56	0.04	0.494
UL4	7.2±0.7	7.23±0.97	-0.03	0.911
UL5	6.8±0.5	6.93±0.71	-0.13	0.459
UL6	10.0±1.2	10.39±1.38	-0.39	0.328
LR1	5.7±0.5	5.98±1.63	-0.28	0.869
LR2	5.8±0.7	6.30±0.65	-0.5	0.507
LR3	6.6±0.8	7.00±0.87	-0.4	0.789
LR4	7.0±0.7	7.14±0.62	-0.14	0.128
LR5	7.2±0.8	7.5±2.32	-0.3	0.058
LR6	10.3±0.8	10.27±1.40	0.03	0.367
LL1	5.6±0.6	5.98±1.63	-0.38	0.224
LL2	5.9±0.6	6.27±0.98	-0.37	0.240
LL3	6.7±0.5	6.92±0.86	-0.22	0.277
LL4	7.1±0.7	7.23±0.59	-0.13	0.712
LL5	7.4±1.0	7.41±0.53	-0.01	1.000
LL6	10.6±0.9	10.79±0.67	-0.19	0.163

Abbreviations as in table 1.
P value is provided from the two-sample t-test.

Discussion

In the present study, the mesiodistal tooth dimension was compared between patients affected with hypodontia and normal control subjects. In our study we found significant statistical difference between the patients who lacked one or two permanent teeth compared with the control group in which the maxillary arch right central incisor and right molar were larger than those in the control group; significant differences were also observed between the groups in the maxillary arch left central incisor where the hypodontia group showed a smaller tooth size than the control group.

These findings are contradictory to those in prior studies (13-18) where the findings reported narrower teeth in the hypodontia group than in the control group, except for the maxillary central incisors; however, they concurred with the study by Yamada et al. [20], who reported that tooth size in patients with agenesis of one or two teeth tended to be larger when compared with that in the control group having all 32 permanent teeth present, possibly due to the compensatory interactions that affected tooth dimension.

In contrast, Wisth et al. [21], did not find any statistical difference in the mesiodistal diameter of the teeth between the hypodontia group and the control group without tooth agenesis. Chung et al.[22], concluded that hypodontia was not associated with reduced tooth size.

The difference in tooth width between the two groups was more evident in the anterior than in the posterior segments, showing statistical significance for the central incisors and was in agreement with the study of Mirabella et al. [16], who reported that in subjects with unilateral or bilateral missing of the maxillary lateral incisors, the mesiodistal widths of the right and left maxillary first molars were comparable to those of normal individuals. Therefore, they suggested an interproximal reduction of the maxillary first molars in patients where additional space was required to place an implant-supported restoration in the anterior tooth segment.

In this study, patients withhypodontia did not show any significant reduction in tooth size in the posterior dentition compared with the control group, except in right molar. This finding is in line with several studies that reported statistically narrower anterior teeth in patients with missing teeth when compared with normal subjects [15, 18, 23].

It has been demonstrated that the degree of the decrease in tooth size is related to the number of missing teeth; therefore, as the number of missing teeth increases, the decrease in tooth size of the remaining dentition would also be more remarkable [14, 18]. Furthermore, agenesis of the maxillary lateral incisors occurred bilaterally in most cases; thus, the prevalence of the peg or small lateral incisors, as frequently reported in unilateral cases, would be smaller in the sample [16, 17, 23-25].

The maximum difference in the average mesiodistal tooth size between the two groups was 0.7 mm in the upper arch and 0.38 mm in the lower arch. These values are contradictory to the maximum difference of 0.49 mm between the control group and the agenesis group, as reported by Mirabella et al. [16].

The difference may be related to the smaller number of agenesis per individual in the present sample, whereas severe cases were also included in the prior studies, which revealed a close relationship between the reduction in tooth size and missing teeth [14, 19, 20].

Otherwise, the findings of this study corroborate the results of Brook et al. [18], where in the less severe cases of hypodontia, the relationship between tooth agenesis and the size of the remaining dentition is not strong.

The congenital absence of the permanent teeth is a complex condition that necessitates a multidisciplinary treatment approach. The orthodontist is frequently the first practitioner who detects the problem and decides either on closing the space or on providing adequate space for placement of a restoration, in the future. Although the decision depends on the individualized characteristics such as the type of malocclusion and the need for extraction in the opposite arch, as well as to the number of missing teeth, it is important to consider the dental and skeletal anomalies that may be associated with tooth agenesis. For example, the deficient alveolar growth, which may be observed in these patients, supports the prosthetic replacement of the absent tooth/teeth to improve lip protrusion and patient profile.

Conclusion

Patients affected with hypodontia showed greater mesiodistal crown size when compared with the control group in the remaining dentition. Reduce tooth size was evident, except in the posterior segment right molar. This should be considered during treatment planning and deciding on the treatment mechanics in order to achieve functional occlusion and an esthetic dentition at the culmination of the orthodontic treatment.

References

1. Brook AH. A unifying aetiological explanation for anomalies of human tooth number and size. Arch Oral Biol 1984; 29(5):373-8.
2. Polder BJ, Van't Hof MA, Van Der Linden FP, Kuijpers-Jagtman AM. A meta-analysis of the prevalence of dental agenesis of permanent teeth. *Community Dent Oral Epidemiol* 2004; 32(3):217-26.
3. Baccetti T. A controlled study of associated dental anomalies. Angle Orthod 1998; 68(3):267-74.
4. Vastardis H. The genetics of human tooth agenesis: new discoveries for understanding dental anomalies. Am J Orthod Dentofacial Orthop 2000; 117(6):650-6.
5. Mostowska A, Kobielak A, Biedziak B, Trzeciak WH. Novel mutation in the paired box sequence of PAX9 gene in a sporadic form of oligodontia. Eur J Oral Sci 2003; 111(3):272-6.
6. Brook AH. Multilevel complex interactions between genetic, epigenetic and environmental factors in the aetiology of anomalies of dental development. Arch Oral Biol 2009; 54(Suppl 1):S3-S17.
7. Schalk-van der Weide Y, Steen WH, Bosman F. Distribution of missing teeth and tooth morphology in patients with oligodontia. ASDC J Dent Child 1992; 59:133-40
8. Schalk-van der Weide Y, Bosman F. Tooth size in relatives of individuals with oligodontia. Arch Oral Biol 1996; 41(5):469-72.
9. McKeown HF, Robinson DL, Elcock C, al-Sharood M, Brook AH. Tooth dimensions in hypodontia patients, their unaffected relatives and a control group measured by a new image analysis system. Eur J Orthod 2002; 24(2):131-41.
10. Jepson NJ, Nohl FS, Carter NE, Gillgrass TJ, Meechan JG, Hobson RS, et al. The interdisciplinary management of hypodontia: restorative dentistry. Br Dent J 2003; 194:299-304.
11. Rashedi B. Prosthodontic treatment with implant fixed prosthesis for a patient with ectodermal dysplasia: a clinical report. J Prosthodont 2003; 12:198-201.
12. Rune B, Sarnas KV. Tooth size and tooth formation in children with advanced hypodontia. Angle Orthodont 1974; 44(4):316-21
13. Ramazanzadeh BA, Ahrari F, Hajian S. Evaluation of tooth size in patients with congenitally-missing teeth, J Dent Res Dent Clin Dent Prospects 2013; 7(1):36-41.
14. Brook AH, Elcock C, al-Sharood MH, McKeown HF, Khalaf K, Smith RN. Further studies of a model for the etiology of anomalies of tooth number and size in humans. Connect Tissue Res 2002; 43(2-3):289-95.
15. Brook AH, Elcock C, Aggarwal M, Lath DL, Russell JM, Patel PI, et al. Tooth dimensions in hypodontia with a known PAX9 mutation. Arch Oral Biol 2009; 54(Suppl 1):S57-62.
16. Mirabella AD, Kokich VG, Rosa M. Analysis of crown widths in subjects with congenitally missing maxillary lateral incisors. Eur J Orthod 2012; 34(6):783-7.
17. Yaqoob O, DiBiase AT, Garvey T, Fleming PS. Relationship between bilateral congenital absence of maxillary lateral incisors and anterior tooth width. Am J Orthod Dentofacial Orthop 2011; 139(3):e229-33.
18. Brook AH, Griffin RC, Smith RN, Townsend GC, Kaur G, Davis GR, et al. Tooth size patterns in patients with hypodontia and supernumerary teeth. Arch Oral Biol 2009; 54(Suppl 1):S63-70.
19. Schalk-van der Weide Y, Bosman F. Tooth size in relatives of individuals with oligodontia. Arch Oral Biol 1996; 41(5):469-72.
20. Yamada H, Kondo S, Hanamura H, Townsend GC. Tooth size in individuals with congenitally missing teeth: a study of Japanese males. Anthropol Sci 2010; 118:87-93.
21. Wisth P, Thunold K, Böe O. Frequency of hypodontia in relation to tooth size and dental arch width. Acta Odontol Scand 1974; 32(3):201-6.
22. Chung CJ, Han JH, Kim KH. The pattern and prevalence of hypodontia in Koreans. Oral Dis 2008; 14(7):620-5.
23. McKeown HF, Robinson DL, Elcock C, al-Sharood M, Brook AH. Tooth dimensions in hypodontia patients, their unaffected relatives and a control group measured by a new image analysis system. Eur J Orthod 2002; 24(2):131-41.
24. Garib DG, Peck S, Gomes SC. Increased occurrence of dental anomalies associated with second-premolar agenesis. Angle Orthod 2009; 79(3):436-41.
25. Baidas L, Hashim H. An anterior tooth size comparison in unilateral and bilateral congenitally absent maxillary lateral incisors. J Contemp Dent Pract 2005; 6(1):56-63.