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## Meziodistalne i bukolingvalne dimenzije zuba pacijenata s hipodoncijom u hrvatskoj populaciji

### Mesiodistal and Buccolingual Dimensions in Croatian Orthodontic Hypodontia Patients' Teeth

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#### Sažetak

**Svrha:** Istraživanje uspoređuje meziodistalne (MD) i bukolingvalne (BL) dimenzije zuba pacijenata s hipodoncijom (lat. *hypodontia*) i onih u kontrolnoj skupini koji imaju sve svoje zube. Nulta hipoteza bila je da između obje skupine nema razlike u veličini zuba kod pacijenata s hipodoncijom i onih u kontrolnoj skupini. **Metoda:** Uzorak se sastojao od 76 pacijenata s hipodoncijom (50 žena i 26 muškaraca) u dobi između 11 i 18 godina. U kontrolnoj skupini bilo je također 50 ženskih i 26 muških ispitanika iste dobne skupine kao i u ispitivanoj. Meziodistalne (MD) i bukolingvalne (BL) dimenzije zuba mjerene su na studijskim modelima pomičnom mjerkom s preciznošću od 0,01 milimetar. Svi podatci analizirani su u programu Statistica 7,1 (StatSoft Inc.) i statističkim paketom (deskriptivna statistika, test normalnosti distribucije, parametrijska statistika). **Rezultati:** Zubi koji kongenitalno najčešće nedostaju su drugi donji premolari (lijevo 13,45 % i desno 13,90 %), gornji lateralni incizivi (desni i lijevi 12,56 %) te drugi gornji premolari (desni 9,40 % i lijevi 10,31 %). Najveća razlika između ispitivane i kontrolne skupine pronađena je za gornje lateralne incizive 8,08 posto u MD dimenziji i 6,40 posto u BL dimenziji. Najmanja razlika zabilježena je u BL dimenziji donjih lateralnih inciziva (2,37 %), u MD dimenziji drugih donjih premolara i prvih gornjih molara (2,61 %) te u MD dimenziji donjih središnjih inciziva (2,26 %). **Zaključak:** Ispitanicima s hipodoncijom veličina zuba manja je negoli u kontrolnoj skupini i to prosječno za 4,02 posto u MD dimenziji i 3,85 posto u BL dimenziji. Zubi koji pokazuju najveću razliku u dimenziji su gornji lateralni incizivi.

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#### Adresa za dopisivanje

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#### Ključne riječi

anodoncija; dencija; prirodene anomalije

#### Uvod

Hipodoncija je kongenitalni nedostatak jednoga ili više zuba i ubraja se u najčešću razvojnu anomaliju trajne dencije, isključujući treće molare (1 – 3). Prema podacima iz literature, etiologija hipodoncije još nije dovoljno jasna. Može nastati zbog genetskih ili okolišnih čimbenika ili kao njihova kombinacija. Istraživanja na blizancima i unutar obitelji upućuju na to da ulogu u ekspresiji tog obilježja imaju ne samo genetski čimbenici, nego i drugi faktori (4). Hipodoncija se može pojaviti izolirano ili u kombinaciji sa sindromima [ektodermalna displazija (5) te rascjepi usne i/ili nepca (6)]. Često je u kombinaciji s dentalnim i skeletnim anomalijama kao što su bimaxilarna retruzija, mandibularni prognatizam, smanjena maksila, smanjena vertikalna facijalna dimenzija te rudimentarni gornji lateralni inciziv (7, 8). Kako bi postigli estetiku zubnog luka, pacijenti s hipodoncijom često zahtijevaju interdisciplinarni tretman, uključujući ortodontsku i restorativnu intervenciju. Dimenzije zuba ključne su za odluku

#### Introduction

Hypodontia is a congenital absence of one or more teeth and is one of the most common developmental abnormalities in the permanent dentition excluding the third molars (1-3). According to the literature, the etiology of hypodontia remains unclear. It may occur due to genetic or environmental factors, or as a combination of both factors. Family and twin studies have showed that not only genetic factors but also other conditions play a role in the expression of this trait (4). Hypodontia may be present as an isolated condition or in association with syndromes (ectodermal dysplasia (5) and cleft lip and/or palate (6)). It is frequently associated with dental and skeletal malocclusions such as bimaxillary retrusion, mandibular prognathism, decreased maxillary jaw size, reduced vertical facial dimension, and peg shaped maxillary lateral incisors (7, 8). In order to achieve an esthetically pleasing dentition, patients with hypodontia often require interdisciplinary treatment, including orthodontic and restor-

o raspodjeli prostora unutar zubnog luka gdje zubi nedostaju, te za omogućavanje funkcionalne okluzije. Prevalencija hipodoncije u mlječnoj denticiji kreće se od 0,1 do 0,9 posto, a u trajnoj od 2,3 do 11,3 posto (9 – 12).

U literaturi su različiti podatci o dimenzijama zuba kod pacijenata s hipodoncijom. Chung i suradnici (13) istaknuli su da nema povezanosti između hipodoncije i smanjenja dimenzije zuba. Yamada i njegovi kolege (14) zaključuju da su pacijentima s blago izraženom hipodoncijom preostali zubi općenito veći od onih u kontrolnoj skupini, osim kada nedostaju tri ili više zuba. Kod takvih slučajeva uočeno je značajno smanjenje veličine zuba u usporedbi s kontrolnom skupinom. Wisth i suradnici (15) nisu pronašli razliku kod pacijenata s hipodoncijom u usporedbi s onima iz kontrolne skupine.

Svrha istraživanja bila je usporediti meziodistalne (MD) i bukolingvalne (BL) dimenzije zuba pacijenata s hipodoncijom s onima u kontrolnoj skupini koji imaju sve zube. Nulla hipoteza bila je da nema razlike u dimenziji zuba između pacijenata s hipodoncijom i onih iz kontrolne skupine.

## Materijal i metoda

### Pacijenti

Uzorak je odabran iz arhiva Zavoda za ortodontiju Stomatološke klinike Kliničkoga bolničkog centra Zagreb. Odobrenje za istraživanje dalo je Etičko povjerenstvo Stomatološkog fakulteta Sveučilišta u Zagrebu. Jedan istraživač pregledao je više od tisuću kartona pacijenata. Hipodoncija je dijagnostificirana radiološkim i kliničkim pregledom. Uzorak se sastojao od 76 pacijenata s hipodoncijom (50 žena i 26 muškaraca) u dobi između 11 i 18 godina (prosječna dob  $13 \pm 2,35$  godina). U kontrolnoj skupini bilo je također 50 žena i 26 muškaraca iste dobi kao u ispitivanoj skupini (prosječna dob  $12,54 \pm 1,95$  godina). Kriteriji za odabir ispitanika u obje skupine bili su erupcija svih zuba osim trećih molara, studijski modeli i ortopantomogram prije početka terapije. Pacijenti kojima su ekstrahirani trajni zubi, ako su bili na ortodontskoj terapiji, oni s karijesima, aproksimalnim restauracijama ili ektopičnim nicanjem zuba, bili su isključeni.

### Mjerenja i dimenzije zuba

Meziodistalne (MD) i bukolingvalne (BL) dimenzije mjerene su na studijskim modelima pomičnom mjerkom (Levi S.R.O., Kokory 381-CZ) s preciznošću od 0,01 milimetar. MD dimenzija svakog zuba mjerena je prema metodi koju je opisao Moorrees sa suradnicima (16) – od mezijalne kontaktne točke do distalne kontaktne točke na njegovoj najvećoj interproksimalnoj udaljenosti. BL dimenzija mjerena je na najvećoj udaljenosti između vestibularne i oralne površine zuba okomite na meziodistalnu dimenziju. Sva je mjerenja obavio dva puta isti istraživač pod dnevnim svjetlom (A.V.) i to najviše sedam na dan kako bi se izbjegao umor očiju i minimalizirala mogućnost subjektivne pogreške.

active interventions. Tooth dimension plays a key role in decision-making about space management in the edentulous area or in managing functional occlusion. The prevalence of hypodontia in the deciduous dentition ranges from 0.1% to 0.9, whereas the prevalence of hypodontia in the permanent dentition ranges from 2.3% to 11.3% (9-12).

In the literature, the reports regarding tooth dimensions in hypodontia patients are controversial. Chung et al. (13) reported no associations between hypodontia and reduction in tooth dimensions. Yamada et al. (14) concluded that the remaining teeth were generally larger in patients with mild hypodontia, than those in the control group, except in cases when three or more teeth were missing. A significant reduction in tooth size was observed in the remaining dentition compared to the control group. Wisth et al. (15) found no difference in patients with hypodontia compared to the control group.

The aim of this study was to compare mesiodistal (MD) and buccolingual (BL) tooth sizes in hypodontia patients with a control group with complete dentition. The null hypothesis was that there was no difference in tooth sizes between hypodontia patients and the controls.

## Material and methods

### Patients

The sample was chosen from archives of Department of Orthodontics, Dental Clinic, Clinical Hospital Center Zagreb. The approval for this study was obtained by the Ethics Committee, School of Dental Medicine, University of Zagreb. More than a thousand of patient files were reviewed by the same examiner. Hypodontia was diagnosed by radiological and clinical examinations. The sample comprised 76 patients with hypodontia (50 female and 26 male) aged between 11 and 18 years (mean age  $13 \pm 2.35$  years). The control group comprised 50 females and 26 males with the same age range as the study group (mean age  $12.54 \pm 1.95$  years). The inclusion criteria for both study groups consisted of full eruption of all teeth except third molars, having dental casts and pretreatment panoramic radiographs. The patients with history of permanent tooth extraction or previous orthodontic treatment and those with caries, interproximal restorations and ectopic tooth eruption were excluded from the study.

### Measurement and dental dimensions

Mesiodistal (MD) and buccolingual (BL) dimensions were measured on pretreatment dental casts with a digital caliper (Levi S.R.O., Kokory 381-CZ) to the nearest 0.01 mm. The MD dimension of each tooth was measured according to the method described by Moorrees et al. (16), from its mesial contact point to its distal contact point at its greatest interproximal distance. The BL dimension was measured as the greatest distance between vestibular and oral teeth surface perpendicular to the mesiodistal dimension. All the measurements, taken under natural light, were performed twice by the same operator (A.V.) who did not exceed the number of seven casts per day in order to avoid eye strain and to minimize the possibility of subjective error.

## Analiza podataka

Podatci su analizirani programom Statistica 7,1 (StatSoft Inc.) i statističkim paketom (deskriptivna statistika, test normalnosti distribucije, parametrijska statistika). Test normalnosti distribucije obavljen je jednosmjernim Kolmogorov-Smirnovljevim testom. Rezultati pokazuju da su ispitivane varijable normalno distribuirane ( $p > 0,01$ ) te je posljedično korišten parametrijski test (t test).

## Rezultati

U tablici 1. prikazana je distribucija ageneze prema tipu zuba kod ispitanika s hipodoncijom. Zubi koji najčešće kongenitalno nedostaju jesu drugi donji premolari (lijevi 13,45 % i desni 13,90 %) i gornji lateralni incizivi (lijevi i desni 12,6 %) te drugi gornji premolari (desni 9,40 % i lijevi 10,31 %).

Paired-sample t-test korišten je za usporedbu srednjih vrijednosti istih dimenzija mjerenih na lijevoj i desnoj strani svakoga zubnog luka. Budući da nije pronađena značajnija statistička razlika ( $p < 0,05$ ), za daljnju analizu korišten je prosjek rezultata.

U tablici 2. prikazane su razlike meziodistalnih i bukolingvalnih dimenzija zuba pacijenata s hipodoncijom u odnosu na one u kontrolnoj skupini. Razlika u veličini zuba između pacijenata s hipodoncijom u odnosu na one u kontrolnoj skupini pronađena je u MD dimenziji za 4,02 posto i u BL dimenziji za 3,85 posto. Najveća razlika bila je kod gornjih lateralnih inciziva – 8,08 posto u MD dimenziji i 6,40 posto u BL dimenziji. Najmanja razlika pronađena je u BL dimenziji kod donjih lateralnih inciziva (2,37 %), u MD dimenziji kod drugih donjih premolara i prvih gornjih molara (2,61 %) te u MD dimenziji kod donjih središnjih inciziva (2,26 %).

## Data analysis

The data were analyzed using Statistica 7.1 (StatSoft Inc.) statistical package (descriptive statistics, test of distribution normality, parametric statistics). A test of distribution normality was performed by means of the (one way/unidirectional) Kolmogorov-Smirnov test. The results showed that the tested variables were normally distributed ( $p > 0.01$ ) and consequently parametric tests were used (t test).

## Results

The distribution of agenesis by tooth type in hypodontia group is presented in Table 1. The most commonly congenitally missing teeth were the lower second premolars (left 13.45% and right 13.90%) and upper lateral incisors (both left and right 12.56%), followed by the upper second premolars (right 9.40% and left 10.31%).

The paired-sample t-test was used to compare the mean values of the same dimension measured on the left and the right side of each dental arch. Since no statistically significant difference was found ( $p < 0.05$ ), the results were averaged for further analysis.

The differences of mesiodistal and buccolingual dimensions for hypodontia patients and the control group are presented in Table 2. The average differences in tooth size between hypodontia patients and the control group were found in MD dimension (4.02%) and in BL dimension (3.85%). The greatest differences were found in the upper lateral incisors. They amounted to 8.08% in MD and 6.40% in BL dimension. The smallest difference was found in BL dimension of the lower lateral incisor (2.37%), MD dimension of the lower second premolars and the upper first molar (2.61%) and MD dimension of the lower central incisor (2.26%).

**Tablica 1.** Distribucija hipodoncije po tipu zuba kod eksperimentalne skupine.

**Table 1** The distribution of hypodontia in experimental group.

Zub • Tooth	Br. • No.	%
15	21	9.40
25	23	10.31
35	30	13.45
45	31	13.90
12	28	12.56
22	28	12.56
46	1	0.45
47	5	2.24
27	6	2.69
31	13	5.83
41	18	8.07
17	4	1.79
37	5	2.24
13	1	0.45
33	1	0.45
43	1	0.45
24	4	1.79
14	3	1.35
Total	223	100

**Tablica 2.** Razlike u meziodistalnim i bukolingvalnim dimenzijama (mm) kod ispitanika s hipodoncijom i onih u kontrolnoj skupini (t test)  
**Table 2** The differences of mesiodistal and buccolingual dimensions (mm) for hypodontia and control groups (t test).

Zub • Tooth	Hipodoncija • Hypodontia group		Kontrolna skupina • Control group		t-test	p	Razlika • Difference (%)
	Srednja vrijednost • Mean	Sd	Srednja vrijednost • Mean	Sd			
<b>Meziodistalna dimenzija • Mesiodistal dimension</b>							
17.27	9.83	0.52	10.2	0.59	-3.07	0.003*	3.79
16.26	10.21	0.74	10.48	0.45	-2.67	0.008	2.61
15.25	6.53	0.43	6.73	0.38	-2.84	0.005*	3.15
14.24	6.77	0.49	7.02	0.39	-3.45	0.001*	3.76
13.23	7.36	0.50	7.67	0.43	-3.98	0.0001*	4.20
12.22	6.31	0.79	6.82	0.58	-4.06	0.0001*	8.08
11.21	8.31	0.62	8.65	0.55	-3.59	0.0004*	4.10
37.47	10.33	0.54	10.45	0.63	-0.87	0.385	1.16
36.46	10.61	0.71	11.01	0.53	-3.83	0.0002*	3.73
35.45	6.99	0.47	7.18	0.45	-2.11	0.037	2.61
34.44	6.91	0.41	7.13	0.44	-3.16	0.002*	3.23
33.43	6.44	0.44	6.67	0.39	-3.33	0.001*	3.58
32.42	5.58	0.44	5.86	0.43	-3.96	0.0001*	5.01
31.41	5.17	0.38	5.40	0.36	-3.50	0.001*	4.39
<b>Bukolingvalna dimenzija • Buccolingual dimension</b>							
17.27	10.79	0.84	11.11	0.77	-2.10	0.038	2.99
16.26	10.99	0.71	11.34	0.59	-3.26	0.001*	3.16
15.25	9.03	0.60	9.31	0.55	-2.74	0.007*	3.14
14.24	8.87	0.63	9.20	0.51	-3.53	0.001*	3.77
13.23	7.37	0.66	7.73	0.62	-3.18	0.002*	4.86
12.22	5.84	0.75	6.21	0.61	-2.89	0.005*	6.40
11.21	6.75	0.59	7.12	0.55	-3.81	0.0002*	5.41
37.47	10.15	0.64	10.27	0.50	-1.08	0.284	1.16
36.46	10.31	0.61	10.64	0.47	-3.73	0.0002*	3.19
35.45	8.20	0.67	8.51	0.51	-2.87	0.005*	3.81
34.44	7.59	0.62	7.83	0.53	-2.56	0.012	3.22
33.43	6.62	0.68	6.88	0.68	-2.26	0.025	3.86
32.42	5.89	0.43	6.03	0.47	-1.88	0.062	2.37
31.41	5.66	0.54	5.79	0.41	-1.57	0.118	2.26

\* (p<0.05)

## Rasprava

Prema stajalištu nekih autora (4, 17, 18), pacijenti kojima kongenitalno nedostaju zubi imaju manje zube u MD i BL dimenziji od onih u kontrolnoj skupini, što je također potvrđeno u našem istraživanju. Suprotno tomu, Wisth i suradnici (15) nisu pronašli statistički značajnu razliku u MD promjeru zuba između skupine s hipodoncijom i kontrolne skupine, što se slaže s istraživanjima Chunga i suradnika (13) koji zaključuju da hipodoncija nije povezana sa smanjenom veličinom zuba.

U ovom istraživanju postotak smanjenja dimenzije zuba kod pacijenata s hipodoncijom bio je 4,02 posto za MD dimenziju i 3,85 posto za BL. Najveća razlika pronađena je za MD dimenziju (8,08 %) i BL dimenziju (6,40 %) gornjega lateralnog inciziva. Razlika od 2,61 posto za MD i 3,81 posto za BL dimenziju pronađena je za drugi donji premolar. Brook i suradnici (17) pronašli su veću razliku kod muških ispitanika s hipodoncijom u BL dimenziji u prednjem zubnom segmentu te u MD dimenziji u stražnjem zubnom segmentu.

## Discussion

Several authors (4, 17, 18) have reported that patients with congenitally missing teeth had smaller teeth in MD and BL dimensions than subjects in the control group, which was also confirmed in our study. In contrast to the above mentioned authors, Wisth et al. (15) found no statistical difference in the MD diameter of the teeth between the hypodontia group and the healthy controls, which is in concordance with Chung et al. (13) who concluded that hypodontia was not associated with reduced tooth size.

In this study, the percentage of reduction in the tooth dimensions of hypodontia group was 4.02% in MD and 3.85% in BL dimension. The greatest difference was found in MD (8.08%) and BL (6.40%) dimensions of the upper lateral incisor. The difference of 2.61% in MD, and 3.81% in BL dimension was found for the lower second premolar. Brook et al. (17) reported that male hypodontia patients showed greater difference in BL dimension in anterior segment and in MD dimension in posterior segment of dental arch. Gun-

Gungor i suradnici (19) pronašli su smanjenu MD i BL dimenziju zuba kod pacijenata s jače izraženom hipodoncijom (nedostatak šest ili više zuba), negoli kod onih s manje izraženom (bez dva do pet zuba), a najveća razlika bila je u MD dimenziji zuba u objema skupinama s hipodoncijom kod gornjih i donjih lateralnih inciziva i drugih premolara.

Raspon dobi naših ispitanika (hipodoncija i kontrolna skupina) bio je od 12 do 18 godina. Tako mladi ljudi odabrani su zato da bi smanjio utjecaj atricije, ispuna ili karijesa na MD dimenzije zuba, što se poklapa s istraživanjem Dorisa i suradnika (20). Posljedično je učinak tih čimbenika na stvarnu MD širinu zuba bio minimalan.

U ovom istraživanju statistički značajne razlike u dimenziji zuba između pacijenata s hipodoncijom i onih u kontrolnoj skupini pronađene su na onim zubima koji su najčešće zahvaćeni hipodoncijom, no najveća razlika bila je kod gornjih lateralnih inciziva. Ramazanzadeh i suradnici (21) istaknuli su da je razlika u širini zubi između dviju skupina ispitanika bila vidljivija za prve i druge premolare te molare, negoli u prednjim segmentima. Brook i suradnici (18) navode najveću razliku za donje središnje i gornje lateralne incizive u MD dimenziji te za donje središnje incizive u BL dimenziji. Rezultati ovog istraživanja upućuju na to da je mjerenje zuba itekako važno kad je riječ o pacijentima s hipodoncijom. Kliničke istraživanja potvrđuju da različitost u morfologiji zuba nije samo u veličini, nego i u obliku, što svakako treba uzeti u obzir pri planiranju terapije kako bi se postigla što bolja estetika i funkcionalna okluzija na kraju ortodontske terapije.

## Zaključak

Zubi koji najčešće kongenitalno nedostaju su drugi donji premolari (lijevi 13,45 % i desni 13,90 %) te gornji lateralni incizivi (lijevi i desni 12,56 %), zatim drugi gornji premolari (desni 9,40 % i lijevi 10,31 %)

Ispitanicima s hipodoncijom zubi su manji od onih u kontrolnoj skupini i to prosječno za 4,02 posto u MD dimenziji i 3,85 posto u BL dimenziji. Najveću razliku pokazuju gornji lateralni incizivi.

## Sukob interesa

Autori nisu bili u sukobu interesa.

gor et al. (19) found smaller MD and BL tooth dimensions in patients with severe hypodontia (six or more missing teeth) than those with mild hypodontia (two to five missing teeth), and the greatest difference was found to be MD dimension in maxillary and mandibular lateral incisors and second premolars in both hypodontia groups.

The age range of our subjects (hypodontia and controls) was 12 to 18 years. This young age group was chosen in accordance with the study of Doris et al. (20) to minimize the alteration of mesiodistal tooth dimensions due to attrition, restoration or caries. Consequently, these factors had a minimal effect on the actual MD tooth widths.

In this study, statistically significant differences in tooth sizes between hypodontia and control group were found in the teeth that are most commonly affected by hypodontia. However, the greatest difference was found for the upper lateral incisors. Ramazanzadeh et al. (21) found that the difference in tooth width between the two groups was more evident in the first and second premolars. Also, this difference was more evident in the first molars than in anterior segments. Brook et al. (18) found the greatest difference in the mandibular central incisor and maxillary lateral incisor in MD dimension and the mandibular central incisor in the BL dimension.

The results of our study point to the importance of dental measurements which should be performed for patients with hypodontia. Clinical observations have confirmed the fact that variation in tooth morphology is not only in size, but also in shape, which should be taken into consideration in orthodontic treatment planning in order to produce an occlusion that is functionally efficient, esthetic, and healthy.

## Conclusions

The most commonly congenitally missing teeth in this study were the lower second premolars (left 13.45% and right 13.90%) and the upper lateral incisors (both left and right 12.56%), followed by the upper second premolars (right 9.40% and left 10.31%)

The dimensions of teeth in hypodontia groups were smaller than those in control subjects. Measurements showed that average sizes were 4.02% in mesiodistal dimension and 3.85% in buccolingual dimension. The maxillary lateral incisor showed the greatest variation in size.

## Conflict of Interest

None declared

**Abstract**

**Objective:** This study compared mesiodistal (MD) and buccolingual (BL) tooth dimensions of hypodontia patients with a control group with complete dentition. The null hypothesis was that there was no difference in tooth sizes between hypodontia patients and the controls. **Methods:** The sample comprised 76 patients with hypodontia (50 female and 26 male) aged between 11 and 18 years. The control group comprised 50 females and 26 males with the same age range as the study group. Mesiodistal (MD) and buccolingual (BL) dimensions were measured on pretreatment dental casts with a digital caliper to the nearest 0.01 mm. The data were analyzed using Statistica 7.1 (StatSoft Inc.) statistical package (descriptive statistics, test of distribution normality, parametric statistics). **Results:** The most common congenitally missing teeth were the lower second premolars (left 13.45% and right 13.90%) and upper lateral incisors (both left and right 12.56%), followed by upper second premolars (right 9.40% and left 10.31%). The greatest differences between the study and control group were found in upper lateral incisors, 8.08% in MD and 6.40% in BL dimension. The smallest difference was found in BL dimension of lower lateral incisor (2.37%), MD dimension of lower second premolars and upper first molar (2.61%) and MD dimension of lower central incisor (2.26%). **Conclusion:** The teeth are smaller in subjects with hypodontia than those of the controls on average 4.02% in MD dimension and 3.85% in BL dimension. The tooth that showed the greatest difference in tooth dimension was maxillary lateral incisor.

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**Key words**

Anodontia; Dentition; Congenital Abnormalities; Tooth

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