Prevalence and Pattern of Hypodontia among Croatian Orthodontic Patients

Učestalost i obrazac hipodoncije kod ortodontskih pacijenata u Hrvatskoj

Introduction

Hypodontia is a congenital absence of one or more permanent teeth, excluding third molars (1). It represents the most common developmental anomaly of the human dentition (2). The prevalence of hypodontia in permanent dentition varies among different ethnic groups, by gender and geographical location, and ranges from 1.6% to 36.5% (3). The prevalence of hypodontia in Europe is 4.6% for males and 6.3% for females, while in Australia it is 5.5% for males and 7.6% for females (4). In North America, the prevalence among the Caucasians is lower than in Europe and Australia, with 3.2% for males and 4.6% for females (4). Regarding the gender, hypodontia affects women more often than men, precisely 1.37 times more (4). The teeth most affected with hypodontia are as follows: lower second premolar, upper lateral incisor and upper second premolar. Bilateral hypodontia is more common only when the upper lateral incisor is missing.

Uvod

Hipodoncija je kongenitalni nedostatak jednoga ili više zuba, isključujući umnjake (1). Jedna je od najčešćih anomalija u razvoju ljudske dentitije (2). Učestalost hipodoncije u trajnoj dentitiji varira među različitim etničkim skupinama, prema spolovima i zemljopisnim položajima, te se kreće u rasponu od 1,6 % do 36,5 % (3). Prevalencija hipodoncije u Europi iznosi 4,6 % za muški i 6,3 % za ženski spol, a u Australiji 5,5 % iznosi za muškarce i 7,6 % za žene (4). U Sjevernoj Americi među pripadnicima bijele rase učestalost je manja u odnosu prema Europi i Australiji te iznosi 3,2 % za muški i 4,6 % za ženski spol (4). S obzirom na spol hipodoncija češće pogađa žene, točnije 1,37 puta više negoli muškarce (4). Zubi koji najčešće nedostaju jesu redom: donji drugi pretkutnjak, gornji lateralni sjekutić i gornji drugi pretkutnjak. Obostrana hipodoncija češća je samo u slučaju nedostatka gornjega lateralnog sjekutića, a u slučajevima nedostatka
whereas in cases where other types of teeth are missing, unilateral hypodontia is more common (4). The absence of one or two teeth is present in 83% of subjects with hypodontia (4). There is no statistically significant difference between the prevalence of hypodontia in the maxilla and mandible (4).

The aim of this retrospective study was to assess the prevalence of hypodontia in the permanent dentition among Croatian orthodontic patients. The occurrence was evaluated concerning gender, specific missing teeth, the location and pattern of distribution in the maxillary and mandibular arches and in the sagittal and vertical skeletal pattern.

Material and Methods

The sample was gained from the patients’ database of the Department of Orthodontics, Dental Clinic, Clinical Hospital Center Zagreb. It consisted of 194 subjects (75 males and 119 females) between the ages of 10 and 18. After clinical examination, hypodontia was further confirmed by analyzing patients’ radiographic images.

Based on the severity of hypodontia, the sample was divided into mild (1-2 missing teeth), moderate (3-5 missing teeth) and severe groups (6 or more missing teeth). The location of missing teeth was used to further divide the sample into anterior (intercanine region), posterior (premolars and molars) and anteroposterior groups. Also, it was considered which jaw was affected.

The inclusion criteria for this study were permanent dentition hypodontia and Croatian ethnicity, while exclusion criteria were craniofacial syndromes, cleft lip and/or palate, history of teeth trauma and previous orthodontic treatment.

A customized cephalometric analysis was performed by DOLPHIN IMAGE software (v.11.5) on lateral cephalograms that were taken as a part of a standard procedure prior to treatment. To determine the sagittal relationships, ANB angle was observed. The values of 2.5 ± 2 were defined as a skeletal Class I, > 4.5 as Class II and < 0.5 as Class III. Vertical relationships were estimated using the Jarabak’s ratio of posterior and anterior facial height (S-Go : N-Ne), with a standard value of 65.5% ± 3.5%. The subjects with a ratio of less than 62% were classified as having a vertical growth pattern and those with a ratio of more than 69% were classified as having a horizontal growth pattern.

The Chi square test with Cramer V for effect size were used for comparison of categories. The Mann-Whitney test for comparison of number of teeth between sexes was applied, while the Rosenthal formula r = Z/N was used to calculate the effect size. Data were analysed in SPSS 16.0 software (SPSS Inc., Chicago, USA).

The Ethics Committee of the Zagreb School of Dental Medicine approved this study. An informed consent forms authorizing the use of patients radiograms were signed by each patient or their parent, if they were under 18.

Ispitanici i postupci

Uzorak je izdvojen iz baze podataka pacijenata Zavoda za ortodontiju Klinike za stomatologiju Kliničkog centra Zagreb. Sastoje se od 194 ispitanika (75 muškog i 119 ženskog spola), u dobi od 10 do 18 godina. Nakon kliničkoga pregleda, hipodoncija je potvrđena analizom rentgenskih snimki pacijenata.

Prema opsežnosti hipodoncije ispitanici su podijeljeni u skupine s blagom (nedostatak 1–2 zuba), umjerenom (nedostatak 3–5 zuba) te ozbiljnom hipodoncijom (nedostatak 6 ili više zuba). Prema lokalizaciji hipodoncije u segmentima čeljusti, ispitanici su podijeljeni u skupine s anteriornom (intekanina regija), posteriornom (regija premolara i molara) i antero-posteriornom hipodoncijom (kombinacija prvih dviju skupina). U obzir je također uzeta lokalizacija hipodoncije po čeljustima.

Uključujući kriteriji za izbor ispitanika bili su hipodoncija u trajnoj dentici te hrvatska populacija, a isključujući kriteriji bili su kraniofazijalni sindromi, rascjep usne i/ili nepca, prijašnja trauma zuba i prijašnja ortodontska terapija.

Na laterolaterálnim kranigramima, snimljena kao dio standardnog postupka prije početka ortodontske terapije, za svakoga ispitanika učinjena je kefalometrijska analiza s pomoću programske podrške DOLPHIN IMAGE (v.11.5). Za određivanje sagitalnih međučeljusnih odnosa korišten je ANB kut. Vrijednosti od 2,5° ± 2 definirane su kao skeletna klasa I, one veće od 4,5° klasa II, te manje od 0,5° kao klasa III. Vertikalni međučeljusni odnosi procijenjeni su s pomoću Jarabakova omjera stražnje i prednje visine lica (S-Go : N-Ne), standardne vrijednosti 65,5% ± 3,5%. Ispitanici s omjerom manjim od 62 % svrstani su u kategoriju vertikalnog obrasca rasta, a oni s omjerom većim od 69 % uvršteni su u kategoriju horizontalnog obrasca rasta.

Statistička analiza učinjena je u komercijalnom programu SPSS 16.0 (SPSS Inc., Chicago, SAD). Za usporedbu kategorijalnih varijabli korišten je χ²-test, a za procjenu snage efekta Cramerov V. Za usporedbu broja zuba medu spolovima korišten je Mann-Whitneyjev test, a snaga efekta izračunata je Rosenthalovom formulom $r = Z/\sqrt{N}$.

Istraživanje je odobrilo Etičko povjerenstvo Stomatološkoga fakulteta Sveučilišta u Zagrebu. Svaki pacijent, odnosno roditelj u slučaju maloljetnosti pacijenta, potpisao je informirani pristanak kojim se odobrava uporaba pacijentovih RTG-snimki.
Rezultati

Hipodoncija je bila zastupljenija u ispitanici (61,3%) u odnosu prema ispitnicima (38,7%).

Broj zuba koji nedostaju kretao se u rasponu od 1 do 12 po osobi (medijan 2, interkvartilni raspon 1 – 2) i nije se razlikovao među spolovima (p = 0,590; slika 1.). Hipodoncija je uglavnom bila blaga (80%), podjednako zastupljena u maksili (39%) i mandibuli (41%), te u prednjim i stražnjim segmentima celju (44%).

Opsežnost i lokalizacija hipodoncije nisu se značajno razlikovale među spolovima (p ≥ 0,106; slike 2 – 4).

Opsežnost i lokalizacija hipodoncije također se nisu statistički značajno razlikovale između kategorija obrazaca rotacijskog rasta lica, ni između skeletnih klasa (p ≥ 0,105; slike 5 – 10).

Rasprava

Različitosti između studija srodne tematike, s obzirom na uzorkovanje, raspon dobi i zastupljenost prema spolovima, otežavaju njihovu usporedbu (2). Velik doprinos za utvrđivanje učestalosti i raspodijeljenosti hipodoncije u ljudskoj populaciji možemo zahvaliti metaanalizama na koje se referi- ra većina autora. Najbolji primjeri su studije koje su objavili Polder i suradnici 2004. (4) te Khalaf i suradnici 2014. godine (2). U ovoj posljednjoj autori znose zaključak o većoj uče- stalosti hipodoncije nego što se to prije tvrdilo, što bi moglo biti rezultat korištenja kvalitetnijih dijagnostičkih metoda, te većeg broja dostupnih studija o toj temi. U ovom istraživanju hipodoncija je bila uglavnom blaga (80 %), što znači da su većini ispitanika nedostajali jedan do dva zuba. Jednako zaključuju i istraživači u još nekim studijama (5 – 7).

Opsežnost i lokalizacija nisu se značajno razlikovale među spolovima, kako je utvrđeno i prije (7, 10, 13, 17, 32, 33). Za korelaciju između broja zuba zahvaćenih hipodoncijom i spola, u literaturi se pronalazi mnogo više dokaza da su žene sklonije ozbiljnoj hipodonciji od muškaraca (13, 14, 16, 34 – 37).

Rezultati studija vezani uz predominaciju čeljusti zahvaćene hipodoncijom nisu konzistentni (8). Prema nekim autorima, čini se da ne postoji statistički značajna razlika u uče- stalosti hipodoncije u čeljustima (4, 5, 9, 30), a to je potvrđeno i u ovom istraživanju. U mnogo dosadašnjih studija istraživači zaključuju da je maksila češće zahvaćena hipodoncijom od mandibule (6, 7, 10 – 14, 31). No, postoji skupina autora koji su pronašli veću stopu hipodoncije u mandibuli (15 – 21).

Samo u nekoliko studija autori su proučavali raspodijeljenost hipodoncije u prednjim i stražnjim segmentima zubnih lukova (10, 13, 22). U nekim je utvrđena veća učestalost u prednjem segmentu (10, 13, 23), a u drugima je uočeno da zahvaćenost stražnjeg segmenta raste s povećanjem broja zuba koji nedostaju (5, 22). Ovo istraživanje je pokazalo da je hipodoncija jednako zastupljena u oba segmenta.

Nije pronađena statistički značajna razlika između kategorija obrazaca rotacijskog rasta lica, ni između skeletnih klasa s obzirom na opsežnost i lokalizaciju hipodoncije. Ozbiljna

Results

Females (61.3%) were more affected with hypodontia than males (38.7%).

The number of missing teeth per person ranged from 1 to 12 (median 2, interquartile range 1–2) and did not differ between the genders (p=0.590; Figure 1).

Hypodontia was found to be generally mild (80%), localized equally in the maxilla (39%) and the mandible (41%) and in both the anterior and posterior segments of dental arch (44%).

The severity and location of hypodontia did not differ significantly between the genders (p=0.106; Figures 2–4).

The severity and location of hypodontia also did not differ between the categories of facial rotation patterns or between skeletal classes (p=0.105; Figures 5-10) in a statistically significant manner.

Discussion

The differences between studies about hypodontia, regarding sampling, age range and gender, make their comparison difficult (2). For defining the incidence and distribution of hypodontia in the human population, meta-analyses have a great importance and majority of the authors are referring to them. The best examples are studies published by Polder et al. in 2004. (4) and by Khalaf et al. in 2014. (2). The latter reported of a higher prevalence of hypodontia than stated before, which might be a result of using better diagnostics and having a greater number of prevalence studies.

In the present study, hypodontia was found to be generally mild (80%), meaning that most of the subjects were missing one or two teeth. Similar findings were reported in some other studies (5-7).

The severity and location of hypodontia did not differ significantly between the genders, which was also found in previous studies (7, 10, 13, 17, 32, 33). When it comes to number of missing teeth and sexual dysmorphism, there is much more evidence that females are at greater risk of being affected with more severe hypodontia than males (13, 14, 16, 34-37).

The results as which arch is predominantly affected with hypodontia are not conclusive (8). According to some authors, there seems to be no significant difference between the prevalence of hypodontia in the maxilla and mandible (4, 5, 9, 30), which was also confirmed in our study. Many previous studies concluded that the maxilla was more frequently affected with hypodontia than mandible (6, 7, 10-14, 31). There is also a group of authors who had found a greater rate in the mandible (15-21).

Few studies have evaluated the distribution of hypodontia in the anterior and posterior segments of dental arch (10, 13, 22). Some authors reported that the anterior segment is more affected with hypodontia (10, 13, 23), while others noted that the posterior tooth agenesis increased with hypodontia severity (5, 22). Our findings suggest that hypodontia is equally localized in the anterior and posterior segments of dental arch.

No statistically significant difference was found between the categories of facial rotation patterns or between skeletal
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classes regarding the severity and location of hypodontia. Severe hypodontia, according to some studies, was associated with Class III malocclusion (24, 25). Hirukawa et al. (26) reported that hypodontia in the maxilla was commonly associated with Class III, while Class II was more common among subjects with hypodontia in the mandible.

It is assumed, that an anterior rotation of the mandible is attributed to a lack in occlusal support, arising from a large

Figure 1 Frequency histogram for number of persons by number of missing teeth
Slika 1. Histogram frekvencija za broj osoba prema broju zuba koji nedostaju
Figure 2 Severity of hypodontia
Slika 2. Opsežnost hipodoncije
Figure 3 Location of hypodontia in dental arch
Slika 3. Lokalizacija hipodoncije po segmentima čeljusti
Figure 4 Jaw localization of hypodontia
Slika 4. Lokalizacija hipodoncije prema lokalizaciji u čeljusti
Figure 5 Distribution of hypodontia by severity and skeletal class
Slika 5. Rasprostirjenost hipodoncije prema opsežnosti i skeletnim klasama
Figure 6 Distribution of hypodontia by location in dental arch and skeletal class
Slika 6. Rasprostirjenost hipodoncije prema antero-posteriornoj lokalizaciji i skeletnim klasama

Figure 1: Frequency histogram for number of persons by number of missing teeth
Figure 2: Severity of hypodontia
Figure 3: Location of hypodontia in dental arch
Figure 4: Jaw localization of hypodontia
Figure 5: Distribution of hypodontia by severity and skeletal class
Figure 6: Distribution of hypodontia by location in dental arch and skeletal class
number of agenetic teeth (27). A tendency towards horizontal growth pattern in subjects with posterior hypodontia was reported by Bauer et al. (28). Another study published by Kreczi et al. (29) reported that in subjects with hypodontia neither a vertical nor a horizontal growth pattern is dominant.

**Conclusion**

Permanent dentition hypodontia among Croatian orthodontic patients was found to be generally mild, localized equally in the anterior and posterior segments in both the maxilla and the mandible. The number of missing teeth per person ranged from 1 to 12, with no difference between genders.

The severity and location of hypodontia did not differ significantly between the genders, as well as in between the categories of vertical and sagittal skeletal growth pattern.

The obtained results suggest that the treatment plan for patients with hypodontia in permanent dentition should be individualized and adjusted for each case.

**Conflict of interest**

None declared

**Zaključak**

Hipodontija u trajnoj dentici među hrvatskim pacijentima uglavnom je blaga, jednako lokalizirana u prednjim i stražnjim segmentima maksile i mandibule. Broj zuba koji nedostaju kretao se u rasponu od 1 do 12 po osobi, bez razlika među spolovima.

Opsežnost i lokalizacija hipodontije nisu se značajno razlikovale među spolovima, ni među kategorijama sagitalnih i vertikalnih skeletnih obrazaca rasta.

Dobiveni rezultati pokazuju da pacijenti s hipodontijom u trajnoj dentici zahtijevaju individualizirani pristup pri izradi plana terapije.

**Sukob interesa**

Nije ga bilo.
Svrsena jejo hipodontija kod obiteljskih pacijenata u Republici Hrvatskoj. U brojnim istraživanjima se zahtijeva individualizirani pristup pri izradi plana terapije.

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