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EVALUATION OF THE DEGREE OF TEETH MINERALIZATION IN PATIENTS WITH TEETH AGENESIS (HYPODONTIA)

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Abstract

The main goal of this study is to determine the correlation between hypodontia and the mineralization of teeth and to prove the impact of hypodontia on delayed tooth development.
For the realization of our objectives, clinical and X-ray analysis was performed on 64 subjects, of which 6 subjects were with congenital absence of one or more teeth, and 58 subjects as a control group with complete dentition. Patients were aged (8-15) from both genders. The dental age (DA) and chronological age (CA) of the subjects were calculated by the Demirijan method. The mean difference between dental and chronological (DA – CA) age was analyzed by T-test and One Way ANOVA, and the correlation between (DA – CA) difference was analyzed by Spearman Correlation and Pearson Correlation. Tooth development in patients with hypodontia was delayed compared to patients without hypodontia. Male subjects with hypodontia had a greater delay in tooth development compared to female subjects, with an insignificant difference of $p > 0.05$. The prevalence of delayed tooth development in patients with hypodontia increases in proportion to increasing chronological age. Patients with hypodontia have delayed development of permanent teeth, compared with subjects without hypodontia of the same age and the same gender.

Keywords: Hypodontia, dental development, dental age, chronological age, Demirijan method, prevalence.

1. Introduction

The growth and development of teeth in humans it takes long period of time. Teeth, are very important for the development of alveolar processes, for maintaining space for the permanent teeth, and perform the function of mastication, speech and aesthetics. They change in two sequences, first as deciduous teeth and then as permanent teeth (Azza Husam Al-Ani et al., 2017).

Disorders in the early stages of tooth formation can cause developmental problems or congenital absence of one or more teeth. Hypodontia is the developmental absence of one or more teeth excluding the third molars. Hypodontia, has an impact not only on aesthetics, but also on morphological-functional features of the orofacial system (Aida Carolina Medina et al., 2016) With the exception of third molars, the prevalence of hypodontia varies from 1.6% to 6.9% (Khalaf K et al., 2014).

Depending on the number of missing teeth (excluding the third molar), congenital absence of teeth can be classified as: hypodontia (hypodontia) with absence of one or more teeth, oligodontia with absence of six or more teeth5 and anodontia complete absence of all teeth. Oligodontia and anodontia occur rarely, and most often occur within some syndrome.

Hypodontia is more common and is an orthodontic anomaly that can occur as part of anomalies present in craniofacial syndromes such as: ectodermal dysplasia, Down syndrome, or as an isolated non-syndromic condition. Factors for the etiology of hypodontia are multifactorial. In many studies the etiology of hypodontia is indicated because of a combination of genetic factors with the factors of environment such as: infectious diseases (rubeolla, syphilis), radiotherapy, chemotherapy, trauma.

In the scientific literature in several papers hypodontia is defined as deficiency and problem, and the results of various authors show a connection between hypodontia and delayed development of permanent teeth. Correlation data between hypodontia and delayed mineralization of permanent teeth have been recorded in several studies (Jelena Cavri' ca 2016).

In 1973, Demirjan and Goldstein introduced the most widely used method of analysis tooth development in children, where the stages of tooth formation with one root and more the roots divided them into eight stages, from stage A to stage H (Demirjian, A et al., 1973).

(S. Uslenghi et al., 2015) performed a radiographic examination of teeth in older children 3 to 15 years (66 girls and 69 boys) with hypodontia and found that the development of the teeth of these children is visibly delayed compared to the control group, which consisted of children of the same age, same sex, and same race without hypodontia. The results of their research also showed that the development of teeth in patients with hypodontia was significantly delayed compared to the corresponding teeth in children without hypodontia.

(Lee Sang Eon et al., 2011) examined Demirjan's stages through analysis of orthopantomographic recordings of 2706 Korean patients aged 1 to 20 years. The results of the examination showed that except for third molars, the development of permanent teeth in girls was more advanced compared to boys of the same age. On the prevalence of hypodontia concerning gender distribution.

Hypodontia in milk dentition is rare and is most often followed by an absence of appropriate permanent tooth substitutes. The teeth that are most often missing in milk dentition are lateral incisions in the maxilla and mandible.

(Santanu Mukhopadhyay et al., 2014) performed an analysis on hypodontia of deciduous teeth and their correlation with permanent teeth. The analysis of orthopantomogram recordings of 1680 patients at 5 years of age indicated that 6 patients with hypodontia on milk dentition (4 boys and 2 girls) had hypodontia on the same teeth and in permanent dentition.

2. Material and method

For the realization of the set goals, examinations were performed on 64 respondents, students with mixed dentition, aged 8-15, of both genders. The respondents in the sample are divided into four age groups: 8-9 years, 10- 11 years, 12-13 years, and 14-15 years. The survey was conducted in 2020, with the students from third, fifth, seventh, and ninth grade from the primary school "Naim Frasheri "in Tetovo.

Each patient underwent a clinical examination and was made orthopantomogram recording in PHI Polyclinic of Specialist Consulting Activity "Alba Orthodent" in Tetovo and supervised by the Clinic for Orthodontics, Faculty of Dentistry, UKIM, Skopje.

Criteria for inclusion in the study were: patients with mixed dentition, patients aged 8-15 years patients in good health, patients without syndromes (ectodermal dysplasia, Down syndrome, and cleft palate of the mouth and palate). Exclusion criteria were: Patients with malignant diseases, patients who have been treated with medication for a long time (with chronic diseases), patients with a history of tooth loss from trauma, patients who have been orthodontically treated, or are in the process of orthodontics treatment.

Radiographic analysis was performed on the sample that we divided into two groups: one is the study group (with hypodontia), and the other is the control group (without hypodontia).

To analyze whether the dental age (DA) matches the chronological age (CA) of patients using the Demirijan method. Demirijan made an orthopantomogram analysis of 1446 boys and 1482 girls aged 2-20 of French and Canadian origin. According to Demirijan et al11, the analysis is performed on the first seven teeth on the left side of the mandible, where eight stages of coronary development are used and the root of the teeth, which are marked with the letters A-H. The stages of tooth development are illustrated with diagrams and radiographs of incisions, canines, premolars, and molars. It corresponds to each developmental stage of each tooth's corresponding numerical value, and the cumulative values are presented in the table of Demirijan

where the results of dental development (DA) are based on values obtained from gender analysis and converted to total dental developmental level in dental age. To determine the exact difference between dental and chronological age (DA-CA) Sample T-test and One Way ANOVA are used. A positive value means no delay of the teeth, while a negative value tells us that there is stagnation in the group's dental development.

3. Statistical analysis

The survey data were processed in SPSS version 20, and they were shown in tabular and graphical form.
The analysis of the attributive (qualitative) series was done by determining the coefficient of relations, proportions, and rates, and they were shown as absolute and relative numbers. Numerical series were analyzed by central measures tendency (average, median, minimum values, maximum values, interactive rankings), as well as with dispersion measures (standard deviation, and standard error).
The Shapiro-Wilk W test was used to determine the correctness of the frequency distribution of the examined variables. Pearson Chi-square test for homogeneity was used to determine the association between certain attribute variables. A difference test was used to compare the proportions. Two or more independent variables with the correct distribution were compared, respectively with a T-test for an independent sample and One Way ANOVA.
The comparison of more independent variables involving the influence of the confounding factor was made with ACNOVA. Spearman Rank Order Correlation and Pearson Correlation were used for the determination of the relationship between numerical variables with irregular/distribution rules of frequencies. Two-sided analysis was used to determine the statistical significance level of $p < 0.05$.

4. Results

The sample of the study consisted of a sample of 64 patient. The sample of respondents was in accordance with the pre-set inclusion and exclusion criteria for the research. When selecting respondents for the sample was applied the method of simple random selection of students from third, fifth, seventh, and ninth grade.

Comparison of chronological and dental age in a whole sample by gender and age groups.

Analysis of the entire sample by gender indicated that in males and females, the average chronological age of respondents was consistent 12.04 ± 1.68 vs. 12.35 ± 1.69 and was higher compared to the average dental age which was 11.86 ± 1.64 vs. 12.26 ± 1.52.
For $p > 0.05$, the analysis did not indicate significant difference between the dental and chronological age of the subjects from male or female for consistent (Table 1).

Table 1. Comparison of chronological and dental age in the whole sample by gender and age groups

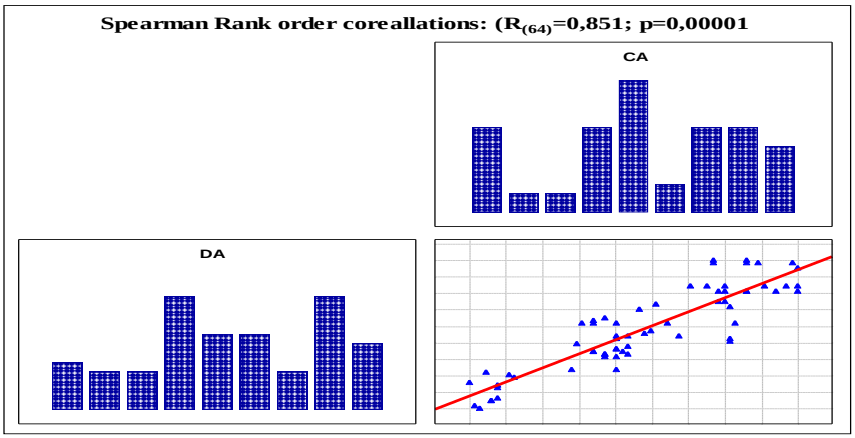
Age Groups	N	All Participants			[1]p
		DA $\overline{X}$ ± SD	CA $\overline{X}$ ± SD	DA - CA $\overline{X}$ ± SD	
Total (N=64)					
Boys	29	11,86±1,64	12,04±1,68	-0,17±0,69	t=0,413; df=56; p=0,6813
Girls	35	12,26±1,52	12,35±1,69	-0,10±0,81	t=0,234; df=68; p=0,8155
Boys(N=29)					
8 – 9 years	6	9,62±0,56	9,55±0,27	0,07±0,31	t=-0,276; df=10; p=0,7883
10 – 11 years	8	11,20±0,63	11,45±0,36	-0,25±0,71	t=0,975; df=14; p=0,3463
12 – 13 years	10	12,72±0,90	12,88±0,77	-0,16±0,90	t=0,398; fr=18; p=0,6957

14 - 15 years	5	13,92±0,58	14,28±0,41	-0,36±0,63	t=1,133; df=8; p=0,2899
Girls (N=35)					
8 – 9 years	5	9,80±0,45	9,44±0,21	0,36±0,58	t=-1,621; df=8; p=0,1437
10 - 11 years	13	11,58±0,50	11,56±0,20	0,02±0,64	t=-0,134; df=24; p=0,8946
12 – 13 years	10	13,10±0,95	13,31±0,45	-0,21±1,05	t=0,632; df=18; p=0,5355
14 - 15 years	7	14,06±0,51	14,54±0,37	-0,48±0,78	t=2,016; df=12; p=0,0668
[1]T-test for independent samples *significant p<0,05 DA – dental age; CA – chronological age;					

Correlation between chronological and dental age whole sample

Additionally for the whole sample, with nonparametric correlation was analyzed the relationship between dental and chronological age and was found the existence of a significant linear positive strong correlation. In respondents throughout the sample, with an increase of chronological age significantly increased and dental age. (Graphic 1).

Graph 1. Correlation of dental (DA) and chronological age (CA) in the whole sample

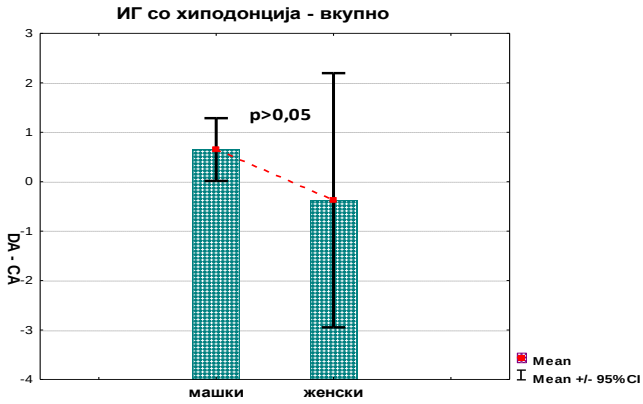


Comparison of CA and DA - examined group with hypodontia

The analysis of the examined group with hypodontia by gender indicated that in male subjects the average chronological age was higher than the average dental age and was consequently 12.55 ± 0.34 vs. 11.90 ± 0.28. In the female sex the mean chronological age was higher compared to the mean dental age for consequently 12.25 ± 2.58 vs. 11.87 ± 1.47. For p> 0.05, the analysis did not indicate significant difference between dental and chronological age in male respondents in female for consequent.

The mean difference between dental and chronological age (DA-CA) was higher in males (-0.65 ± 0.07) compared to females (-0.37 ± 1.61), but the same for p> 0.05 was not statistically significant (Graphic 2)

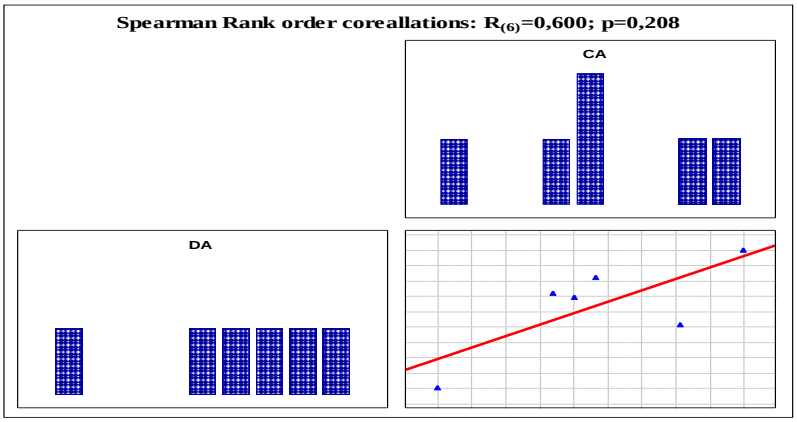
Graph 2. Comparison of mean DA-CA difference by gender total for IG with hypodontia



Association between CA and DA- group with hypodontia

In the hypodontics study group, despite the small sample, with nonparametric correlation was analyzed the relationship between dental and chronological age. A linear positive correlation was found between DA and CA. However, it was found that among respondents in this group, with increasing chronological age insignificant dental age also increased (Graph. 3).

Graph 3. Association of dental (DA) and chronological age (CA) in IG with hypodontia

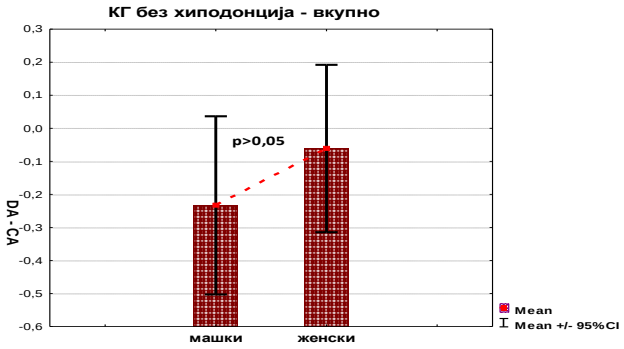


Comparison of CA and DA - control group without hypodontia

The analysis of the control group of respondents without hypodontia according to gender indicated that in male or female respondents the average chronological age was consequently 12.05 ± 1.45 vs. 12.37 ± 1.60 and was higher compared to the average dental age which was 11.81 ± 1.69 vs. 12.30 ± 1.

The average difference between dental and chronological age (DA-CA) in the male was larger and was (-0.23 ± 0.68), compared to the female where was (-0.06 ± 0.69), but it was not statistically significant for p> 0.05 (Graph 4).

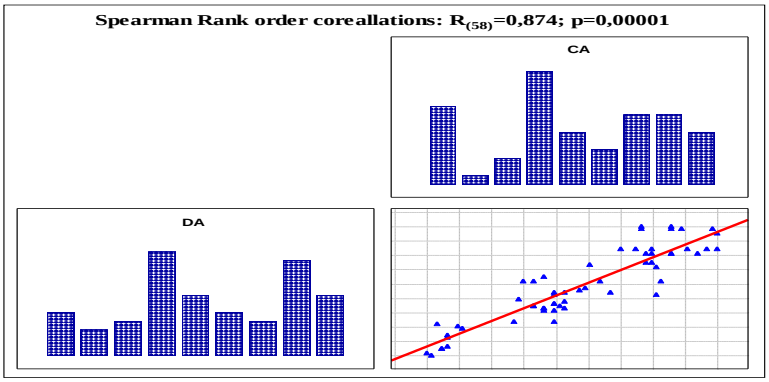
Graph 4. Comparison of the average DA-CA difference by age groups in total for KG without hypodontia



Correlation between CA and DA in a control group without hypodontia

Additionally for the control group without hypodontia, with non-parametric correlation the relationship between dental and chronological age was analyzed.
In the subjects in the control group, with an increase in chronological age significantly increased dental age (Graph5)

Graph 5. Relationship of dental (DA) and chronological age (CA) in KG without hypodontia



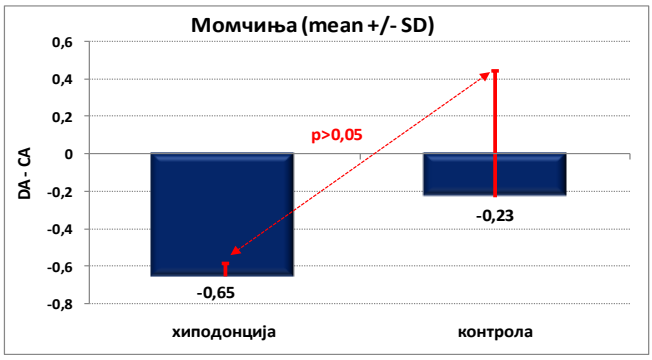
Comparison of the average difference between dental and chronological age of subjects with hypodontia and control group

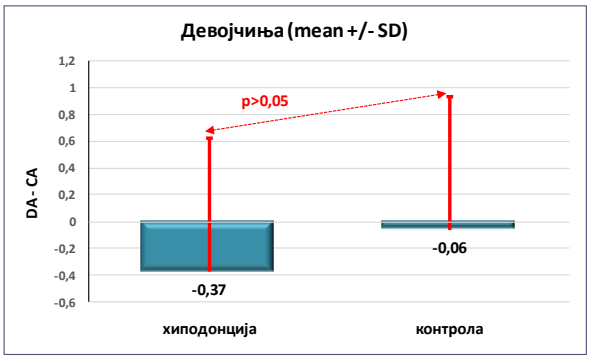
Additionally, the subjects were compared with/without hypodontia in the ratio of the mean difference between dental and chronological age (DA - CA). It was found that in male respondents with hypodontia, the average difference DA - CA was -0.65. 0.07, the dental delay was determined development. In comparison, among the respondents from the control group, it was registered almost three times milder slowing of dental development of -0.23 ± 0.68. For p> 0.05, the analysis did not indicate a significant difference between the two groups of male respondents concerning DA-CA

In female subjects with hypodontia, the average difference in DA - CA. was -0.37 ± 1.61, while in those of the control group it was -0.06 ± 0.69. The observed delay in dental development was greater in girls with

hypodontia compared with the control. However, for p> 0.05, the analysis did not indicate a significant difference between the two groups of female respondents concerning DA - CA (Graph 6).

Graph 6. Comparison of the average difference between dental and chronological age in respondents with/without hypodontia by gender





5. Discussion

Hypodontia, as an anomaly of the orofacial region, due to the severity of and the interdisciplinary approach is always a challenge for orthodontists, pedodontists, prosthetists, and surgeons.

Hypodontia is defined as the congenital absence of one or more teeth, which can occur in both deciduous and permanent teeth dentition. Missing teeth are those teeth that do not clinically erupt in the mouth of the patient, and the radiographs show no signs of follicle formation the tooth. The causes are usually disorders in the early stages of tooth formation.

From the results we obtained by comparing the average values of the dental and the chronological age between the group with hypodontia and without hypodontia we prove that tooth development in patients with congenital absence of teeth was delayed. Male subjects with hypodontia had greater delayed tooth development, compared with female respondents, with non-significant difference p> 0.05, whereas the prevalence of hypodontia was significantly higher in females. No association was observed between the magnitude of the number of missing teeth and the delayed tooth development in patients with hypodontia.

Similar results as in our study, but with significantly higher values of delayed tooth development were also found by (S. Uslenghi et al., 2005) who performed a radiographic examination of teeth in children aged 3 to 15 years (66 girls and 69 boys) with hypodontia and found that the tooth development of these children was visible delayed compared with the control group without hypodontia for 11.51 years, with significant difference p <0.001. The results of their research also showed that tooth development near the site of agenesis was significantly delayed compared with the corresponding teeth in children without hypodontia, most notably in women half.

When examining the most missing teeth, the descriptive analysis of our results indicated: the absence of a maximum of two teeth in only one (16.7%) of female respondents, while in the other five (83.3%) of the respondents only one tooth was missing. Absence of lateral maxillary incision, and we had a mandibular second premolar on the right in four (33.3%) of respondents and the absence of a mandibular second premolar on the left we had only in one (16.7%) of the male respondents. From this we prove that most often lateral maxillary incisions are missing (66.67%) followed by the latter mandibular premolars (50%).

The prevalence of hypodontia in relation to gender distribution shows statistically significant difference between males and females p <0.05. In our study, the prevalence between girls and boys was 1: 0.5 The prevalence of hypodontia was higher in females with (66.7%) compared with males with (33.3%). These our results matched the results of (Z Kırzıoğ˘ lu et al., 2005) and (Darko Pop Acev et al., 2014) who concluded that the prevalence of hypodontia is higher in female, compared to male.

The results obtained from our research, lead us to the conclusion that tooth development in patients with hypodontia was delayed by (-0.65 years) in males and (-0.37 years) in females, compared with patients without hypodontia. Male subjects with hypodontia had a greater delay in the development of teeth, compared to female subjects, with a non-significant difference $p > 0.05$. There is no association between the magnitude of the number of missing teeth and the delayed development of permanent teeth in patients with hypodontia.

6. Conclusion

The development of the teeth in male patients was delayed for (-0.65 years) and in female patients for (-0.37 years). Male patients with hypodontia have more delay in tooth formation compared with female patients with hypodontia. There is no association between the magnitude of the number of missing teeth and the delayed development of permanent teeth in patients with hypodontia. The prevalence of hypodontia was (9.4%) of the examined sample. The prevalence was bigger in female patients (66.7%) compared to male patients (33.3%). Hypodontia occurs unilaterally with a prevalence (of 83.3%) compared to bilateral hypodontia (16.7%). Most often are missing the lateral maxillary incisors (66.67%) followed by second mandibular premolars (50%). No correlation between hypodontia and other size irregularities of teeth was found.

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