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Comparison of Dental Age Using Demirjian's Method in Children with Cleft Lip, Alveolus and Palate with Non-Cleft Children

Porównanie wieku zębowego dzieci z rozszczepem wargi, wyrostka zębodołowego i podniebienia oraz dzieci zdrowych za pomocą metody Demirjiana

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Abstract

Background. Establishing children's maturity is one of the crucial diagnostic methods for orthodontic treatment. Dental and osseal age are important to aim the proper time for the functional treatment.

Material and Methods. The study was based on 120 dental panoramic radiograms of children with and without clefts (cleft lip and palate). The average age of the examined individuals was 9.4 years (± 2.1) for patients with clefts and 10.5 years (± 2.2) in a non-cleft group.

Results. Demirjian's method overstated the age in both of the examined groups. The least difference among the clefted patients can be noticed in BCLP female's group. The biggest differences between the Demirjian's value and chronological age have been noticed in a control group – 1.99 years for females and 2.13 years for males.

Conclusions. The difference between dental and chronological age in UCLP group was greater than in a BCLP group. Demirjian's method is inappropriate to establish the dental age of Polish children. New standards adequate for Polish population should be established (*Dent. Med. Probl.* 2011, 48, 3, 388–392).

Key words: dental age, cleft, Demirjian method.

Streszczenie

Wprowadzenie. Określenie dojrzałości dziecka jest jedną z ważniejszych metod diagnostycznych stosowanych w leczeniu ortodontycznym. Wiek zębowy i kostny są ważne, by uchwycić najbardziej odpowiedni czas do leczenia czynnościowego.

Materiał i metody. Badanie objęło 120 zdjęć pantomograficznych dzieci zdrowych i z rozszczepem (rozszczep wargi i podniebienia). Średni wiek badanych wynosił 9,4 roku ($\pm 2,1$) u pacjentów z rozszczepem i 10,5 roku ($\pm 2,2$) w grupie dzieci zdrowych.

Wyniki. Metoda Demirjiana zawyżała wiek zębowy w obu z badanych grup. Najmniejszą różnicę zaobserwowano u dziewcząt z rozszczepem obustronnym. Największą różnicę stwierdzono wśród dzieci zdrowych – 1,99 roku u dziewcząt i 2,13 roku u chłopców.

Wnioski. Różnica między wiekiem zębowym a chronologicznym była większa w grupie dzieci z rozszczepem jednostronnym niż w grupie z rozszczepem obustronnym. Metoda Demirjiana jest nieadekwatna do określenia wieku zębowego dzieci polskich. Powinno stworzyć się nowe standardy dla polskich dzieci (*Dent. Med. Probl.* 2011, 48, 3, 388–392).

Słowa kluczowe: wiek zębowy, rozszczep, metoda Demirjiana.

Dentists use many methods to determine patient's age. There are three main groups of age establishing: first one is based on skeletal esti-

mations (hand phalanges or cervical vertebrae), second – on tooth development and the third – on a chronological age (day of birth) [1]. A good un-

derstanding of tooth maturity is very important to every dentist who treats children. The maturity may affect the results of orthodontic treatment as well [2].

Demirjian dental maturity method is commonly used by orthodontics to estimate dental age of each patient. This system is based on establishing the maturation of 7 left mandibular teeth. It is divided into 9 developmental stages: 0 and A to H, which are presented in Table 1. Criteria for stages are given for every tooth. Each stage of seven teeth is given a score according to a statistical model [3]. The sum of all seven left mandibular teeth can be compared to the proper value in the table and the sum of it determines the dental age. There are separate tables for males and females. Demirjian's studies were based on data from a reference sample comprising of 4756 French-Canadians children. There are many studies suggesting that this method can be inappropriate for other populations. The age can be overstated or understated [2, 4–9]. Similar results were obtained according to the Polish children. According to Fudalej et al. [10], the use of Demirjian method overestimates the dental age of Polish youth by ca. 12 months.

Material and Methods

The study was based on 120 dental panoramic radiographs from the Department of Orthodontics Wrocław Medical University and from private files. There were two groups of children: patients with cleft lip, alveolar bone and palate (CLP) and non-cleft individuals. All children were between the age of 6 and 14. In the first group, there were 28 females: 9 with bilateral cleft lip palate (BCLP) and 19 with unilateral cleft lip palate (UCLP) and 33 boys: 7 with BCLP, 26 with UCLP. The average age in this group was 9.4 years (± 2.1). It was 9.12 year (± 2.4) for females and 9.7 (± 2.8) for males. In a non-cleft group, there were 37 females and 23 males, with average age of 10.5 years (± 2.2). All samples were selected randomly. From the initial groups, 7 children had to be declined, because of tooth hypodontia, which caused the inability to calculate the Demirjian ratio. After this verification, the study compared to 55 children in the cleft group (8 females with BCLP, 18 females with UCLP, 7 males with BCLP, 22 with UCLP) and 59 in the control one (37 females and 22 males). In UCLP group right or left sided position of the cleft was not taken into consideration.

Table 1. The stages of tooth mineralization according to Demirjian's method

Tabela 1. Stopnie mineralizacji zębów zgodnie z metodą Demirjiana

Symbol (Symbol)	Description of stage (Opis stopnia mineralizacji)
0	No sign of mineralization
A	Begins with the upper level of mineralization of the crypt, take the form of inverted cones, no evidence of fusion of mineralization
B	Blend of mineralization places, formation of dental cups and because of that occlude surface is clearly marked
C	a) the formation of enamel on the occlude surface is completed b) stars the deposition of dentine c) ceiling limit of the pulp chamber is curved course, convexity directed to the occlusal surface
D	a) crown formation is finish till the <i>cement-dentin</i> interface b) formation of the pulp chamber ceiling limit of single-root teeth tooks its final shape; the bulge is directed toward the cervical; pulp chamber horns are visible; in molar teeth the pulp chamber has trapezoidal – shape c) roots – formation begins
E	Single-root teeth: a) pulp chamber walls are straight, their continuity is uninterrupted b) root length is still smaller than the crown Premolars and morals: a) the beginnig of bifurcation formation in form of points of mineralization or in crescent form b) root length is still smaller than the crown
F	Single-root teeth: a) pulp chamber walls form isosceles triangles, the root takes the shape of an inverted funnel b) root length is longer or the same as the crown length Premolars and morals: a) in bifurcation region the mineralization is still progressing; the root takes the shape of an inverted funnel b) root length is longer or the same as the crown length
G	Canal walls are parallel processes, an apical foramen is still partially open
H	a) apical foramen is closed b) periodontal membrane around apical foramen and root has the same width

Table 2. The number of the examined patients according to their age**Tabela 2.** Liczba zbadanych pacjentów podzielonych ze względu na wiek

Age (Wiek)	Girls (Dziewczynki)	Boys (Chłopcy)	Girls and boys (Dziewczynki i chłopcy)
6	5	6	11
7	7	4	11
8	4	7	11
9	15	5	20
10	3	9	12
11	13	5	18
12	5	4	9
13	8	4	12
14	3	6	9
Total (Suma)	63	50	113

The statistical analysis was performed using paired T-test in PQstat Program. It determines the statistically significant differences between groups as $p \leq 0.05$.

Results

All dental maturity scores with standard deviation and median differences expressed in years are presented in Table 3. It was observed that Demirjian's method overstated the age in a cleft group. The least difference can be noticed in BCLP female's group and it is only 0.31 years with average dental age of 10.31 ± 3.1 years, when chronological age was 10.00 ± 2.5 years. In the males cleft group, the difference was much more significant and it was 0.75 years with average dental age of 12.01 ± 4.11 years, when chronological age was 11.28 ± 2.93 years. T-test showed no statistically significant difference between the dental and chronolo-

gical ages in BCLP group (females $p = 0.46$, males $p = 0.36$), but it was meaningful in UCLP group (females $p = 0.012$, males $p = 0.002$).

For both females and males in UCLP group, the score was very similar and it was 0.8 and 0.87 years retrospectively. Females reached the average dental age of 9.5 ± 2.68 and chronological 8.7 ± 2.24 years; males 10.1 ± 2.59 and 9.23 ± 2.59 year retrospectively.

The bigger differences between the Demirjian's value and chronological age have been noticed in a control group – 1.99 years for females and 2.13 years for males. The statistically significant difference was observed (for both girls and boys $p < 0.000001$).

Discussion

The Demirjian's method presented in 1973 [11] has its limitations. In a situation of one of the premolars missing, the same tooth from the right side is established. In a situation with a missing tooth bilaterally, there is an inability to assess the dental age. This is a very common situation, especially at cleft patients. Hipodontia of lower premolars can range in this group from 1.7% up to 7.3% in UCLP and even 23.3% in BCLP [12]. This was the reason of exclusion of six patients from the cleft group in our research. The frequency of hipodontia of lower premolars in healthy individuals is lower and ranges from 2.5% to 4%, but may also cause problems in use of Demirjian's method of establishing the dental age [13]. In a control group the exclusion was caused by the premolar extraction for orthodontics treatment. The same problems were noticed by Chaillet et al. [7]. Another problem is that seven left teeth of the mandible cannot represent full dentition, especially teeth lying in the immediate nearness of the cleft gap. On the other hand, considering the left side of the mandible may give false results, as there is a higher frequency of left-sided

Table 3. Comparison of dental and calendar age**Tabela 3.** Porównanie wieku zębowego i kalendarzowego

	BCLP girls (BCLP dziewczynki)	UCLP girls (UCLP dziewczynki)	BCLP boys (BCLP chłopcy)	UCLP boys (UCLP chłopcy)	Control girls (Grupa kontrolna dziewczynki)	Control boys (Grupa kontrolna chłopcy)
Demirjian's age (Wiek wg Demirjiana)	10.31 ± 3.1	9.5 ± 2.68	12.01 ± 4.11	10.1 ± 2.59	12.47 ± 2.6	12.22 ± 3.06
Calendarly age (Wiek kalendarzowy)	10.00 ± 2.5	8.7 ± 2.24	11.28 ± 2.93	9.23 ± 2.59	10.48 ± 2.12	10.09 ± 2.43
Average difference (Średnia różnica)	0.31	0.8	0.73	0.87	1.99	2.13
p	0.46	0.012	0.36	0.002	< 0.000001	< 0.000001

clefts (3 : 1, comparing with the right side) and the dentition on the clefted area is retarded [14, 15].

As in many previous studies on non-cleft children, this one also showed a difference between dental and chronological age. The difference often depends on the origin of the researched group. One of probes showed significant differences, measured in years, between German, Japan and South African population. According to this research [9], Japanese population was relatively 1–2 years older than Germans, and 1–4 years older than South African population. On the other hand, Demirjian's method is very compatible for Indian children, and it has a greater degree with chronological age than with skeletal one [3].

Willem's et al. study [6] on group of 2523 Belgian children also showed a dental and chronological difference. It was 0.5 years for females and 0.6 years for males. This also supports the hypothesis that Demirjian's method overstated the dental age when compared to chronological age.

An interesting observation in reference to literature is that the difference between sexes depends on the stage of tooth mineralization. It is smaller for earlier stages and more significant for the final ones. Liversidge [8] observed this on the canines development. She also concluded that it is possible for this difference to have no biological meaning.

The smallest differences were noted by Hegde and Sood [2]. Their dental and skeletal ages differed for 54 days (0.14 years) for females and 15 days (0.04 years) for males. They also proved much smaller overestimation in youngest, then in older groups. The highest co-relation between dental and chronological age was in 6–9-year-old group.

Huyskens et al. [16] reached very similar results to this study in his analysis of UCLP children from the Netherlands. The overestimation for UCLP females was 0.51 years and 0.73 years for males, which gave a more significant difference than in this study. The delay was also more pronounced in males than in females in this research. Other supporting thesis study showed that the measurement error increased within age, but the delay in dental age can be correlated with the severity of a cleft [17].

Hannelore considered all types of clefts together and a significant difference between the cleft and control group, but discussed only a BCLP group [occ. 18]. The results of this research showed no significant difference in the male group. Female's groups of all cleft disorders showed no significant difference.

Borodkin's study [15] showed almost an opposite result as in present research. The difference

in males cleft group was 1.07 ± 0.32 years, as for females it was only 0.11 ± 0.28 years. She also stated that this dental-age discrepancy was large enough to arise clinicians interest and initiate further study.

A research about submucosal cleft palate showed no significant difference between dental and chronological age [19]. It can be concluded that cleft which did not include the alveolar bone caused no delay in dental development. The only retardation of teeth eruption was noticed in patients with premolars hypodontia. The retardation in dentition was increasing with the number of missing teeth.

Polish research also indicated difference between the chronological and dental ages with use of Demirjian's method. In Fudalej's study [10] the difference for non-cleft females was 1.49–1.83 years and for males 1.06–1.37 years. The T-test showed a statistically significant difference between chronological and dental age as well. What is interesting, the average difference was higher in female than in male group, which is converse to this study.

According to the authors knowledge, no studies concerning establishing the dental age by Demirjian's method in group of children with clefts were found in the Polish literature. The researchers from the Department of Orthodontics of Gdansk Medical University tested children with UCLP and BCLP using Nolla's method [20]. The examination showed that dental age of UCLP group was congenial to chronological age. In a non-cleft female group it was the same, but non-cleft male group showed even an acceleration of dental age compared to the Nolla's model.

Another Polish research using Nolla's method, reported that only half of the population in both female and male group showed compliance with the Nolla's standard. In both groups – cleft and non-cleft – the dental age was very similar. Females and control group showed more often a delayed development of teeth in maxilla and mandible [21].

Hubert's [22] studies from 1986 were examining Panek's method of dental age evaluation. He proved that the beginning of teeth eruption is the same for cleft and non-cleft children. The delay manifested at the age of 7 at female group and at the age of 8 at male group. The retardation in teeth eruption is most frequently reported in children with BCLP.

The authors concluded that:

- 1) the difference between dental and chronological age in UCLP group was greater than in a BCLP group,

- 2) the biggest difference between dental and chronological age was observed in a non-cleft group,

- 3) female's groups were dentally less developed than male's groups,

4) in all groups, standard deviation was higher than average difference which may suggest, that the groups were too small to get statistically significant results,

5) Demirjian's method is inappropriate for Polish children,

6) there is no proper method which can rate dental age,

7) there should be made new standards adequate for Polish population.

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