Acta Odontologica Scandinavica, 2009; 67: 80–84

informa
healthcare

ORIGINAL ARTICLE

Dental age in 6-year-old children with submucous cleft palate and cleft of the soft palate

ARJA HELIÖVAARA[1] & MARJATTA NYSTRÖM[2]

[1]*Cleft Palate and Craniofacial Center, Department of Plastic Surgery, Helsinki University Central Hospital and Department of Orthodontics and* [2]*Institute of Dentistry, University of Helsinki, Finland*

Abstract

Objective. To evaluate dental age in 6-year-old children with submucous cleft palate (SMCP) and to compare this in age-matched and sex-matched children with clefts of the soft palate (CPs). ***Material and Methods.*** The dental maturity of 73 children (39 girls) with SMCP was evaluated from panoramic radiographs and compared in age-matched and sex-matched controls with CPs. Mean biological age of the children was 6.1, ranging from 5.5 to 6.8 (boys 6.2 years, range 5.7–6.8; girls 6.1 years, range 5.5–6.7). Dental stages were assessed following the method of Demirjian, and dental age was calculated in accordance with the Finnish dental maturity reference values. Student's paired *t*-test was used in the statistical analysis. ***Results.*** There were no significant differences in dental age between the sexes, such that boys and girls were combined in the further analyses. Dental age of the children with SMCP (6.2 years, range 4.9–7.4) was similar to their biological age (NS). Dental age of those with CPs was 0.2 years delayed (dental age 5.9 years, range 4.6–7.5; $p < 0.001$) compared to their biological age. Children with CPs had a lower dental age than children with SMCP ($p < 0.001$). ***Conclusion.*** Dental maturation in 6-year-old children with submucous cleft palate is not delayed, whereas in children with clefts of the soft palate dental age is slightly delayed.

Key Words: *Cleft of the soft palate, dental age, dental maturation, isolated cleft palate, submucous cleft palate*

Introduction

Classic submucous cleft palate (SMCP) consists of bifid uvula, notching of the posterior border of the bony palate, and palatal muscle diastasis [1]. Occult SMCP consists only of an abnormal levator muscle insertion in the posterior border of the palate [2]. Whereas overt clefts of the palate are operated on in early childhood, the majority of children with SMCP may not require surgical treatment [1]. Submucous cleft palates may require surgery in the presence of velopharyngeal insufficiency (VPI) or because of prolonged problems with feeding or secretory otitis media. The estimated incidence of SMCP is roughly 1:1000, but only about 10% of these patients have symptoms of VPI [3–5]. In the absence of VPI, submucous clefts often remain undetected.

Dental maturation, often expressed as dental age, is used in clinical dentistry and orthodontics as an aid in diagnosis and treatment planning. In addition, dental age can be used in forensic age assessment, and to supplement other maturity indicators in estimating the chronologic age of children with unknown or uncertain birth records. In studies of syndromes and growth disturbances, dental age can give information about how diseases influence tooth mineralization. In children with cleft lip, cleft palate, or both, anomalies in the number of teeth, in the size and shape of the teeth, and in the eruption of teeth are common. The prevalence of hypodontia increases strongly with severity of the cleft [6], i.e. greatest in unilateral cleft lip and palate (UCLP) and bilateral cleft lip and palate (BCLP) [6]. The prevalence of hypodontia in the permanent dentition of children with SMCP [7] and isolated cleft palate (CP) [6,8,9] is higher than in children without clefts. Defects in enamel and abnormalities in shape and size of deciduous and permanent teeth in children with CP are also common [6], and smaller tooth size is a constant finding [6,10]. In the permanent dentition, the timing of tooth formation is delayed in children in all cleft groups [6]. The delay lengthens with increasing severity of cleft [6].

Correspondence: Arja Heliövaara, Cleft Palate and Craniofacial Center, Department of Plastic Surgery, Helsinki University Central Hospital, P.O. Box 266, FIN-00029 HUS, Finland. Tel: +358 9 471 87247. E-mail: arja.heliovaara@mbnet.fi

(Received 17 August 2008; accepted 10 November 2008)

ISSN 0001-6357 print/ISSN 1502-3850 online
DOI: 10.1080/00016350802612706

Ectopic eruption of upper molars in children with SMCP [7] and CP [9,11] and delayed tooth formation of the permanent dentition in children with CP have been reported [6]. In 251 Finnish children with isolated cleft palate without syndromes, the mean delay was 0.7 years [12] and was found to increase with increasing number of missing permanent teeth and increasing age [12].

As dental abnormalities and hypodontia have been reported to occur frequently in patients with submucous cleft palate [7], it is possible that maturation of the dentition of children with SMCP is delayed. To our knowledge, no previous reports on dental maturation in children with SMCP have been published. The purpose of this study was to evaluate dental age in 6-year-old Finnish children with SMCP and, using the Finnish dental maturity reference values, to compare with age-matched and sex-matched children with clefts of the soft palate (CPs). It was expected that dental age of the children with SMCP would be less delayed than that of children with CPs, but only slightly delayed compared to the dental age of the age-matched and sex-matched children without clefts.

Material and methods

The study group comprised 73 consecutive ethnic Finns with SMCP (39 girls) who had had dental panoramic radiographs (OPT) taken at the 6-year-old check-up control at the Cleft Palate and Craniofacial Center at the Department of Plastic Surgery, Helsinki University Central Hospital between 1980 and 2000. The mean biological age of the children was 6.1 years, ranging from 5.5 to 6.8 (boys 6.2 years, range 5.7–6.8; girls 6.1 years, range 5.5–6.7). In all children, diagnoses of submucous cleft palate were verified in the Cleft Center either clinically or by nasopharyngoscopy. Children with combined clefts or syndromes were excluded. Six-year-old children were selected because panoramic radiographs are taken at the Cleft Palate and Craniofacial Center at that age in order to evaluate dental development and the need for orthodontic treatment. Unlike the situation in more severe types of clefts, many of the children with SMCP who are free of symptoms do not need regular follow-up at the Cleft Palate Centers until the end of growth. SMCP had been operated on in 63 of the 73 patients mainly because of VPI, and only rarely because of persistent problems with ears or feeding. The surgical treatment consisted of palatal repair, pharyngeal flap surgery or a combination of two or more techniques consisting of pharyngeal flap, palatal repair, and/or intravelar veloplasty.

An age-matched and sex-matched control group of dental panoramic radiographs taken of ethnic Finns with clefts of the soft palate was collected for the children with SMCP. Clefts of the soft palate were chosen because they are the least severe type of isolated cleft palate. The matched age had to be at an accuracy of 0.1 years. The children with CPs had attended the Cleft Palate and Craniofacial Center between 1980 and 1993. Extension of the cleft was classified from hospital records before primary surgery. Primary surgery had been done at the mean age of 1.5 years (range 1.0–2.1 years) using the Veau-Wardill-Kilner V-Y pushback operation or the Cronin modification. Children with combined clefts or syndromes were excluded.

Developmental stages of seven left mandibular teeth were rated on an eight-stage scale as described by Demirjian & Goldstein [13]. A biologically weighted score for girls and boys specific to the Finnish population was used for each stage of the seven teeth [14]. The Finnish standards were used since dental maturation varies in children from different ethnic backgrounds [15]. The method of calculating the weighted scores was the same as presented by Demirjian & Goldstein [13]. The sum of the scores of the seven teeth was the dental maturity score of the child, which was then converted to dental age using the Finnish reference values [14]. If the left index tooth was missing, or its image was unclear, the contralateral tooth was used. If the mandibular index teeth were missing bilaterally, specific mathematical formulae were used. The formulae are stepwise regression equations assessing the developmental stages of individual teeth which are based on the developmental stages of the existing teeth, and on the sex and the age of the individual [16].

The dental stages were assessed by one senior orthodontist (A.H.). Intra-examiner reliability in dental age assessment was determined by reassessing 20 randomly selected panoramic radiographs. Agreement was assessed by the Kappa coefficient of agreement, which was calculated for each tooth. The mean intra-examiner reliability was 0.89 kappa (range 0.86–0.92).

Student's paired *t*-test was used to compare the dental ages of children with SMCP and CPs with their biological ages and the dental age of the boys and the girls with SMCP with the age-matched and sex-matched controls with CPs. The research protocol was approved by the Helsinki University Central Hospital.

Results

There were no significant differences in the dental ages of the boys and the girls with SMCP (boys 6.2 years, range 4.9–7.4; girls 6.3 years, range 4.9–7.3, NS) or between the boys and girls with CPs (boys 5.9 years, range 5.0–7.5; girls 5.9 years, range 4.6–7.3, NS). The boys and girls were thus combined for further analyses and the results are presented in Table I. The children with CPs had

Table I. The means, ranges, and *p*-values of paired *t*-tests between biological and dental ages in children with submucous cleft palate (SMCP) and clefts of the soft palate (CPs). Ages are reported in years

		Biological age		Dental age		
	No. of children	Mean	Range	Mean	Range	*p*-value
SMCP	73	6.1	5.5–6.8	6.2	4.9–7.4	0.154 NS
CPs	73	6.1	5.5–6.8	5.9	4.6–7.5	<0.001

a significantly lower dental age than those with SMCP ($p < 0.001$).

In the SMCP group, missing lower-left 2nd premolars were observed in three boys and in two girls. In the CPs group, missing lower-left 2nd premolars were observed in two boys and in one girl. Lower premolars were missing bilaterally in three children with SMCP (2 boys and 1 girl) and in two children with CPs (1 boy and 1 girl). In addition, a girl with CPs had bilaterally missing lower 2nd molars. In these cases, specific mathematical formulae were used to estimate the developmental stage of the missing tooth [16]. The mean dental ages in children with missing teeth were 5.6 years in the SMCP group ($n = 5$) and 5.3 years in the CP group ($n = 4$).

Discussion

The major finding of this study is that the dental maturity of Finnish children with SMCP was not delayed compared with the Finnish dental maturity reference values for a large normal population [14]. On the other hand, the dental age of the children with clefts of the soft palate was slightly delayed. This trend is in accordance with previous Finnish studies with isolated cleft palate [12]. In Finnish children aged 6 to 12 years with isolated cleft palate the mean delay in tooth formation has been reported to be 0.7 years [12]. The delay in the formation of permanent dentition was 0.6 years in the age group 6–9 years and 1.1 years in the 9–12 years age group [12]. However, in that study the extension of cleft palate varied from submucous to complete. In contrast, Loevy & Aduss [17] found no difference in dental maturity between children with cleft palate and a sample without a cleft aged 4 to 12 years. In their study, the sample included only 27 children with isolated cleft palate.

Submucous cleft palate is anatomically a milder form of overt cleft palate. Thus SMCP could be expected to be associated with less delayed dental development than CPs. However, it was not expected that the dental age of the children with SMCP was not delayed. The extent of the cleft at birth has been shown to correlate with the delay in dental age in children with cleft palate and unilateral cleft lip and palate [6]. In recent studies, the dental age in BCLP has tended to be delayed at 5 years of age [18], whereas the 5-year-old children with UCLP showed a significant delay in dental development compared to their peers without clefts [19]. It has been postulated that the retardation in tooth formation in children with clefts may be caused by the genetic factors that are responsible for genesis of the oral cleft [20]. Additional possible factors that could influence dental development in children with clefts include risk factors during gestation [21], debilitating postnatal environmental factors such as recurrent upper respiratory infections and problems in feeding [22], and indirect effects of the cleft such as surgical interventions [6]. In the present study, lower teeth were used to evaluate dental age. Thus, development of the dentition could not be influenced by surgical trauma or other local factors related to the cleft.

We assessed the dental stages as described by Demirjian & Goldstein [13], but dental age was estimated using the dental maturity reference values for Finnish children [14]. The maturity standards of Demirjian are based on French-Canadian children. It has been shown that different populations have different schedules of dental maturation. In Scandinavia, comparisons have been made between the French-Canadian standards and Finnish, Swedish, and Norwegian children. The dental ages of the Scandinavian children were advanced compared to the French-Canadian children [23–25]. In Finnish boys, the difference was about 4.5 months at the age of 5–10 years and about 7 months at 11–12 years. The dental ages of Finnish girls were on average 3.5 months ahead of French-Canadian girls at the age of 4–9 years and 9 months in the age groups 10–14 years [25]. In the present study, no differences in dental age were found between boys and girls with either SMCP or CPs. In children without clefts there is a close similarity in the early stages of dental development in boys and girls, whereas in older age groups girls are always ahead of boys [26]. The dental age of 6-year-old Finnish girls without clefts is 0.4 years advanced compared to that of boys of the same age [16]. In children with clefts, the studies show conflicting results [12,17].

A disadvantage with the Demirjian 7-tooth method is that it cannot be used if index teeth are missing bilaterally. In children with cleft palate this problem is encountered especially with 2nd premolars. In four children in the present study who had bilaterally missing index teeth, formulae based on

mathematical models assessing the developmental stages of the missing teeth [16] were used. Of the seven mandibular index teeth, prediction of the latest developing teeth, the 2nd premolar, and the 2nd molar, is difficult. The method we used here in a non-cleft population estimated the developmental stage of the 2nd premolar correctly in 70% and of the 2nd molar in 69% [16].

In children with SMCP, the prevalence of hypodontia, 16%, (excluding 3rd molars), is higher than in the general Scandinavian population, 7–8% [27,28], but lower than in children with isolated cleft palate, 25.5–33% [6,9]. Children with SMCP have fewer missing teeth than children with isolated cleft palate, but the distribution of the missing teeth is similar [7]. The most common missing teeth in children with SMCP [7] and CP are lower 2nd premolars followed by upper lateral incisors and upper 2nd premolars [9]. If lower premolars are missing in children with cleft palate, they are usually (75%) missing bilaterally [29]. The delay in dental development has been reported to increase with increasing number of missing permanent teeth [29]. If only one lower premolar is missing, development of the lower contralateral premolar is delayed from 0.4 to 1.4 years [29]. In this study, 5 children with SMCP and 4 with CP had missing teeth. This unexpected finding may have been due to the small sample size. The mean dental ages of the children with missing teeth were 0.6–0.8 years delayed compared to their biological ages. A shortcoming of our study was that in some children late developing premolars may initiate. Nevertheless, a tooth not present at the age of 6 years is a sign of delayed dental maturation.

In conclusion, dental maturation in 6-year-old children with submucous cleft palate is not delayed, whereas dental age in children with CPs is slightly delayed. If the dental age of a child with SMCP is delayed in clinical and radiological examination, the reason for the delay is not the cleft itself.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

References

[1] Calnan J. Submucous cleft palate. Br J Plast Surg 1954; 6:264–82.
[2] Kaplan EN. The occult submucous cleft palate. Cleft Palate J 1975;12:356–68.
[3] Bagatin M. Submucous cleft palate. J Maxillofac Surg 1985; 13:37–8.
[4] Garcia Velasco M, Ysunza A, Hernandez X, Marquez C. Diagnosis and treatment of submucous cleft palate: a review of 108 cases. Cleft Palate J 1988;25:171–3.
[5] Weatherley-White RCA, Sakura CY Jr, Brenner LD, Stewart JM, Ott JE. Submucous cleft palate. Its incidence, natural history, and indications for treatment. Plast Reconstr Surg 1972;49:297–304.
[6] Ranta R. A review of tooth formation in children with cleft lip/palate. Am J Orthod Dentofacial Orthod 1986;90:11–8.
[7] Heliövaara A, Ranta R, Rautio J. Dental abnormalities in permanent dentition in children with submucous cleft palate. Acta Odontol Scand 2004;62:129–31.
[8] Jiroutova O. Hypodontia in patients with isolated cleft palate, its relationship to etiopathogenesis. Acta Chir Plast 1991;33: 57–63.
[9] Larson M, Hellquist R, Jakobsson OP. Dental abnormalities and ectopic eruption in patients with isolated cleft palate. Scand J Plast Reconstr Surg Hand Surg 1998;32:203–12.
[10] McCance A, Roberts-Harry D, Sherriff M, Mars M, Houston WJ. Sri Lankan cleft lip and palate study model analysis: clefts of the secondary palate. Cleft Palate Craniofac J 1993;30:227–30.
[11] Bjerklin K. Ectopic eruption of the maxillary first permanent molar. An epidemiological, familial, aetiological and longitudinal clinical study. Swed Dent J 1994;18 Suppl 100:1–66.
[12] Ranta R. Associations of some variables to tooth formation in children with isolated cleft palate. Scand J Dent Res 1984; 92:496–502.
[13] Demirjian A, Goldstein H. New systems for dental maturity based on seven and four teeth. Ann Hum Biol 1976;3: 411–21.
[14] Chaillet N, Nyström M, Kataja K, Demirjian A. Dental maturity curves in Finnish children: Demirjian's method revisited and polynomial functions for age estimation. J Forensic Sci 2004;49:1324–31.
[15] Chaillet N, Nyström M, Demirjian A. Comparison of dental maturity in children of different ethnic origins: international maturity curves for clinicians. J Forensic Sci 2005;50: 1164–74.
[16] Nyström M, Aine L, Peck L, Haavikko K, Kataja M. Dental maturity in Finns and the problem of missing teeth. Acta Odontol Scand 2000;58:49–56.
[17] Loevy HT, Aduss H. Tooth maturation in cleft lip, cleft palate, or both. Cleft Palate J 1988;25:343–7.
[18] Heidbuchel KL, Kuijpers-Jagtman AM, Ophof R, Van Hooft RJ. Dental maturity in children with a complete bilateral cleft lip and palate. Cleft Palate Craniofac J 2002;39:509–12.
[19] Huyskens RW, Katsaros C, Van't Hof MA, Kuijpers-Jagtman AM. Dental age in children with a complete unilateral cleft lip and palate. Cleft Palate Craniofac J 2006;43:612–5.
[20] Jordan RE, Kraus BS, Neptune CM. Dental abnormalities associated with cleft lip and/or palate. Cleft Palate J 1966; 3:22–55.
[21] Pöyry M, Ranta R. Formation of anterior maxillary teeth in 0–3 year old children with cleft lip and palate and prenatal risk factors for delayed development. J Craniofac Genet Dev Biol 1986;6:15–26.
[22] Hunter WS. The effects of clefting on crown-root length, eruption, height and weight in twins discordant for cleft lip and/or palate. Cleft Palate J 1975;12:222–8.
[23] Mörnstad H, Reventlid M, Teivens A. The validity of four methods for age determination by teeth in Swedish children: a multicentre study. Swed Dent J 1995;19:121–30.
[24] Nykänen R, Espeland L, Kvaal SI, Krogstad O. Validity of the Demirjian method for dental age estimation when applied to Norwegian children. Acta Odontol Scand 1998; 56:238–44.
[25] Nyström M, Haataja J, Kataja M, Evälahti M, Peck L, Kleemola-Kujala E. Dental maturity in Finnish children,

estimated from the development of seven permanent mandibular teeth. Acta Odontol Scand 1986;44:193–8.

[26] Demirjian A, Levesque GY. Sexual differences in dental development and prediction of emergence. J Dent Res 1980; 59:1110–22.

[27] Bergström K. An orthopantomographic study of hypodontia, supernumeraries and other anomalies in schoolchildren between ages of 8–9 years. Swed Dent J 1977;1:145–57.

[28] Haavikko K. Hypodontia of permanent teeth, an orthopantomographic study. Suom Hammaslääk Toim 1971;67:219–25.

[29] Ranta R. Hypodontia and delayed development of the second premolars in cleft palate children. Eur J Orthod 1983;5:145–8.