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Secular trend of earlier onset and decelerated development of third molars: Evidence from Croatia

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ABSTRACT

The purpose of this study was to evaluate the influence of the secular trend on development of third molars in 30 years period in Littoral region of Croatia.

A total of 1103 panoramic radiographs of subjects aged from 6 to 18 years were analysed. First group comprised 531 panoramic radiographs (258 girls) taken from year period 1977 till 1979 and second group 572 radiographs (325 girls) taken from year period 2007 till 2009. Demirjian's method was used to determine the developmental stage of third molars.

A secular trend in 30 years period was observed as earlier onset of third molars development in boys (6 months on average maxillary and 11 months mandibular) and girls (6 months for maxillary and 4 months for mandibular). Now-a-days, an increase in mineralisation for one Demirjian stage occurs at a slower pace of 5.2 months in boys and 3.4 in girls in maxilla and 2.3 or 2 months in mandible for boys and girls, respectively. The study showed a secular trend present as earlier onset but decelerated development of third molars in both genders and both jaws.

1. Introduction

Secular trend seen as acceleration in growth and development has been documented during the last hundred years in humans [1–6]. Dental development correlates with different morphological stages of mineralisation that can be observed on radiographs, and comprises a more uniform and gradual set of changes than eruption. It may be less influenced by external factors (such as malnutrition, disease and mental stress) than other measurable criteria and is therefore more accurate for evaluating the influence of secular trend [7]. Third molars differ from other molars in more aspects. It is the most variable tooth in dentition with respect to size, time of formatting and time of eruption [8,9]. Its development tends to continue over a long period of life, therefore, its formation can be used to predict age in later adolescence in forensics [10]. Previous findings imply that the mineralisation of wisdom teeth is a population specific process and does not occur in every ethnic group at the same age [11].

Due to scarce evidence, the purpose of this study was to evaluate the influence of the secular trend on development of third molars in two biannual periods within three decades (from 1977 till 2009) in Littoral region of Croatia. It was hypothesised that wisdom teeth now-a-days begin to develop earlier than three decades ago.

2. Materials and methods

The sample for this repeated cross-sectional study consisted of panoramic radiographs of examinees aged 6–18 years (mean 10 years 3 months ± 2 years 4 months) collected from orthodontic and paediatric dentistry offices. Since it has been reported that the onset of molar mineralisation can occur at the age of 6, radiographs of 6 year olds were included in the sample [12]. After excluding radiographs with anomalies in teeth number, shape and size and those with low quality where there was no possibility to assess tooth development, 1103 panoramic radiographs remained. The sample consisted of 2 groups. The first group was comprised of 531 radiographs (258 girls) recorded in the period 1977–1979. The second group consisted of 572 radiographs (325 girls) taken in the period 2007–2009. Examinees shared the same geographical background of

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Littoral region of Croatia, i.e. North-Adriatic coast ensuring a homogeneous population regarding climate and dietary habits. Geographical background was considered an important factor as previous research has proven dissimilarities in third molar maturation among Croatian population of different geographical areas [13]. Chronological age was determined by the date when the panoramic radiograph was taken and the patient's date of birth.

The development of third molars was ascertained by the method of Demirjian [14]. In order to collect precise data, 30 panoramic radiographs assessed by authors M.L. and A.S. were randomly selected. Author M.L. has over 30 years of experience in analysis of panoramic radiographs and application of Demirjian's method. Procedure was repeated until differences between examiners were eliminated. Afterwards, third molar maturation analyses of 200 randomly selected radiographs was conducted by A.S. and repeated a month later. Cohen Kappa coefficient was used to assess intraobserver reliability and it ranged between 0.90 and 0.97. All radiographs from the sample were analysed by A.S.

Intraclass correlation coefficient was used to determine the matching of third molar mineralisation between left and right side in each jaw. For differences between average chronological age inside the same mineralisation stage between two time periods an independent samples *t*-test was performed. Linear regression analysis was used to assess the trend of dependence of the development of third molars on chronological age obtained data were processed by commercial statistical software SPSS 10.0 (SPSS Inc., Chicago, IL, USA). The research was approved by the local Ethical Committee.

3. Results

Distribution of subjects according to age groups is shown in Table 1 and distribution of mineralisation stages in groups is shown in Table 2. When third molars are present bilaterally there is a high degree of similarity in mineralisation stages among the left and right side, for maxilla ICC = 0.95 (95% CI 0.94–0.96; $p < 0.001$), and for mandible 0.97 (95% CI 0.96–0.97; $p < 0.001$). Therefore, left and right third molars were not used separately in the statistical analysis. Only one tooth per jaw has been used for statistical analysis (left) and when the left was not visible the right was used instead.

Results demonstrate a few trends. Male examinees from year period 2007–2009 show lower chronological age in regards to examinees from 1977–1979 within lower maturation stages of third molars, while females demonstrate increase in chronological age from 2007–2009 to 1977–1979 within higher maturation stages (Fig. 1). On the basis of independent samples *t*-test the differences in chronological ages between periods are mainly statistically significant among initial mineralisation stages (Fig. 1, $p < 0.05$). Secular trend is observed as earlier onset of maxillary third molar mineralisation for 6 months in girls and boys on average, while in mandible onset begins 11 months earlier in boys and 4 months in girls.

Regression analysis demonstrates that third molars have an earlier onset of development, but they mature over a longer period of time now-a-days compared to 30 years ago. Trends are observed in both jaws and both genders (Fig. 2). Prediction of chronological age from third molars development is more precise now-a-days ($R^2 = 0.58–0.61$) than 30 years ago ($R^2 = 0.29–0.43$). Regression analysis for the prediction of chronological age from the maturation stage of third molars shows that an increase for 1 stage in maxilla takes 5.2 months (5 months 6 days) longer in males and 3.4 months (3 months 12 days) in girls now-a-days compared to 30 years ago (Fig. 2). In mandible it is 2.3 months (2 months 9 days) in males and 2 months in females. Regression equations for prediction of Demirjian stage of mineralisation of wisdom teeth from subjects' chronological age are presented in Table 3.

Table 1
Distribution of subjects according to age groups, gender and period.

Age groups	Gender and period				Total
	M 77–9	F 77–9	M 07–9	F 07–9	
6	7	7	5	2	21
7	38	29	30	35	132
8	40	46	35	39	160
9	60	56	42	84	242
10	65	52	25	49	191
11	30	30	23	20	103
12	14	16	32	32	94
13	6	12	26	24	68
14	1	2	12	21	36
15	7	3	7	8	25
16	3	2	4	5	14
17	1	3	5	2	11
18	1	0	1	4	6
Total	273	258	247	325	1103

Table 2
Distribution of stages of mineralisation of third molars in sample.

Wisdom teeth	Demirjian stage	Gender and period				Total
		M 77–9	M 07–9	F 77–9	F 07–9	
Maxillary right	0	156	56	156	100	468
	1	25	16	12	22	75
	2	43	68	35	91	237
	3	30	39	29	46	144
	4	12	44	23	40	119
	5	4	16	1	17	38
	6	1	7	0	6	14
	7	2	1	2	3	8
Total		273	247	258	325	1103
Maxillary left	0	156	53	156	99	464
	1	18	19	14	18	69
	2	50	61	33	96	240
	3	29	43	28	46	146
	4	15	45	24	41	125
	5	2	17	1	16	36
	6	1	8	0	5	14
	7	2	0	2	4	8
	8	0	1	0	0	1
Total		273	247	258	325	1103
Mandibular left	0	172	68	167	130	537
	1	52	35	34	25	146
	2	24	65	26	94	209
	3	15	29	16	24	84
	4	3	22	10	14	49
	5	3	16	3	30	52
	6	0	10	0	5	15
	7	4	2	2	3	11
Total		273	247	258	325	1103
Mandibular right	0	174	75	174	124	547
	1	50	33	31	35	149
	2	25	62	24	85	196
	3	15	28	15	28	86
	4	3	23	9	16	51
	5	3	14	3	27	47
	6	0	11	0	6	17
	7	3	0	0	4	7
	8	0	1	2	0	3
Total		273	247	258	325	1103

4. Discussion

Present study provides evidence of secular trend observed as earlier onset of third molar mineralisation today than three decades earlier. Similar trends are seen in some other physiological