



Willems II. Non-gender-specific dental maturity scores

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ABSTRACT

Demirjian's dental maturity scoring system has been adapted for a Belgian Caucasian population for males and females. The purpose of this study was to adapt Demirjian's dental maturity scoring system from a Belgian Caucasian population to provide non-gender-specific scores. We selected 2116 orthopantomograms of 1029 boys and 1087 girls aged 3–16 years. A weighted ANOVA was performed in order to adapt the scoring system for this Belgian population. A second test sample of 273 orthopantomograms of individuals with immature dentitions aged 3–16 years was used to evaluate the accuracy of the original method, gender-specific scores and non-gender-specific scores of the adapted method. Mean/median difference between dental age and real age was calculated as well as other measures of accuracy. The adapted scoring system resulted in new age scores expressed in years and in a higher accuracy compared to the original method in Belgian Caucasians.

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1. Introduction

Demirjian's dental maturity scores [1] are widely used to assess dental maturity and estimate age. Many researchers have modified the scores but the revised scores by Willems et al. [2] have been found to be not only the easiest but also the most accurate [3]. Occasionally there is a need to estimate age of skeletal remains of unknown gender in archaeology or forensic anthropology. The purpose of this study was to develop non-gender-specific dental maturity scores from the same reference sample.

2. Materials and methods

The same sample detailed by Willems et al. [2] was used to calculate adapted scores. This consisted of 2116 orthopantomograms of 1029 boys and 1087 girls aged 3–16 years. A weighted ANOVA was performed using the General Linear Models procedure of the SAS statistical software package in order to adapt the scoring system for this Belgian Caucasian population. The ANOVA model used was an adaptive model with all seven teeth as covariates for boys and girls combined. No interactions were included in the model. Weighted ANOVA was used because the homoscedasticity assumption was not fulfilled.

A second selected sample of 273 orthopantomograms of individuals with immature dentitions aged 3–16 years was the test sample. The age and sex distribution is shown in Table 1. Dental age was calculated using the original method, gender-specific scores and non-gender-specific scores of the adapted

method. The dental status of some very young individuals prevented dental age being calculated using Demirjian's method and this accounts for the different sample sizes. Mean and median differences between dental age and real age were calculated. Other measures of accuracy (mean/median absolute difference, % aged to 0.5 year and % aged to within 10% or less of age) were also calculated.

3. Results and discussion

Dental maturity scores for combined gender, males and females expressed in years are shown in Table 2. Results of the difference between dental age and real age are shown in Table 3. This includes mean and median differences, mean and median absolute differences, percentage of the test sample aged to within six months of real age and percentage aged to 10% or less of real age. Demirjian's original method overestimated age by six months while gender-specific scores and non-gender-specific scores estimated age accurately. Mean and median absolute differences between dental age and real age were also considerably improved using the newer scores. The proportion of the test sample aged to within six months of real age and the proportion aged to 10% or less of real age were both considerably better using the newer scores compared to the original method. The adapted method for dental age estimation in a Belgian Caucasian population has been extended to include scores for the pooled sample of males and females. The adapted method was validated and resulted in more accurate dental age estimations in this population.

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Table 1

Age distribution of test sample. Age group 3+ includes all individuals aged 3.00–3.99 years, etc.

Age group	Male	Female	Males and females
3+	13	9	22
4+	18	9	27
5+	20	8	28
6+	13	16	29
7+	18	14	32
8+	24	19	43
9+	17	13	30
10+	11	8	19
11+	8	7	15
12+	2	4	6
13+	10	3	13
14+	4	1	5
15+	1	0	1
16+	2	1	3
Total	161	112	273

Table 2

Developmental tooth stages according to the Demirjian's technique (1) with corresponding age scores expressed directly in years for each of the seven left mandibular teeth.

Tooth	Demirjian's developmental tooth stages							
	A	B	C	D	E	F	G	H
<i>Males and females</i>								
Central incisor	–	–	1.87	1.88	1.97	2.40	2.71	2.74
Lateral incisor	–	–	–0.82	–0.65	–0.57	–0.29	–0.01	0.07
Canine	–	–	1.13	1.11	1.27	1.51	1.85	2.20
First bicuspid	–0.07	0.31	0.54	0.84	1.05	1.67	2.07	2.64
Second bicuspid	–0.01	0.07	0.19	0.26	0.46	0.55	0.64	1.55
First molar	–	–	–	0.75	1.14	1.70	1.95	2.28
Second molar	0.17	0.32	0.50	0.61	1.04	1.79	2.55	4.42
<i>Males</i>								
Central incisor	–	–	1.68	1.49	1.50	1.86	2.07	2.19
Lateral incisor	–	–	0.55	0.63	0.74	1.08	1.32	1.64
Canine	–	–	–	0.04	0.31	0.47	1.09	1.90
First bicuspid	0.015	0.56	0.75	1.11	1.48	2.03	2.43	2.83
Second bicuspid	0.08	0.05	0.12	0.27	0.33	0.45	0.40	1.15
First molar	–	–	–	0.69	1.14	1.60	1.95	2.15
Second molar	0.18	0.48	0.71	0.80	1.31	2.00	2.48	4.17
<i>Females</i>								
Central incisor	–	–	1.83	2.19	2.34	2.82	3.19	3.14
Lateral incisor	–	–	–	0.29	0.32	0.49	0.79	0.70
Canine	–	–	0.60	0.54	0.62	1.08	1.72	2.00
First bicuspid	–0.95	–0.15	0.16	0.41	0.60	1.27	1.58	2.19
Second bicuspid	–0.19	0.01	0.27	0.17	0.35	0.35	0.55	1.51
First molar	–	–	–	0.62	0.90	1.56	1.82	2.21
Second molar	0.14	0.11	0.21	0.32	0.66	1.28	2.09	4.04

Table 3

Difference between dental age and real age using Demirjian's original method [1], Willems [2] and non-gender-specific scores (Willems II).

Method	N	Mean diff, SD	Median diff	Mean diff	Median diff	% 0.5 year	≤10%
Demirjian	263	0.51, 0.99	0.49	0.88	0.75	37	50
Willems	273	0.06, 0.93	0.08	0.70	0.55	45	65
Willems II	273	–0.02, 0.97	0.05	0.74	0.54	45	60

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