Assessment of orthodontic treatment needs of Iraqi Kurdish teenagers using the Dental Aesthetic Index

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تقييم الاحتياجات للمعالجة التقويمية للأسنان لدى المراهقين العراقيين الأكراد باستخدام منسب التجميل السني

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الخلاصـة: هدف هذا المسح الذي تناول صحة الفم التعرف على الاحتياجات للمعالجة التقويمية للأسنان لدى المراهقين في السليمانية، في العراق. وقد أجرى الباحثون فحصاً سريرياً لعينة عشوائية تضم 998 من أطفال المدارس الكردية، الذين يبلغون 13 عاماً من العمر؛ وقد وجدوا أن أحراز (درجات قياس) منسب التجميل السني تتراوح بين 13 و65 ويبلغ الوسطي لها 25.4 (بانحراف معياري مقداره 9.2). وانطلاقاً من هذه الأحراز قيَّم الباحثون الاحتياجات للمعالجة على الوجه التالي: لا توجد احتياجات أو احتياجات طفيفة 58.6٪، احتياجات انتقائية 18.5٪، احتياجات مرغوبة بشدة 12.5٪، احتياجات إجبارية (سوء الإطباق المسبب للإعاقة) 10.3٪. وقد وجد الباحثون الاحتياجات للمعالجات المرغوبة بشدة أو الإجبارية (منسب التجميل السني يساوي أو يزيد على 31) في نسب مئوية متساوية لدى الذكور (23.2٪) والإناث (22.6٪)، ولكنها لدى سكان الأرياف (25.1٪) أكثر منها لدى سكان المدن (20.6٪).

ABSTRACT This oral health survey aimed to determine the orthodontic treatment needs of teenagers in Sulaimaniya, Iraq. A clinical examination was made of a random sample of 998 Kurdish schoolchildren aged 13 years. Dental Aesthetic Index (DAI) scores ranged from 13 to 65, with a mean of 25.4 (SD 9.2). From these scores, treatment needs were assessed as: no or slight need 58.6%, elective 18.5%, highly desirable 12.5% and mandatory (handicapping malocclusion) 10.3%. Highly desirable or mandatory treatment need (DAI ≥ 31) was found in equal proportions of males (23.2%) and females (22.6%), but in more rural (25.1%) than urban (20.6%) residents.

Évaluation des besoins en soins orthodontiques des adolescents kurdes iraquiens à l'aide de l'indice esthétique dentaire

RÉSUMÉ Cette enquête sur la santé bucco-dentaire visait à déterminer les besoins en soins orthodontiques des adolescents de Sulaimaniya (Iraq). Un examen clinique a été réalisé sur un échantillon aléatoire de 998 écoliers kurdes âgés de 13 ans. Les scores de l'indice esthétique dentaire (IED) étaient compris entre 13 et 65, avec une moyenne de 25,4 (écart type : 9,2). D'après ces scores, la nécessité des soins a été évaluée comme suit : pas ou peu nécessaires, 58,6 % ; facultatifs, 18,5 % ; fortement recommandés, 12,5 % ; et obligatoires (malocclusion handicapante), 10,3 %. Les niveaux de nécessité de soins « fortement recommandés » ou « obligatoires » (IED ≥ 31) se retrouvaient en proportions égales chez les garçons (23,2 %) et chez les filles (22,6 %), mais davantage chez les adolescents vivant en milieu rural (25,1 %) qu'en milieu urbain (20,6 %).

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Introduction

Many people undergo orthodontic treatment to improve their dental appearance [1]. In relation to facial aesthetics it has been shown that, from the patient's point of view, teeth are second in importance only to background facial appearance [2]. Most individuals who have had orthodontic treatment feel that they have benefited, even though dramatic changes in facial appearance are not always evident [3].

During the 1970s, the importance of psychological factors in the assessment of malocclusion was acknowledged in the United States of America (USA) and internationally [4]. In response to the demand for an orthodontic index that includes psychosocial criteria in assessing need for orthodontic care and for use in epidemiological surveys, Cons et al. developed the Dental Aesthetic Index (DAI) using the opinions of the lay public as to what constituted unacceptable dental arrangements from an aesthetic viewpoint. It links the clinical and aesthetic components mathematically to produce a single score that combines the physical and the aesthetic aspects of occlusion [5]. The DAI has decision points along the DAI scale defining case severity levels that approximate to the judgement of orthodontists [6].

The DAI can be useful in both epidemiological surveys and as a screening device to prioritize subsidized orthodontic treatment in public programmes where resources are insufficient to meet the demand [5]. The DAI is currently being employed by the World Health Organization (WHO) as an epidemiological tool to assess unmet need for orthodontic care in its International Collaborative Study of Oral Health Outcomes [7].

Although the DAI was based on perceptions of dental aesthetics in the USA, perceptions in students in 11 diverse groups were similar to those of American students.

Therefore the standard DAI can be used internationally without modification [8–11]. Because people of Kurdish ethnicity are spread across Turkey, Iraq, the Islamic Republic of Iran, Armenia and the Syrian Arab Republic very few epidemiological studies have been carried out on them. Therefore, there is no baseline data for orthodontic treatment need.

This study aimed to assess the orthodontic treatment need of Kurdish schoolchildren according to the DAI and relate it to sex and geographic location, providing baseline data that can be used in planning orthodontic treatment services.

Methods

Sample

The sample was 998 13-year-old students from 20 intermediate schools in Sulaimaniya and surrounding villages, selected according to a multi-stage stratified sampling technique described in detail in an earlier report [12]. Half the students were living in urban areas and the rest in rural areas.

Data collection

Informed consent forms were signed by the students' parents and approval from the Ministry of Education and the school heads were obtained. The study was carried out from the beginning of October 2005 to the end of December 2005.

Each child was given a dental examination by orthodontists to determine the DAI score. The 10 DAI components are: missing visible mandibular and maxillary incisor, canine and premolar teeth (number of teeth); crowding in the incisal segment (number of crowded segments 0, 1 or 2); spacing in the incisal segment (number of spaced segments 0, 1 or 2); maxillary diastema (mm); largest maxillary anterior irregularity (mm); largest mandibular an-

terior irregularity (mm); anterior maxillary overjet (mm); anterior mandibular overjet (mm); vertical anterior open bite (mm); and antero-posterior molar relation (0 = normal, 1 = half cusp, 2 = full cusp). Total DAI scores are classified according to decision points that approximate to the judgement of orthodontists about treatment need: 13–25 (normal or minor malocclusion; no treatment need or slight need); 26–30 (definite malocclusion; treatment elective); 31–35 (severe malocclusion; treatment highly desirable); 36+ (very severe, handicapping malocclusion; treatment mandatory) [5].

Inter-and intra-examiner calibration were performed before the study, to ensure the consistent application of the diagnostic criteria. The results showed no statistically significant difference.

Statistical analysis

Data entry and analysis was carried out using *SPSS*, version 14. Student *t*-test was used to examine the differences of mean and standard deviation (SD) DAI scores between males and females and between urban and rural residents. *P*-values < 0.05 were considered significant.

Results

The total number of students examined was 1020, however 22 case sheets were excluded because of incomplete or inaccurate information, incorrect age or currently undergoing orthodontic treatment, giving a valid sample of 998: 497 males (249 urban and 248 rural) and 501 females (251 urban and 250 rural).

The distribution of the DAI scores for the total sample is displayed in Table 1 and Figure 1. The lowest DAI score registered in this study was 13 and the highest was 65. The most commonly registered DAI score was 19 (9.9%) followed by 20 (9.0%).

According to the DAI cut-offs, normal or minor malocclusion with no or slight treatment need (DAI 13–25) was found in 58.6% of the sample, definite malocclusion with treatment elective (DAI 26–30) in 18.5%, severe malocclusion with treatment highly

Table 1 **Distribution of Dental Aesthetic Index (DAI) scores of 13-years-olds in Sulaimaniya by sex and residence**

Sex/residence	No. patients	DAI score								Mean	SD
		13–25		26–30		31–35		36–65			
		No.	%	No.	%	No.	%	No.	%		
Males											
Urban	249	149	59.8	49	19.7	27	10.8	24	9.6	24.9	8.7
Rural	248	138	55.6	46	18.5	33	13.3	31	12.5	26.4	10.0
Total	497	287	57.7	95	19.1	60	12.1	55	11.1	25.6	9.4
Females											
Urban	251	152	60.6	47	18.7	31	12.4	21	8.4	24.7	8.4
Rural	250	146	58.4	43	17.2	34	13.6	27	10.8	25.7	9.6
Total	501	298	59.5	90	18.0	65	13.0	48	9.6	25.2	9.0
Total											
Urban	500	301	60.2	96	19.2	58	11.6	45	9.0	24.8	8.5
Rural	498	284	57.0	89	17.9	67	13.5	58	11.6	26.1	9.8*
Total	998	585	58.6	185	18.5	125	12.5	103	10.3	25.4	9.2

Total urban versus rural: t = −2.132, df = 996, P < 0.05.
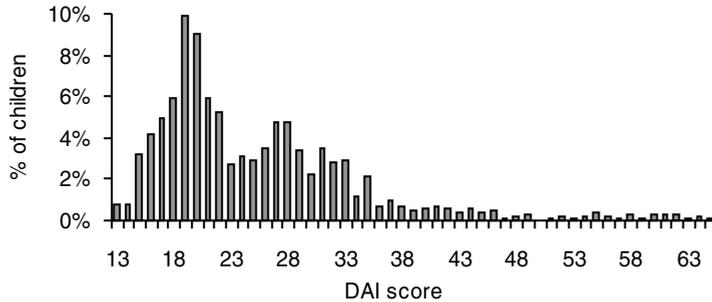*SD = standard deviation.*

Figure 1 **Distribution of the total sample of 13-years-olds in Sulaimaniya according to their Dental Aesthetic Index (DAI) score**

desirable (DAI 31–35) in 12.5% and very severe (handicapping) malocclusion with treatment mandatory (DAI ≥ 36) in 10.3%.

DAI scores of 31+ (severe malocclusion and treatment highly desirable or mandatory) were found in similar proportions of males (23.2%) and females (22.6%), but in slightly more rural (25.1%) than urban residents (20.6%) (Table 1).

The overall mean score was 25.4 (SD 9.2). Rural males showed the highest mean DAI score [26.4 (SD 10.0) mm] followed by rural females [25.7 (SD 9.6) mm] (Table 1). There were no significant differences in mean DAI scores by sex or residence, but the mean DAI score was higher among rural residents than urban residents.

Discussion

The DAI was chosen for this research because it is simple, reliable, valid, relatively fast and accounts for both function and aesthetics. A DAI score can be obtained intraorally without the use of radiographs in about 2 minutes by trained dental auxiliaries. Previous studies found that auxiliaries were highly reliable in measuring DAI scores [5,13]. Studies in the USA as well as internationally show the validity of the DAI [8,9]. It has been adopted by the WHO, making it a universally accepted index, and it has decision points differentiating treatment priority [5,7,13–15].

To the authors' knowledge, the only published studies presenting detailed DAI score distributions are those of Jenny et al. [16], published in more detail in a later paper [14], and Al-Huwaizi [17,18]. In the present study the range of DAI scores was from 13 to 65, which is identical to that found by Al-Huwaizi in Iraq [18], whereas Cons et al. found a range of 15–66 in the USA [10].

The most commonly registered DAI scores were 19 (9.9%) and 20 (9.0%). This was comparable to the findings of Jenny et al. with 19 (9.3%) and 21 (6.6%) [14] and of Al-Huwaizi, 21 (13.1%) [18]. This result showed that the Iraqi and American samples had comparable median, lower and upper limits on the DAI scale, showing that the DAI score can be used on the Iraqi population with the same relative precision as on the American population for whom it was constructed.

According to the DAI cut-offs, treatment need was judged as no or slight in

58.6% of the sample, elective in 18.5%, highly desirable in 12.5% and mandatory in 10.3%. When comparing these results with those found by others (Table 2) our Iraqi Kurdish sample seems to have lower orthodontic treatment need than that of samples taken from American whites and natives, Australians, Japanese, New Zealanders, Spaniards, South Africans or Peruvians [6,14,16,19–25]. However, treatment need in our sample was markedly higher than that of studies done on Chinese, Australians, Nigerians, Malaysians, Iraqi Arabs and Iranians [18,19,26–30]. These differences may be attributed to differences in race, sampling techniques and environmental effects.

We found no significant sex difference in orthodontic treatment need, which agrees with some previous studies [18,22,25,31] but differs from others who found a significant difference by sex [23,24,28,30].

The prevalence of DAI scores where there was severe malocclusion and treatment was highly desirable or mandatory was higher in the rural than in the urban residents. This may be explained by the greater demand for orthodontic treatment by urban residents [32,33], who would have been excluded from the study, thus decreasing the prevalence of malocclusion in urban areas. Our result agrees with the findings of Al-Huwaizi in Iraq [18] and Esa et al. in Malaysia [28] but contradicts those of Ansai et al. in Japan [20] and Baca-Garcia et al. in Spain [22] who found that urban students had significantly higher DAI scores than rural students.

Table 2 **Reported orthodontic treatment needs in different countries using the Dental Aesthetic Index (DAI)**

| Author | Year | Sample | | | DAI scores | | | | Mean DAI score |
		Country	Size	Age (years)	13–25 %	26–30 %	31–35 %	≥ 36 %	
Jenny et al. [16]	1991	America (whites)	1337	15–18	46	26	15	13	26.5
		America (native)	485	12–17	19	26	25	30	31.8
Spencer et al. [19]	1992	Australia	5000	13	–	–	–	–	28.1
Jenny et al. [14]	1993	America	1306	15–18	45.7	23.6	15.5	15.2	–
Ansai et al. [20]	1993	Japan	409	15–18	32	21	25	22	30.5
Jenny & Cons [6]	1996	America	7500	12–17	45.8	25.2	15.0	14.0	–
Katoh et al. [21]	1998	China (Taiwan)	176	18–24	–	–	–	–	22.3
		Australia	268	12–16	–	–	–	–	24.1
Otuyemi et al. [22]	1999	Nigeria	703	12–18	77.4	13.4	9.2		22.3
Johnson & Harkness [23]	2000	New Zealand	–	10	23	22	22	33	–
Esa et al. [28]	2001	Malaysia	1519	12–13	62.6	30.4		7.0	–
Abdullah & Rock [25]	2001	Malaysia	5112	12–13	–	–	24.1		24.6
Al-Huwaizi [18]	2002	Iraq	6957	13	65.8	16.8	10.2	7.2	24.3
Baca-Garcia et al. [22]	2004	Spain	744	14–20	58.6	20.3	11.2	9.9	25.6
Van Wyk & Drummond [23]	2005	South Africa	6142	12	47.7	21.2	14.1	16.9	–
Foster et al. [24]	2006	New Zealand	430	12–13	39.5	43.5		17.0	28.3
Bernabe & Flores-Mir [25]	2006	Peru	267	16–25	41.9	25.5	15.0	17.6	28.9
Danaei et al. [30]	2007	Iran	900	12–15	70.1	17.8	7.9	4.2	23.5
Present study	2005	Iraq, Sulaimaniya	998	13	58.6	18.5	12.5	10.3	25.4

– indicates data not available.

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