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Orthodontic treatment need in a 12-year-old population in the Western Sahara

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SUMMARY The aim of this study was to establish orthodontic treatment need according to the Dental Aesthetic Index (DAI) and Aesthetic Component (AC) and Dental Health Component (DHC) of the Index of Orthodontic Treatment Need (IOTN) and to determine its association with gender among Saharan schoolchildren. The study was carried out in accordance with World Health Organization (WHO) recommendations for oral health surveys at 12 years of age. The sample comprised 248 Sahrawi children (135 girls and 113 boys) living in refugee camps in Tindouf, Algeria. None of the children had previously received any orthodontic treatment. A chi-square test was used to analyse the IOTN results by gender, and a Student's *t*-test was employed for the DAI results.

The mean DAI was 23.32 with a standard deviation of 6.05, 4 per cent with a very severe and 9.2 per cent with severe malocclusion. Orthodontic treatment need was 16.1 and 2.0 per cent, respectively, according to grades 4 and 5 of the IOTN DHC, 13.7 per cent according to the IOTN AC, and 28.6 per cent according to the modified IOTN (IOTN DHC grades 4–5 and/or IOTN AC grades 8–10). There were no statistically significant differences by gender. The orthodontic treatment need of Western Saharan schoolchildren is similar to that reported by many recent studies in European and in Sub-Saharan countries.

Introduction

Since 1975 the majority of the Western Saharan population has lived in exile in refugee camps in the neighbourhood of Tindouf, Algeria. These refugee camps in the middle of the Sahara desert have been provisional for the past 30 years. Around 165 000 people live in the camps and are dependent on aid provided by the United Nations High Commissioner for Refugees, the International Red Cross, and various non-government organizations. Sahrawi children present considerable health problems, including skin diseases (mycosis, pediculosis, and scabies), chronic diarrhoea caused by parasites and gluten intolerance, malnutrition-related developmental disorders, anaemia, and stunting (the height of 85 per cent of the children and the weight of 90 per cent are below the 50th percentile), as well as both dental caries and dental fluorosis (Almerich-Silla *et al.*, 2008).

Many indices have been developed to assess orthodontic treatment need in particular populations or communities to select patients who can be treated in certain dental care systems in order to establish priorities when resources are limited, and to help plan specialist training (Brook and Shaw, 1989; Cons *et al.*, 1989; Burden *et al.*, 1999). In recent years, a consensus seems to have been reached on the individual characteristics and occlusal features that should be assessed in order to objectively establish treatment need. This can be seen in the recent literature, where the tendency in epidemiological studies of malocclusion in different countries has been to coincide in many respects and to unify criteria regarding the use of orthodontic treatment need indices and in their recognition by several international associations. These indices include the Dental Aesthetic Index (DAI; Cons *et al.*, 1989) and the Index of Orthodontic Treatment Need (IOTN; Brook and Shaw, 1989).

As no data have been published on orthodontic treatment need in the Western Sahara, this study aimed to assess this need in a population with no history of previous treatment and to compare treatment need estimated using the DAI and IOTN.

Subjects and methods

Ethical approval

The study was approved by the Ethical Committee of the Faculty of Medicine and Dentistry of the University of Valencia, Spain. Through the local authorities in the area and the schoolteachers, the families of the children to be examined were contacted to obtain authorization.

Study group

The age chosen for the study of malocclusion was 12 years. A total of 248 children in this age group were examined

(135 girls and 113 boys). No individual had any previous or current history of orthodontic treatment.

Clinical examinations

Following the World Health Organization (WHO) criteria and recommendations for oral health surveys, the examination instruments employed were a WHO-type periodontal probe and a No.5 plain mouth mirror, both disposable.

Eight final-year dental undergraduates at the University of Valencia were chosen to collect the data, with four acting as examiners and four as recorders. Prior to the examinations, sessions were conducted to explain the diagnostic criteria and to train the clinicians in the use of the IOTN and DAI. The necessary calibrations were then conducted with the examiners to ensure the validity and reliability of the results obtained, first using plaster models and then under examination conditions at the university. The results were compared with the measurements carried out by a specialist in orthodontics who had previously been trained in the use of IOTN and DAI, which were used as the gold standard. The kappa statistics for inter-examiner diagnostic agreement compared with the gold standard examiner for the four undergraduates were over 0.85.

All the examinations were undertaken in four refugee camps near Tindouf (Smara, Awsard, El-Aaiun and 27 February). The children examined attended voluntarily. They were examined and their dental status was recorded.

The indices employed were the DAI, which has four grades (Cons *et al*., 1989), and both components of the IOTN: the Aesthetic Component (AC) has 10 grades and the Dental Health Component (DHC) five grades (Brook and Shaw, 1989).

Treatment need was also determined according to the modified IOTN (Burden *et al.*, 1999). This index considers that treatment is needed when the IOTN DHC is grade 4 or 5 and/or the IOTN AC is grades 8–10.

Statistical analysis

The data were recorded on examination record forms and then processed and stored in a Microsoft Access® database. The statistical analysis was carried out with the Statistical Package for the Social Sciences, version 15.0® (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics of all the variables were obtained. The quantitative variables were expressed as the means and standard deviations and the categorical variables as percentages. A Student's *t*-test was used to determine between the means and the chi-square test to assess differences.

Results

The distribution of grades of treatment need according to the IOTN DHC is shown in Table 1. Orthodontic treatment was required by 18.1 per cent of the population (grades 4–5). There were no statistically significant gender differences in treatment need determined using the DHC ($P = 0.21$).

The distribution of grades of orthodontic treatment need according to the IOTN AC assessed by the examiners is shown in Table 2. According to this index, 13.7 per cent needed treatment. No statistically significant gender differences were found (chi-square test, $P = 0.6$).

With the modified IOTN, 28.6 per cent had a treatment need (IOTN DHC grades 4–5 and/or IOTN AC grades 8–10). There were no statistically significant differences by gender ($P = 0.75$).

Table 1 Distribution and 95 per cent confidence interval (95% CI) of Index of Orthodontic Treatment Need (IOTN) Dental Health Component (DHC) levels and orthodontic treatment need in the examined subjects.

IOTN DHC	Male (%), *n* = 113 (95% CI)	Female (%), *n* = 135 (95% CI)	Total (%), *n* = 248 (95% CI)
Grade 1. Normal or minor malocclusion. No need.	37.2 (28.3–46.8)	31.9 (24.1–40.4)	34.2 (28.4–40.5)
Grade 2. Minor malocclusion. Little need.	22.1 (14.9–30.9)	30.3 (22.8–38.9)	26.6 (21.2–32.6)
Grade 3. Moderate malocclusion. Borderline need.	23.0 (15.6–31.8)	19.3 (12.9–26.9)	20.9 (16.1–26.6)
Grade 4. Severe malocclusion. Treatment need.	16.8 (10.4–25.0)	15.6 (9.9–22.7)	16.1 (11.8–21.3)
Grade 5. Very severe malocclusion. Treatment need.	0.8 (0.02–4.8)	2.9 (0.8–7.4)	2.0 (0.6–4.6)

Table 2 Distribution and 95 per cent confidence interval (95% CI) of Index of Orthodontic Treatment Need (IOTN) Aesthetic Component (AC) levels and orthodontic treatment need in the examined subjects.

IOTN AC	Male (%), *n* = 113 (95% CI)	Female (%), *n* = 135 (95% CI)	Total (%), *n* = 248 (95% CI)
Grades 1–4. No need.	71.7 (62.4–79.7)	67.4 (58.8–75.2)	69.3 (63.2–75.0)
Grades 5–7. Moderate need.	14.2 (8.3–21.9)	19.2 (12.9–26.9)	16.9 (12.5–22.2)
Grades 8–10. Definite need.	14.2 (8.3–21.9)	13.3 (8.1–20.2)	13.7 (9.7–18.6)

The mean DAI at 12 years ago was 23.32 (SD 6.05). The mean for boys was 22.82 (SD 6.19) and for girls 23.73 (SD 5.91). No statistically significant differences by gender were found (Student's *t*-test, $P = 0.24$). Table 3 shows the distribution of the four DAI treatment need grades; 13.3 per cent required orthodontic treatment (grades 3 and 4).

Discussion

There is no doubt that the extreme living conditions and the socio-sanitary deficiencies reduce the importance of orthodontic treatment need in this population, but the geographical and ethnic isolation, unlike in developed countries, makes this study noteworthy.

When interpreting the results, it should be noted that in the Sahrawi population, none of the children have been orthodontically treated. In most epidemiological studies, individuals with a previous or current history of orthodontic treatment are systematically excluded from the sample (Bernabé and Flores-Mir, 2006; Manzanera *et al.*, 2008). This leads to underestimation of the real treatment need of the population being studied, a fact that needs to be taken into account when making comparisons.

The percentage of the sample population needing orthodontic treatment according to the DAI was 13.3 per cent, with a mean score of 23.3 similar to the mean score of 24.6 in Malaysia (Esa *et al.*, 2001), 24.6 in Tanzania (Rwakatema *et al.*, 2007), and 26.1 in Spain (Manzanera *et al.*, 2008). Other studies have reported higher percentages such as in South Africa, where 53.3 per cent scored over 26 on the DAI (Van Wyk and Drummond, 2005), Peru, with a mean DAI of 28.8 (Bernabé and Flores-Mir, 2006), and Brazil, where the DAI more than 26 was 23 per cent (Marques *et al.*, 2007). A lower treatment need was only found in a study conducted in Nigeria, where the mean DAI was 22.3 (Otuyemi *et al.*, 1997).

In the present investigation, the percentage of the population requiring orthodontic treatment according to the modified IOTN was 28.6 per cent similar to the 23.5 per cent found in Spain (Manzanera *et al.*, 2008), the 30 per cent in Malaysia (Abdullah and Rock, 2001), and the 21 per cent in France (Souames and Bassigny, 2006). Other studies have reported higher percentages, such as 33 per cent in Northern Ireland (Nimri and Richardson, 2000) and 34 per cent in Jordan (Abu Alhaija and Al-Nimri, 2004).

In terms of the IOTN DHC, the 18.1 per cent result is similar to scores in Spain 21.8 per cent (Manzanera *et al.*, 2008), Iran 18.4 per cent (Hedayati *et al.*, 2007), and Jordan 25 per cent (Abu Alhaija and Al-Nimri, 2004). Higher IOTN DHC scores were found in Italy, 27.3 per cent (Perillo *et al.*, 2009), Malaysia, 47.9 per cent (Abdullah and Rock, 2001), Turkey, 38.8 per cent (Uncuncu and Ertugay, 2001), Sweden, 37 per cent (Josefsson *et al.*, 2007), and Senegal, 42.6 per cent (Ngom *et al.*, 2007). None of the studies reported significantly lower IOTN DHC scores.

As regards the IOTN AC, the present study's assessment of the aesthetic impact of malocclusion showed high values (13.3 per cent), as in Malaysia, where the figure was 22.8 per cent (Abdullah and Rock, 2001), whereas most studies found a lower orthodontic treatment need: 4.4 per cent in Spain (Manzanera *et al.*, 2008), 4.8 per cent in Turkey (Uncuncu and Ertugay 2001), 3 per cent in Jordan (Abu Alhaija and Al-Nimri, 2004), 2.3 per cent in Sweden (Josefsson *et al.*, 2007), 8.7 per cent in Iran (Hedayati *et al.*, 2007), and 4.11 per cent in Senegal (Ngom *et al.*, 2007). The reason for this difference is probably that this component is normally obtained from the aesthetic impact perceived by the children themselves rather than by the dentist. In the present study, particular occlusal features (ectopic teeth, traumatic overbites, or crossbite in posterior sectors) probably led the examiners who assessed the AC to overestimate the treatment need.

Conclusions

In spite of their difficult living conditions and geographical isolation, the Sahrawi population presented a similar orthodontic treatment need to those of European and Sub-Saharan populations, although bearing in mind the absence of any previous history of orthodontic treatment, the need might be slightly lower than in other epidemiological studies.

Table 3 Distribution and 95 per cent confidence interval (95% CI) of Dental Aesthetic Index (DAI) levels and orthodontic treatment need in the examined subjects.

DAI	Male (%), $n = 113$ (95% CI)	Female (%), $n = 135$ (95% CI)	Total (%), $n = 248$ (95% CI)
25 or less (grade 1). Normal or minor malocclusion; no treatment or slight need.	64.6 (55.0–73.4)	59.3 (50.5–67.6)	61.7 (55.3–67.7)
26–30 (grade 2). Definite malocclusion; treatment elective.	23.0 (15.6–31.8)	26.7 (19.4–34.9)	25.0 (19.7–30.8)
31–35 (grade 3). Severe malocclusion; treatment highly desirable.	7.1 (3.1–13.5)	11.1 (6.4–17.6)	9.2 (5.9–13.5)
36 or more (grade 4). Very severe malocclusion; treatment mandatory.	5.3 (1.8–11.2)	2.9 (0.8–7.4)	4.0 (1.9–7.2)

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