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Assessment of orthodontic treatment needs in Brazilian schoolchildren according to the Dental Aesthetic Index (DAI).

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Objective: To assess the distribution, prevalence and severity of malocclusion and orthodontic treatment needs in schoolchildren from the northeast of Brazil aged between 13 and 15 years. ***Research design:*** Cross-sectional study. ***Participants:*** A sample of 600 adolescents (264 males and 336 females) randomly selected and representative of schoolchildren living in Recife (Brazil) was obtained from 12 public schools. ***Method:*** The need for orthodontic treatment was measured using the Dental Aesthetic Index (DAI). ***Results:*** Most of the subjects (77%) were deemed to require orthodontic treatment. Only about 5.8% had a handicapping malocclusion that needed mandatory treatment. A severe malocclusion for which treatment was highly desirable was recorded in 47.5% of the adolescents and 23.7% had a definite malocclusion for which treatment was elective. Three main occlusal features were responsible for allocating subjects into the group of "orthodontic treatment required": crowding (47.3%), tooth loss (22.3%) and maxillary overjet of more than 3mm (21.8%). There were no significant differences ($p>0.05$) in mean DAI scores between males and females. ***Conclusions:*** 77% of adolescents from north-east Brazil were in need of orthodontic treatment for dental health reasons. The distribution of DAI scores among Brazilian adolescents is different from that reported in other populations. This study provides baseline data on the need and demand for orthodontic treatment among Brazilian students.

Key words: Dental Aesthetic Index (DAI), malocclusion, treatment need

Introduction

Although data on orthodontic awareness and treatment needs are still scarce in the northeast of Brazil, malocclusion is undoubtedly a public health concern in the Brazilian population (Brazilian Ministry of Health, 2004; Stiz, 2000) and in other countries (Baca-Garcia *et al*., 2004; Abdullah and Roch, 2001; Otuyemi *et al*., 1999; Estioko *et al*., 1994). High rates of premature tooth extractions, no concern being shown for the maintenance of space, and extensive untreated caries lesions contribute decisively to making these figures even worse (Birkeland *et al*., 1996).

Whilst the literature abounds in the physical characteristics of malocclusion in some locations of Brazil (Oliveira 2001), it is quite difficult from such data to estimate the proportion of the population that requires orthodontic treatment. This is due partly to the multiplicity of measurement methods and the difficulty in standardizing criteria (Otuyemi *et al*., 1999).

A variety of occlusal indices have been developed to categorize the treatment of malocclusion in groups according to urgency and the need for treatment (Otuyemi and Jones, 1995). The place of aesthetic and functional criteria in determining orthodontic treatment needs cannot be underestimated as these are major indications for patients seeking orthodontic services (Onyeaso and Aderinokun, 2003). Dental appearance that deviates from social norms may have a negative impact on social and psychological functions. The Dental Aesthetic Index (DAI), developed by Cons *et al*. (1986), links clinical and aesthetic components mathematically to produce a single score that combines physical and aesthetic aspects of occlusion, including patient perception. A previous report has demonstrated the high reliability and validity of this index (Cons *et al*., 1986), which also compares favourably with other indices (Beglin *et al*., 2001; Otuyemi and Noar, 1996). When tested against other indices, the DAI was more versatile, time-saving and simple to use (Otuyemi and Noar, 1996). This index can be used for different communities and populations without requiring any modification (Estioko *et al*., 1994).

In 1997 the World Health Organization published a description of the DAI as a cross-cultural index (Onyeaso and Aderinokun, 2003), which outlines criteria for the assessment of dentofacial anomalies. With the DAI, the WHO has attempted to establish a simple universally acceptable index which can be used in epidemiological surveys to assess unmet orthodontic treatment needs and as a screening tool for determining priority for orthodontic care in publicly financed programmes.

Despite the Ministry of Health (2004) pointing to the increased percentage of the Brazilian population having access to a fluoridated water supply and fluoridated toothpastes, these two measures in isolation cannot be regarded as sufficient for improving the condition of the oral health of the population, particularly with regard to occlusal pathology. In view of this an epidemiological assessment of malocclusion is very important in order that the appropriate actions can be taken for the prevention and treatment of such diseases. Knowledge of the epidemiological status of malocclusion is necessary for the planning and execution of such measures.

Considering the importance of assessing the need for orthodontic treatment in children and adolescents and the paucity of Brazilian studies on the subject, especially in

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the northeast region, the aim of this study was to evaluate the distribution, prevalence and severity of malocclusion and orthodontic treatment needs in a sample of 13-15-year-old schoolchildren from the urban zone of Recife, one of the largest and most populous cities in the northeast of Brazil with almost 1,500,000 inhabitants, (IBGE, 2004), using the DAI. These data would allow comparison with previous and subsequent studies.

Materials and Methods

Subjects

This study was conducted in 12 municipal public schools in different districts of the city of Recife, selected by sampling from a list of all the municipal schools supplied by the Department of Education. The study population consisted of 600 schoolchildren from different ethnic groups, comprising 264 boys (44%) and 336 girls (56%), in the phase of permanent dentition, whose ages ranged from 13 to 15 years at the time of the clinical examination. Subjects were selected by drawing from a list containing all the schoolchildren at the relevant ages in each of the participating schools. No differentiation was made in terms of social class as those attending public schools in Brazil are from families from the less privileged social strata, having a low purchasing power.

For calculating the sample the following parameters were employed: 4% margin of error, confidence interval of 95% and an estimated 50% prevalence of malocclusions. Individuals presenting a previous history of orthodontic or orthopedic treatment, those undergoing treatment or with syndromes and those whose complete permanent dentition did not include at least the first permanent molar at the time of the clinical examination, were excluded from the study.

In order to obtain the list of all schools in Recife contact was made with the city's Education Council. Ethical approval was obtained from the Ethics Committee of the Federal University of Pernambuco. In addition, a letter was sent to the parents/guardians of the participants to seek their informed consent for their cooperation in this study. This letter also served to inform the parents/guardians about the examination procedures and to assure them of the confidentiality of any information collected. Only those whose parents/guardians had agreed to their participation were included in the study.

All data on malocclusion were collected by one dentist (the author C.R.M.) and calibrated at the Federal University of Rio Grande do Norte (Brazil). Intra-examiner variability was checked through a duplicate examination of 10% of the sample (60 subjects).

Each subject was examined and scored for the ten components of the DAI (Table 1), according to the standard conventions (Cons *et al*., 1986). Distance was measured in whole millimeters using WHO periodontal probes and wooden spatulas. The examiner used gloves and mask throughout the clinical examinations. The subjects were examined at school during class hours in a predetermined order.

Data analysis was carried out on a personal computer using the Statistical Package for Social Sciences (SPSS) software for Windows, Version 10. The chi-square test was used to test the distribution differences between the genders.

The Dental Aesthetic Index (DAI) is an orthodontic index based on socially defined aesthetic standards (Cons *et al*., 1986). It is useful both in epidemiological surveys to identify unmet need for orthodontic treatment and as a screening device to determine priority for public orthodontic treatment. This index integrates the psychosocial and physical elements of malocclusion. It is a regression equation that mathematically links the public's perception of dental aesthetics with the objective physical measurements of the occlusal traits associated with malocclusion. The components of DAI regression equation are shown in Table 1.

The logical regression equation, shown below, results in a numerical value that, according to the creators of the index, indicates the need for treatment as follows: up to 25 points: no treatment need; 26-30 points: treatment elective; 31-35 points: treatment highly desirable; 36 points or more: treatment mandatory.

Dai Regression Equation

(missing theeth x 6) + (crowding) + (spacing) + (midline diastema x 3) + (anterior irregularity on the maxilla) + (anterior irregularity on the mandible) + (anterior maxillary overjet x 4) + (anterior mandibular overjet x 4) + (vertical anterior openbite x 4) + (antero-posterior molar relation x 3) + 13 = score

Table 1. Components of the DAI regression equation (Cons *et al*. , 1986)

DAI components
1. Number of missing visible teeth (incisors, canines and premolars teeth in the maxillary and mandibular arches)
2. Crowding in the incisal segments: 0 = no segments crowded, 1 = 1 segment crowded, 2 = 2 segments crowded
3. Spacing in the incisal segment: 0 = no spacing, 1 = 1 segment spaced, 2 = 2 segments spaced
4. Midline diastema (mm)
5. Largest anterior irregularity on the maxilla (mm)
6. Largest anterior irregularity on the mandible (mm)
7. Anterior maxillary overjet (mm)
8. Anterior mandibular overjet (mm)
9. Vertical anterior openbite (mm)
10. Antero-posterior molar relation: 0 = normal, 1 = ½ cusp, 2 = one full cusp

Results

A high level of reliability in applying the DAI was achieved by the examiner. A Kappa value of 0.90 indicated excellent agreement.

Table 2 shows the distribution of the 600 subjects by age and gender, according to orthodontic treatment need. As may be seen in the table, the majority of the schoolchilren were classified in the category "treatment elective". When we compared the need for treatment between males and females in each age group, we noted that in the subjects aged 13 and 14 years the total classified as "no treatment need" was greater for the females, while the treatment considered "elective" was more frequent among the males. On the other hand, among 15-year-olds the elective treatment was more frequent among the females, while the lack of need for treatment was more common among the males. However, the associations found were not regarded as statistically significant ($p< 0.05$).

Table 3 presents the distribution of the treatment needs in the entire population sample according to the DAI. Most of the subjects (77%) had a dental appearance that required orthodontic treatment. Only 5.8% had a handicapping malocclusion that needed mandatory treatment. A severe malocclusion with treatment being highly desirable was recorded in 47.5% of the subjects and 23.7% had a definite malocclusion with treatment being elective. No need for treatment or a "slight need" was observed in 23% of the subjects.

Three main occlusal features were responsible for allocating subjects into the group of "orthodontic treatment required": crowding (47.3%), tooth loss (22.3%) and maxillary overjet greater than 3mm (21.8%).

Discussion

The results of the present study were evaluated bearing in mind the limitations of Brazilian public dental services regarding the access of the low-income population to appropriate treatment of malocclusions. Currently, particularly in the northeast region of Brazil, only the universities possess the resources, albeit limited ones, to act in the prevention and treatment of the problem. Thus the execution of epidemiologic studies and dissemination of data such as that of the present study, in addition to identifying the prevalence and seriousness of the problem in the population, seek to advocate the need to include an orthodontic focus in the public dental services provided in Brazil.

The results of this study demonstrate a high prevalence of occlusal conditions in adolescents (77% of those analyzed) in Recife, one of the main urban centers in the northeast region of Brazil. Despite the existence of other publications in Brazil revealing quite a high prevalence of malocclusion in schoolchildren, such as the studies published by Brazilian Ministry of Health (2004), among others, it is difficult to compare and contrast their findings, in part because of the varying methods and indices used to assess and record occlusal relationships. Other variables, including age differences of the study populations, examiner subjectivity, specific objectives and differing sample sizes, further complicate efforts to understand and appreciate the differences recorded (Silva and Kang, 2001).

Our results revealed no statistically significant differences in the DAI values between males and females. This is in agreement with other studies published in Brazil (Frazão *et al*., 2002 and Pires *et al*., 2001) and in other countries (Baca-Garcia *et al*., 2004; Otuyemi *et al*., 1999). Those results, however, are at variance with those of Esa *et al*., 2001. The latter, in analyzing the need for orthodontic treatment in 1,519 Malaysian schoolchildren aged 12 and 13 years, found a positive association between the DAI scores and the gender of the individuals studied.

The findings of the present study showed that northeast Brazilian adolescents had DAI scores higher than those reported in other populations. This indicates a greater need for orthodontic treatment among northeast Brazilian students (23.7% with definite malocclusion, 47.5%

Table 2. DAI Index Orthodontic Treatment Need according to gender and age (NTN = no treatment need; Elect = treatment elective; HD = treatment highly desirable or mandatory)

	13		*14*		*15*		
	M	*F*	*M*	*F*	*M*	*F*	*Total*
n	132	177	84	98	48	61	600
NTN (%)	19.7	24.9	17.9	22.4	29.2	27.9	23.0
Elect (%)	75.8	68.9	76.2	71.4	64.6	65.6	71.2
HD (%)	4.5	6.2	6.0	6.1	6.2	6.6	5.8

Table 3. Orthodontic treatment needs of Brazilian schoolchildren according to the DAI.

DAI score	*Severity levels*	*Frequency*	*%*
< or = 25	Minor or no anomaly / no treatment needed	138	23.0
26-30	Definite malocclusion / treatment elective	142	23.7
31-35	Severe malocclusion / treatment highly desirable	285	47.5
> or = 36	Handicapping malocclusion / treatment mandatory	35	5.8
	TOTAL	600	100.0

with severe malocclusion and 5.8% with handicapping malocclusion. While most of the schoolchildren analyzed in this research (77%) had a dental appearance that required orthodontic treatment, most of the schoolchildren and adolescents from other countries in studies where the DAI has been used required no treatment such as those of Baca-Garcia *et al* (2004), in Spain (58.6%), Esa *et al*. (2001) in Malaysia (62.4%), Estioko *et al*. (1994) in Australia (63.4%), and Otuyemi *et al*. (1999) in Nigeria (77.4%). However, the proportion of the subjects with severe handicapping malocclusion was lower in the northeast Brazilian subjects than that observed in other populations.

Differences observed in DAI scores could be attributed to genetic predisposition, cross-cultural differences in living standards or variation in growth and facial skeleton development (Esa *et al*., 2001; Katoh *et al*., 1998). But, it could also be attributed to the high level of premature tooth extractions in children, no concern being shown for the maintenance of space, and to extensive untreated caries lesions (Birkeland *et al*., 1996). Our results revealed a high percentage of tooth loss (22.3%).

One important factor to be emphasized is the fact that the dearth of funds to be applied in public health policies, particularly oral health, makes it necessary to restrict the available treatment to the most serious cases. As a result, we argue that priority treatment be afforded to persons with malocclusions deemed to be incapacitating, (5.8% of the schoolchildren analyzed), bearing in mind that Brazil's current social, political and economic situation makes it impossible for us to be more optimistic concerning the feasibility of a more comprehensive provision.

In conclusion, this study provides baseline data on the need for orthodontic treatment among Brazilian adolescents, which is important for the planning of public orthodontic and other dental services. The distribution of DAI scores among Brazilian adolescents is different from that reported in other populations. In general, Brazilian adolescents were found to have worse dental aesthetics than other populations. Certainly, emphasis should be laid on proper preventive and/or interceptive services to meet demands related to gross functional impairments.

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