

# Orthodontic Treatment Need in Peruvian Young Adults Evaluated Through Dental Aesthetic Index

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**Abstract:** The objectives of this study were to evaluate the frequency and severity of the malocclusion and treatment needs in Peruvian young adults. The second aim was to compare the orthodontic treatment needs according to sex and socio-economic status (SES). This cross-sectional study was conducted at the University Dental Clinic of a private university in Lima, Peru. A total of 267 freshmen (from 16 to 25 years old) were randomly selected from a pool of 780 students. Students wearing an orthodontic appliance or reporting a history of orthodontic treatment were excluded from the study. Clinical examinations were conducted using the Dental Aesthetic Index (DAI). Mann-Whitney and Kruskal-Wallis tests were used to compare the DAI scores according to sex and SES, respectively. The mean DAI score was 28.87 points (IC<sub>95%</sub> 27.77; 29.97, where IC indicates interval of confidence). Around one-third of the sample presented severe or very severe malocclusion, which implies a highly desirable or mandatory orthodontic treatment need. No statistically significant difference was found between the DAI scores according to sex ( $P = .592$ ) and SES ( $P = .397$ ). Approximately one-third of the evaluated Peruvian young adults would need orthodontic treatment according to the DAI. In this population, malocclusion was characterized by a relatively high frequency of missing teeth, appreciable dental crowding, and inadequate anteroposterior relationships. (*Angle Orthod* 2006;76:417–421.)

**Key Words:** Malocclusion; Orthodontic treatment need; Peru; Young adults

## INTRODUCTION

Because of the increasing importance of esthetic considerations and dental appearance, lay people are strongly motivated to seek orthodontic treatment.<sup>1,2</sup> On the basis of these concepts, dental public health administrators and dental epidemiologists need an epidemiological tool to rank dental esthetics and orthodontic treatment needs on a scale of social norms for a socially acceptable dental appearance.<sup>3</sup> The Dental Aesthetic Index (DAI) was developed for this purpose, linking mathematical, objective, clinical, and subjective esthetic factors to produce a single score that reflects both aspects of the malocclusion.<sup>4,5</sup>

The DAI allows orthodontic public health or orthodontic insurance programs to screen and identify persons eligible for such programs on the basis of their objective and subjective esthetic needs. This allows better use of the limited available resources.<sup>6,7</sup>

Although several criteria have been described for an ideal index, the most important are validity and reliability.<sup>2,8</sup> Since its development in 1986,<sup>4</sup> the DAI has proven to be reliable and valid as well as a simple and easily applied index. Several studies have demonstrated the DAI validity,<sup>9–12</sup> and its reliability has also been corroborated,<sup>11</sup> even among dental assistants,<sup>4,9</sup> and this encourages its use as a screening tool by dental auxiliaries. This will allow a decrease of initial consultations by dentists or orthodontists employed in public programs, with the consequent improvement in the efficiency of the use of human resources.<sup>9</sup> Besides, the DAI has been adopted by the World Health Organization (WHO) as a cross-cultural index<sup>13</sup> and has been applied among diverse ethnic groups without modification.<sup>6,7,14–16</sup> All these reasons made it a suitable epidemiological index for using in developing countries, which lack a specifically developed orthodontic treatment need index.<sup>6</sup>

Although some studies have been conducted pre-

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**TABLE 1.** Distribution of the Orthodontic Treatment Need of Peruvian Young Adults ( $n = 267$ ) According to the DAI Scores<sup>a</sup>

DAI Scores	Treatment Category	Severity Levels	n	%
≤25	No treatment need or slight need	Normal or minor malocclusion	112	41.9
26–30	Treatment elective	Definite malocclusion	68	25.5
31–35	Treatment highly desirable	Severe malocclusion	40	15.0
≥36	Treatment mandatory	Very severe (handicapping) malocclusion	47	17.6

<sup>a</sup> DAI indicates Dental Aesthetic Index.

viously in young adults, primarily in those countries where orthodontic treatment is publicly funded,<sup>16–19</sup> epidemiological assessment of malocclusion and its associated treatment need have received little attention in developing countries, including Peru. Nevertheless, malocclusion is undoubtedly a public health concern in any country.<sup>18,20</sup>

In this cross-sectional study, the DAI was used to assess the frequency and severity of the malocclusion and the associated orthodontic treatment need in Peruvian young adults as well as their distribution according to sex and socio-economic status (SES).

## MATERIALS AND METHODS

A total of 267 university freshmen (from 16 to 25 years old) were randomly selected from a pool of 780 students admitted to a private university in Lima (Peru) in 2002. The final sample size was calculated to have a 95% power ( $\beta = 0.05$ ) to obtain an orthodontic treatment need estimation equal or greater than 20% at the 5% level ( $\alpha = 0.05$ ). Approval to conduct this study was received from the university ethical board, and all recruited students signed a consent letter. Students were excluded from the study if they wore an orthodontic appliance or reported a history of previous orthodontic treatment.

The data collection was divided in two parts (an interview and an occlusal examination). During the interviews, students stated their university tuition fee scale as an indirect measure of their SES. In this Peruvian university, students pay different tuition fees according to a socio-economic evaluation corroborated by a university social worker. An ordinal scale of three categories was available (low, medium, and high SES).

Thereafter, a clinical examination was carried out at the University Dental Clinic by one calibrated examiner according to the method recommended by WHO.<sup>13</sup> The DAI consists of 10 occlusal traits related to dentofacial anomalies according to the three components of dentition, spacing-crowding, and occlusion.<sup>4,13</sup> Scores for each component were multiplied by a previously reported weight,<sup>4,13</sup> and a constant was added to obtain a final DAI score for each student.

The calibration process was conducted before the

study to guarantee reliable data collection. Ten students were examined twice, on successive days by the same experienced orthodontist to calculate the intraexaminer reliability. The attained reliability (0.85, intraclass correlation coefficient) was in agreement with the recommended standards.<sup>13</sup>

DAI scores were not normally distributed as was determined by the Shapiro-Wilks test ( $P < .015$ ). Therefore, the statistical analysis included the comparison of the DAI scores according to sex through the Mann-Whitney test and according to the SES using the Kruskal-Wallis test.

Finally, each DAI component was compared according to sex and SES, using the chi-square test for the qualitative DAI components and the Mann-Whitney or Kruskal-Wallis test for the quantitative DAI components.

## RESULTS

The study sample consisted of 267 freshmen students, from which 56.9% were male and 43.1% female. The mean age of the evaluated students was 17.90 years ( $IC_{95\%}$  17.73; 18.06, where IC indicates interval of confidence) with the majority of them (81.3%) between 17 and 19 years old. In addition, the frequency of students in the low SES (52.4%) was higher than in the medium (41.2%) and high (6.4%) SES.

The mean DAI score was 28.87 points ( $IC_{95\%}$  27.77; 29.97), and more than two-fifths of the students (41.9%) were classified as not requiring orthodontic treatment. By dichotomizing the study sample according to the cutoff point recommended by the authors (DAI score  $\geq 31$ ),<sup>5</sup> 32.6% of the students required orthodontic treatment (Table 1). The distribution of the 10 components evaluated for obtaining the DAI score is shown in Table 2. Dental crowding was the most common malocclusion sign.

When the DAI scores were compared according to sex and SES, no statistically significant difference was found between groups ( $P = .592$  and  $P = .397$ , respectively). Subsequent analysis of each DAI component also did not reveal differences between sex and SES ( $P > .175$  and  $P > .219$ , respectively).

**TABLE 2.** Malocclusion Traits of Peruvian Young Adults Evaluated for the DAI (n = 267)<sup>a</sup>

DAI Component		n	%
Missing teeth	≥1	44	16.5
Crowding (incisal segments)	0	25	9.4
	1	77	28.8
	2	165	61.8
Spacing (incisal segments)	0	200	74.9
	1	59	22.1
	2	8	3.0
Midline diastema (mm)	≥1	35	13.1
Anterior maxillary irregularity (mm)	0	88	32.9
	1–2	115	43.1
	≥3	64	24.0
Anterior mandibular irregularity (mm)	0	39	14.6
	1–2	130	48.7
	≥3	98	36.7
Maxillary overjet (mm)	0–3	212	79.4
	≥4	55	20.6
Mandibular overjet (mm)	>0	7	2.6
Open bite (mm)	>0	5	1.9
Molar relationship	normal	128	47.9
	one half cusp	95	35.6
	one full cusp	44	16.5

<sup>a</sup> DAI indicates Dental Aesthetic Index.

## DISCUSSION

This study was carried out in Peru, a South American country with a population of approximately 27 million people and an area of 1,285,215 square kilometers.<sup>21</sup> These figures may give a false idea of an even distribution of the population around the country, but there is an actual large concentration in the main cities. Lima, the capital, has around one-half of the total population.<sup>21</sup> Peruvian demographic characteristics show that this situation is very similar to that of other developing countries.

Although it is expected that a significant number of Peruvian young adults should receive orthodontic treatment because of the associated health risks with malocclusion,<sup>18</sup> unfortunately, not many of them have access to such services. This is probably because of two primary reasons. First, the number of registered orthodontic specialists in Peru is very low and almost all of them practice in Lima. In fact, an orthodontist/population ratio of approximately 1/450,000 exists in Lima, which is not high enough to cover all the possible orthodontic treatment needs. Second, orthodontic concern is still given a low priority in the oral health care system in Peru. Although there is a public health system, the lack of resources makes the funds available for dentistry scarce. Hence, orthodontic services are not readily available and accessible to the general population. At present, orthodontic care is only provided on the basis of paid service by the few trained specialist orthodontists, which makes it expensive and unaffordable for most Peruvians.

The DAI was selected for this study because it com-

bines both the objective occlusal and the subjective esthetic aspects of the occlusion.<sup>4,11</sup> The support of the DAI, as a cross-cultural index by the WHO,<sup>6,7,13–16</sup> is its relative simplicity and high reliability and therefore a widely used index.<sup>22</sup> Several studies have suggested that the DAI can be universally applied without the need for modifications or adaptations to different ethnic or cultural settings;<sup>7,14–16</sup> it has been reported to assess orthodontic treatment need both in developed and developing countries.<sup>6</sup>

Although the DAI has been broadly used to determine orthodontic treatment need in epidemiological studies around the world over recent years, it has not been used to estimate the prevalence of malocclusion and orthodontic treatment need in South American populations. Because consciousness of body image increases from childhood to young adulthood, young adults are considered to be a relevant age group for the study of perception of personal dental appearance.<sup>1</sup>

Different cutoff points (threshold decision to treat) on the DAI score have been proposed to prioritize orthodontic care needs. Initially, Jenny et al<sup>10</sup> suggested a 36 cutoff point to predict handicapping malocclusion. However, the same authors later proposed a 31 cutoff point to determine the number of individuals who require treatment.<sup>5</sup> Later Keay and Freer<sup>23</sup> and Beglin et al<sup>12</sup> suggested revising the cutoff point to 32.5 and 28, respectively.

According to the last cutoff point suggested by Jenny and Cons<sup>5</sup> and Jenny et al,<sup>10</sup> approximately one-third of the evaluated Peruvian young adults had a

score above 31 points, suggesting highly desirable or mandatory orthodontic treatment. Objectively, 17.6% of the sample needed mandatory treatment and could be deemed qualified for publicly subsidized orthodontic treatment. To our knowledge, the DAI has not been used to evaluate the orthodontic treatment need in other young adult populations, except in Nigeria where two-fifths of late adolescents/young adults (16–25 years)<sup>19</sup> had a highly desirable or mandatory orthodontic treatment need.

Obviously, different cutoff points will exhibit different proportions of the population requiring orthodontic treatment. This inconvenience could be avoided if the actual continuous DAI score is used in which the higher the DAI score for an individual, the higher the orthodontic treatment need. If it is only possible to treat a determined number of individuals, the cutoff point selected may need to be adjusted, sometimes within a single category, so that the provision of treatment would correspond to the available resources.<sup>2</sup> When thresholds are set and applied within a public health program, inappropriate cases may be placed in the treatment group.<sup>24,25</sup>

Comparison with other previously published studies demonstrated that the mean DAI score for the evaluated young adults (28.87) was lower than that in Japanese young adults (30.1),<sup>17</sup> but higher than those reported for Nigerian (22.32),<sup>18</sup> Chinese (25.9),<sup>17</sup> and Spanish young adults (25.6).<sup>16</sup> These studies had similar age groups and methodologies.

An analysis of the DAI components sheds some light on which malocclusion traits are more commonly present and where the differences are compared with other populations. This analysis suggested that malocclusion in these Peruvian young adults can be characterized by a relatively high frequency of missing teeth, significant dental crowding, and inadequate posterior occlusal relationships (Table 2).

Only two previous studies reporting analysis by components could be found.<sup>16,18</sup> Differences in some of the DAI components help explain the differences in the DAI scores reported in the Peruvian, Spanish,<sup>16</sup> and Nigerian<sup>18</sup> young adults. The Peruvian young adults appear to have higher orthodontic treatment needs than the previously reported populations.

In the Spanish<sup>16</sup> and Nigerian<sup>18</sup> populations, the frequency of individuals presenting at least one missing tooth was lower (3.7% and 3.5%, respectively) compared with the one reported here (16.5%). The higher frequency of missing teeth in the Peruvian young adults could be a reflection of the limited access to publicly funded dental care. The lack of economic resources could motivate people to elect the least expensive treatment to solve their dental health problems.<sup>21</sup>

**TABLE 3.** Comparisons of DAI Scores According to Sex and SES in Peruvian Young Adults (n = 267)<sup>a</sup>

Variable	n	%	DAI Score		P Value
			Mean	IC of 95%	
Sex					
Male	152	56.9	29.05	(27.62; 30.48)	.592
Female	115	43.1	28.64	(26.90; 30.39)	
SES					
High	17	6.4	26.06	(23.47; 28.65)	.397
Medium	110	41.2	30.56	(29.01; 30.65)	
Low	140	52.4	29.11	(27.46; 30.75)	

<sup>a</sup> DAI indicates Dental Aesthetic Index; SES, Socio-economic status; IC, interval of confidence.

Dental crowding in at least one dental arch was reported in 33.6% of Nigerians<sup>18</sup> and in 76.3% of Spanish young adults,<sup>16</sup> percentages that were smaller than the ones reported in this study (90.6%). The frequency of Peruvian young adults with an anterior irregularity greater than 1 mm was almost similar to the Spanish but much higher than that in Nigerian young adults. Jenny et al<sup>3</sup> have suggested that inheritance differences in tooth size and arch size may be one reason for differences in DAI scores because the DAI includes measurements of the most relevant orthodontic traits that affect dental esthetics, such as crowding.

When posterior occlusal relationships were compared between the three populations, molar relations other than Class I were higher in Peruvian (52.1%) than in Nigerian or Spanish young adults (16.2% and 43.3%, respectively). Possibly, the greater number of missing teeth in Peruvians explains the aforementioned difference. It is also a known fact that the loss of one tooth may cause the migration of the antagonist and the contiguous teeth creating occlusal alterations.<sup>26,27</sup>

As expected, differences in the mean DAI scores according to sex and SES were not found, which agrees with previous reports in young adults<sup>16–18</sup> (Table 3).

Although several studies have emphasized that one disadvantage of the DAI is the lack of records about certain features, which may be a strong indication of treatment need like midline discrepancy, increased overbite, or buccal crossbite;<sup>8,28,29</sup> it has to be understood that the DAI identifies certain occlusal features, which constitute esthetic impairment.<sup>4</sup> Therefore, this index could overestimate treatment need in some cases, but it has the advantage of being simple and fast to use,<sup>11,30</sup> highly reliable,<sup>9,11,23</sup> and requires less professional knowledge of occlusal traits than other indexes reported in the literature.<sup>11,29,30</sup> For all these reasons, the DAI may be considered the most appropriate



orthodontic treatment need index for conducting epidemiological studies in developing countries.

## CONCLUSIONS

- Almost one-fifth of the evaluated population would have a mandatory need for orthodontic treatment, if the DAI scores are used as the main criterion for such decisions. If the highly desirable category is included, the need would increase to one-third of the sample.
- In this population, malocclusion was characterized by a relatively high frequency of missing teeth, appreciable dental crowding, and inadequate posterior occlusal relationships.

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