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# ORTHODONTIC TREATMENT NEEDS OF BRAZILIAN 12-YEAR-OLD SCHOOLCHILDREN

**Aim:** To assess the orthodontic treatment need of 12-year-old Brazilian school children using the Index of Orthodontic Treatment Need (IOTN). **Methods:** One experienced examiner evaluated the IOTN's dental health component (DHC) and its esthetic component (EC) in 1,182 individuals from 50 randomly selected state schools of Rio de Janeiro. He also requested that these students score their own EC (self-perception). **Results:** The DHC showed that 51.1% of the children had no/little need, while 26.7% had a need/high need/priority for orthodontic treatment. There was no significant difference between the two sexes ( $P = .156$ ). According to the EC, esthetics were good in 59.1% of the children, borderline in 32.7%, and unattractive in 8.1%. The self-perception of the EC showed that 89.0% judged themselves as having good esthetics, with girls significantly more critical than boys ( $P = .035$ ). The statistical correlation between EC (examiner) and EC (children) was low (kappa coefficient = .13). **Conclusions:** About half of the scored Brazilian 12-year-old schoolchildren had no/little need for treatment. Orthodontists were more critical in their esthetic evaluation than the children themselves, with girls being more critical in self-perception than boys. World J Orthod 2009;10:305–310.

**Key words:** dental health component, esthetic component, IOTN, occlusal indices, treatment need

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## CORRESPONDENCE

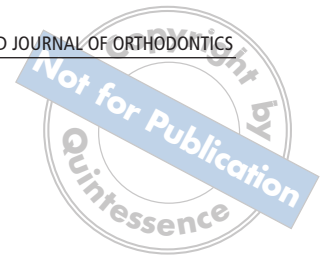
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For many years, occlusal indices have been widely used to uniformly evaluate orthodontic treatment need.<sup>1,2</sup> Several indices have been developed to categorize malocclusions into groups that reflect the level of treatment need. Assessing treatment need is indispensable for public health purposes and specialist-training programs.<sup>3</sup> Such data is limited for the Brazilian population.<sup>4</sup> Most of the published data deal with specific occlusal traits, which makes comparisons difficult and provides little information about treatment need.

The Index of Orthodontic Treatment Need (IOTN) incorporates two components: a dental health component (DHC), based on the recommendations of the Swedish Medical Board,<sup>5</sup> which ranks

five progressive levels of occlusal irregularities, and an esthetic component (EC), which grades dental attractiveness based on a set of 10 color photographs. Grade 1 represents the most attractive and grade 10 the least attractive appearance.<sup>6</sup> Since its introduction, the IOTN has been widely applied by orthodontists the world over.<sup>7,8</sup> The reproducibility and validity of the IOTN is approved, which enforces its use.<sup>1,9,10</sup>

Although dissatisfaction with dental appearance is related to the severity of occlusal irregularities,<sup>11,12</sup> there are differences in the recognition and evaluation of dental features.<sup>13</sup> Previous investigations have suggested that dental professionals have a more critical view of malocclusions than laypersons, when



considering treatment in conditions acceptable to laypersons.<sup>7,11,12,14-18</sup> Additionally, ranking dental attractiveness is subjective and may be related to the judge's background, with differences among patients' self-perception usually related to sex,<sup>12,19-21</sup> age,<sup>22-24</sup> ethnicity, and cultural conditions.<sup>25</sup>

The aims of this study were to evaluate the orthodontic and esthetic treatment need, as well as the self-perception, of 12-year-old schoolchildren from Rio de Janeiro.

## METHODS

One thousand two hundred and fifty 12-year-old schoolchildren from 50 state schools in Rio de Janeiro were evaluated. These schools were randomly selected from all 390 Rio de Janeiro schools in this age group, respecting the city's regions' ratios. Twenty-five children were chosen from each class independent of their sex. Sixty-eight (5.4%) were undergoing or had undergone orthodontic treatment. Subsequently, they were excluded from the sample, bringing the final number to 1,182. Of these, 550 (46.5%) were male and 632 (53.5%) female, with no significant difference between sexes ( $P = .93$ ).

Permission to undergo the survey was obtained from the city of Rio de Janeiro's education department, each school, and each child's parent. Each party was asked to consent to their child's cooperation in the study through an informative letter including a consent form that was approved by the Ethics Research Committee of the authors' university.

One examiner (who had been previously trained in the use of the IOTN index at the University of Manchester) carried out the screening. He was evaluated on a set of 30 plaster casts previously examined (gold standard). To test his (intra-examiner) reliability, these casts were re-examined after 7 days.

The complete investigation was carried out in natural light using a mouth mirror. No radiographs, study casts, or written records were used. All occlusal anomalies of the DHC were recorded and

scored separately on an individual form. The DHC grade was then determined according to the highest scoring anomaly. The EC score was evaluated by both the investigator and each individual.

For the DHC, 10 malocclusions/symptoms were considered: overjet, anterior crossbite, overbite, open bite, lateral crossbite, displacement of teeth, clefts of lip or palate, Class II, Class III buccal occlusion, and hypodontia. The EC complements the DHC by assessing the appearance of the anterior tooth alignment.<sup>2</sup>

The DHC of the IOTN has five grades, while the EC has 10. DHC grades 1 to 2 and EC grades 1 to 4 represent no/little need for treatment, DHC grade 3 and EC grades 5 to 7 correspond to a moderate or borderline need for treatment, and DHC grades 4 to 5 and EC grades 8 to 10 represent a high need/priority for treatment.<sup>2</sup>

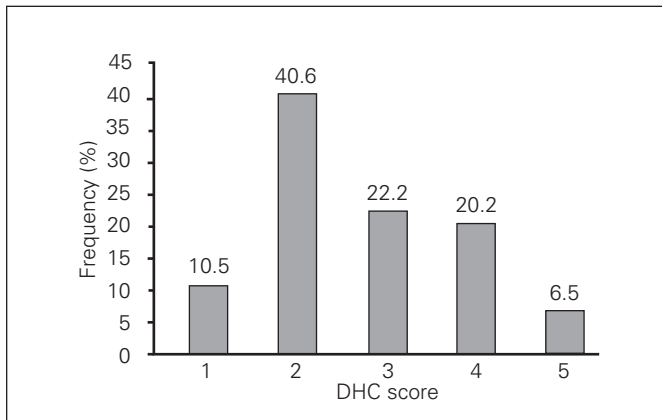
Data analysis was performed using SPSS 9.0, SPSS. The chi-square test was used to analyze qualitative data and determine differences in treatment need among subgroups. The significance level was set at .05. The agreement evaluation between the examiner scores and standard scores (gold standard) and intra-examiner reliability were analyzed with kappa statistics.

## RESULTS

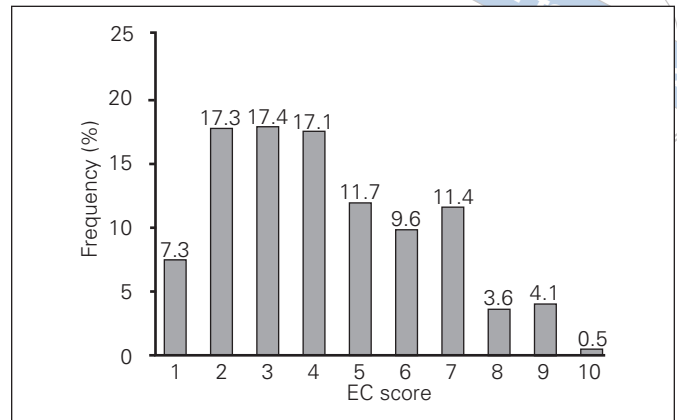
In the examiner gold-standard evaluation, good agreement was found for DHC (kappa = .73) and EC (kappa = .72). Intra-examiner reliability had a kappa of .92, indicating a substantial agreement.<sup>5</sup>

According to the IOTN-DHC, 51.1% of the children had no/little need for treatment, 22.2% had a moderate/borderline need, and 26.7% a high need/priority for treatment (Fig 1). There was no significant difference between the sexes ( $P = .156$ ).

According to the IOTN-EC (examiner), 59.2% of the children had no/little need for treatment, 32.7% had a moderate/borderline need, and 8.1% a high need/priority for treatment (Fig 2). Again, there was no significant difference between the sexes ( $P = .279$ , Table 1).



**Fig 1** Perceptual frequency of the five DHC scores.

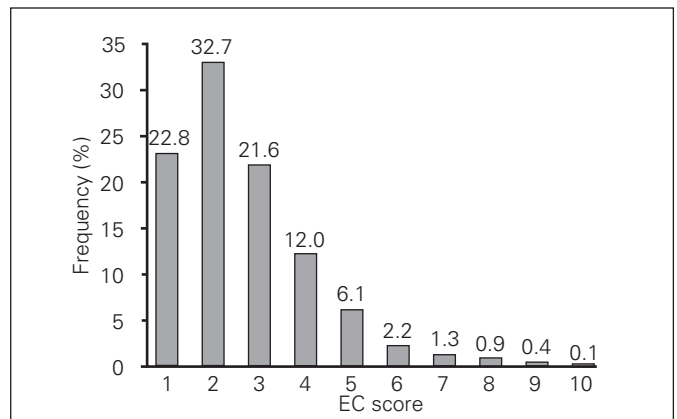


**Fig 2** Perceptual frequency of the 10 ECs (examiner).

**Table 1** IOTN-EC examiner categorization according to sex

EC	Female		Male		Total	
	n	%	n	%	n	%
1-4 (No/little need)	386	61.1	313	56.9	699	59.1
5-7 (Moderate/borderline need)	200	31.6	187	34.0	387	32.7
8-10 (High need/priority for treatment)	46	7.3	50	9.1	96	8.1
Total	632	100.0	550	100.0	1,182	100.0

n = number of individuals.



**Fig 3** Perceptual frequency of the 10 ECs (children).

**Table 2** IOTN-EC children categorization according to sex

EC	Female		Male		Total	
	n	%	n	%	n	%
1-4 (No/little need)	575	91.0	477	86.7	1052	89.0
5-7 (Moderate/borderline need)	48	7.6	65	11.8	113	9.6
8-10 (High need/priority for treatment)	9	1.4	8	1.5	17	1.4
Total	632	100.0	550	100.0	1,182	100.0

n = number of individuals.

According to the IOTN-EC (children) 89.0% had no/little need for treatment, 9.6% had a moderate/borderline need, and 1.4% a high need/priority for treat-

ment (Fig 3). A significant difference was identified between the sexes ( $P = .035$ , Table 2), revealing that girls were more critical in their esthetic self-perception.

**Table 3 Relationship between examiner-assessed EC and DHC scores**

DHC score	EC score			Total
	1-4 (No/little need)	5-7 (Moderate/borderline need)	8-10 (High need/priority for treatment)	
1-2 (No/little need)	560	43	1	604
3 (Moderate/borderline need)	106	146	10	262
4-5 (High need/priority for treatment)	33	198	85	316
Total	699	387	96	1,182

**Table 4 Relationship between children-assessed EC and DHC scores**

DHC score	EC score			Total
	1-4 (No/little need)	5-7 (Moderate/borderline need)	8-10 (High need/priority for treatment)	
1-2 (No/little need)	567	35	2	604
3 (Moderate/borderline need)	238	22	2	262
4-5 (High need/priority for treatment)	247	56	13	316
Total	1,052	113	17	1,182

In this study, the two most frequent occlusal features responsible for the DHC categorization were overjet (32.9%) and crowding (30.4%). The most common feature responsible for a DHC grade 5 was nonerupted teeth.

Cross-tabulation between DHC and EC (examiner) scores showed moderate reliability (kappa = 0.45, Table 3). The correlation of DHC and EC (children) scores was found to be very low (kappa = .056, Table 4). The correlation between EC (examiner) and EC (children) was again low (kappa: .13). This disagreement indicates a less critical evaluation of the affected children.

## DISCUSSION

The present cross-sectional study is one of the few Brazilian surveys using the IOTN to evaluate the treatment need and perception of dental attractiveness in Brazilian children. The sample does not represent the entire Brazilian 12-year-old population but rather gives an overview of the potential request for orthodontic therapy in the studied area.

The 26.7% who, according to the DHC, had an objective need for orthodontic treatment (with a DHC of 4 to 5) are similar to the 21.3% of the 9- to 12-year-old French schoolchildren,<sup>3</sup> the 22.0% of

Tanzanian 9 to 18 year olds,<sup>25</sup> the 22.0% of the Arabian 12 to 18 year olds,<sup>26</sup> and the 21.0% to 24.0% for British 11 to 12 year olds.<sup>9</sup>

However, the percentage for high treatment need in this study was lower than the 32.7% and 32.0% found for 11- to 12-year-old British children in the Brook and Shaw<sup>1</sup> and Holmes<sup>14</sup> studies, respectively. It was also lower than the 38.8% reported for 11- to 14-year-old Turkish children in Uçüncü and Eturgay's<sup>8</sup> study, the 37.0% for 12- to 13-year-old Swedish children in the study of Josefsson et al,<sup>11</sup> and the 42.6% for 12- to 13-year-old Senegalese children in Ngom's et al<sup>25</sup> study.

Hamdan<sup>19</sup> reported that 71.0% of the children in Jordan with a mean age of 15.3 years had an objective need for orthodontic treatment. In another study of 12- to 14-year-old Jordanian individuals, Abu Alhaja et al<sup>27</sup> found that only 34.0% had an objective treatment need. This difference in treatment need between children of similar age shows the impact of sample selection because the individuals of the first survey sought orthodontic or orthognathic surgery treatment at the Jordan University Hospital, whereas the second sample was schoolchildren.

In the IOTN-DHC index, only the most severe occlusal trait is considered for categorization, despite the fact that other

severe symptoms may be present. In this study, the two most common occlusal traits responsible for the final DHC categorization were increased overjet and crowding. Similarly, Souames et al<sup>28</sup> recorded crowding as the most common trait, followed by increased overjet. Again, Ngom et al<sup>25</sup> and Abu Alhaija et al<sup>27</sup> found crowding as the most common occlusal trait. These authors thought that this finding should have implications on public dental health, because crowding is most commonly associated with poor periodontal condition.

According to the EC of the IOTN, Brazilian children had exactly the same frequency of a high need/priority for treatment (examiner EC = 8 to 10) as Tanzanian children (8.1%).<sup>24</sup> Similar results were found for French,<sup>28</sup> Arabian,<sup>16</sup> and Senegalese children.<sup>25</sup> However, in British and Turkish children, the EC values were much lower.<sup>8,9</sup>

In Brazil, Frazão and Narvai<sup>29</sup> evaluated 13,801 12 to 18 year olds in São Paulo state using the Dental Esthetic Index (DEI). They concluded that 16.5% of the sample had severe or very severe malocclusions. In 12-year-old children, these authors did not find a significant sex differences in dental appearance perception, corroborating the present study's findings.

According to the EC, 89.0% of the children of this study perceived themselves as not to have an esthetic need for treatment, which is in contrast to this examiner's view as to that of dental professionals like Shaw et al,<sup>12</sup> Prah-Anderson,<sup>20</sup> Holmes,<sup>14</sup> Hunt et al,<sup>15</sup> Josefsson et al,<sup>11</sup> and Ngom et al.<sup>25</sup> The low correlation between EC score (children) and DHC score and between EC (children) and EC (examiner) scores in this study is in agreement with Ngom et al,<sup>25</sup> Josefsson et al,<sup>11</sup> and Hamdan.<sup>19</sup> The EC scores (examiner) showed a moderate correlation with the DHC scores, while Souames et al<sup>28</sup> found a higher correlation for the same comparison.

The statistical analysis of this study revealed that girls were more critical in their esthetic evaluation than boys. This is in agreement with the findings of others.<sup>12,17,21,29</sup>

On the other hand, when Hunt et al<sup>15</sup> asked 19-year-old British individuals to rank other person's and their own dental esthetics, they did not find any sex differences. Similarly, Locker and Slade,<sup>30</sup> Locker,<sup>23</sup> and Dolan and Gooch<sup>22</sup> reported that age directly influences esthetic self-perception. These authors concluded that the level of criticism increases in laypersons as they grow older, independent of their sex.

## CONCLUSIONS

From this study, the following conclusions were drawn:

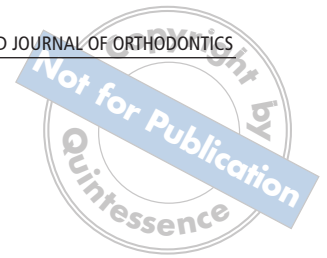
- More than half of the 12-year-old Brazilian schoolchildren who took part in this study had a DHC score indicating no/little need for treatment, whereas a quarter had a high need/priority for treatment.
- According to the EC, as evaluated by an orthodontist, 8.1% of the children had a high need/priority for treatment.
- The examiner was more critical in his esthetic evaluation than were the children. Girls, though, were more critical in their esthetic self-perception than boys.
- Increased overjet and crowding were the most common occlusal features defining the DHC categorization.

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## REFERENCES

1. Brook PH, Shaw WC. The development of an index of orthodontic treatment priority. *Eur J Orthod* 1989;11:309-320.
2. Richmond S, Shaw WC, O'Brien, KD, et al. The relationship between the index of orthodontic treatment need and consensus opinion of a panel of 74 dentists. *Br Dent J* 1995;178:370-374.
3. Tung AW, Kiyak HA. Psychological influences on the timing of orthodontic treatment. *Am J Orthod Dentofacial Orthop* 1998;113:29-39.



4. Frazao P, Narvai PC. Socio-environmental factors associated with dental occlusion in adolescents. *Am J Orthod Dentofacial Orthop* 2006;129:809-816.
5. Linder-Aronson JS. Orthodontics in the Swedish Public Dental Health Service. *Trans Eur Orthod Soc* 1974;233-240.
6. Evans R, Shaw W. Preliminary evaluation of an illustrated scale for rating dental attractiveness. *Eur J Orthod* 1987;9:314-318.
7. Tomita NE, Sheiham A, Bijella VT. Relação entre determinantes socioeconômicos e hábitos bucais de risco para más oclusões em pré-escolares. *Pesquisa Odontológica Brasileira* 2000;14:169-175.
8. Ucuncu N, Ertugay E. The use of the Index of Orthodontic Treatment need (IOTN) in a school population and referred population. *J Orthod* 2001;28:45-52.
9. Burden DJ. Need for orthodontic treatment in Northern Ireland. *Community Dent Oral Epidemiol* 1995;23:62-63.
10. Shaw WC. Factors influencing the desire for orthodontic treatment. *Eur J Orthod* 1981;3:151-162.
11. Josefsson E, Bjerklin K, Lindersten R. Malocclusion frequency in Swedish and immigrant adolescents—influence of origin on orthodontic treatment need. *Eur J Orthod* 2007;29:79-87.
12. Shaw WC, Rees G, Dawe M, Carles CR. The influence of dentofacial appearance on the social attractiveness of young adults. *Am J Orthod* 1985;87:21-26.
13. Landis JR, Kock GG. The measurement of observer agreement for categorical data. *Biomet* 1977;33:159-174.
14. Holmes A. The prevalence of orthodontic treatment need. *Br J Orthod* 1992;19:177-182.
15. Hunt O. The Aesthetic Component of the Index of Orthodontic Treatment Need validated against lay opinion. *Eur J Orthod* 2002;24:53-59.
16. Kerosuo H, Enezi SA, Kerosuo E, Abdulkarim E. Association between normative and self-perceived orthodontic treatment need among Arab high school students. *Am J Orthod Dentofacial Orthop* 2004;125:373-378.
17. de Oliveira CM, Sheiham A. Orthodontic treatment and its impact on oral health-related quality of life in Brazilian adolescents. *J Orthod* 2004;31:20-27.
18. Proffit WR, Fields HW Jr, Moray LJ. Prevalence of malocclusion and orthodontic treatment need in the United States: Estimates from the NHANES III survey. *Int J Adult Orthodon Orthognath Surg* 1998;13:97-106.
19. Hamdan AM. The relationship between patient, parent and clinician perceived need and normative orthodontic treatment need. *Eur J Orthod* 2004;26:265-271.
20. PrahI-Andersen B. The need for orthodontic treatment. *Angle Orthod* 1978;48:1-9.
21. Shaw WC, Lewis HG, Robertson NR. Perception of malocclusion. *Br Dent J* 1975;138:211-216.
22. Dolan TA, Gooch BF. Dental health questions from the rand health insurance study. In: Slade GD (ed). *Measuring Oral Health and Quality of Life*. Chapel Hill: University of North Carolina Press, 1997.
23. Locker D. Concepts of oral health, disease, and the quality of life. In: Slade GD (ed). *Measuring Oral Health and Quality of Life*. Chapel Hill: University of North Carolina, 1997.
24. Mugonzibwa EA, Kuijpers-Jagtman AM, Van't Hof MA, Kikwili EN. Perceptions of dental attractiveness and orthodontic treatment need among Tanzanian children. *Am J Orthod Dentofacial Orthop* 2004;125:426-434.
25. Ngom PI, Diagne F, Dieye F, Diop-Ba K, Thiam F. Orthodontic treatment need and demand in Senegalese school children aged 12-13 years. *Angle Orthod* 2007;77:323-330.
26. Kiyak HA. Cultural and psychologic influences on treatment demand. *Semin Orthod* 2000;6:242-248.
27. Abu Alhaija ES, Al-Nimri KS, Al-Khateeb SN. Orthodontic treatment need and demand in 12-14-year-old north Jordanian school children. *Eur J Orthod* 2004;26:261-263.
28. Souames M, Bassigny F, Zenati N, Riordan PJ, Boy-Lefevre ML. Orthodontic treatment need in French schoolchildren: An epidemiological study using the Index of Orthodontic Treatment Need. *Eur J Orthod* 2006;28:605-609.
29. Gravely JF. A study of need and demand for orthodontic treatment in two contrasting National Health Service Regions. *Br J Orthod* 1990;17:287-292.
30. Locker D, Slade G. Oral health and the quality of life among older adults: the oral health impact profile. *J Can Dent Assoc* 1993;59:830-833.