Orthodontic treatment need for Brazilian schoolchildren: A study using the Dental Aesthetic Index

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Objective: To determine the normative orthodontic treatment need among 12-year-old Brazilian schoolchildren, in the municipality of Juiz de Fora, Minas Gerais, Brazil, and compare with the need as perceived by the children themselves and their parents or caregivers, assessing putative associated sociodemographic factors.

Methods: Four hundred and fifty one children without a previous history of orthodontic treatment were randomly selected from a population of 7,993 schoolchildren regularly attending the public and private educational sectors of the municipality of Juiz de Fora, Minas Gerais, Brazil.

Results: The prevalence of normative orthodontic treatment need in 12-year-old children, assessed with the Dental Aesthetic Index (DAI) was 65.6% (n = 155). The need perceived by the caregivers was 85.6%, and by the children was 83.8%. Only the perception by the caregivers maintained a significant correlation with the normative need of treatment when adjusted to the parents' schooling and economical level (p = 0.023).

Conclusions: There is a high prevalence (65.6%) of malocclusion requiring orthodontic treatment in 12-year-old Brazilian schoolchildren. The most prevalent malocclusions in the study were: Crowding, Class II molar relationship and increased overjet. There was no significant correlation between the Index of Orthodontic Treatment Need – Aesthetic Component (IOTN-AC) related to dental aesthetic perception and the normative treatment need assessed with the DAI.

Keywords: Malocclusion. Prevalence. Health services needs and demand.

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INTRODUCTION

Malocclusions are the third priority among oral health problems, coming right after caries and periodontal disease.[29] Although the gradual reduction of caries rates has led to new expectations concerning the public health strategies targeting malocclusion, the high demand for orthodontic treatment remains a challenge, mainly due to the scarcity of financial resources, affecting developing countries.[10] Rational planning of health actions aiming orthodontic care demands epidemiologic data, and priority should be given to those with greater severity.[11,27]

Among the several methods and indices developed with this purpose,[11,23] the Index of Orthodontic Treatment Need (IOTN) and Dental Aesthetic Index (DAI) have been more frequently used. Although no single assessment instrument has reached consensus, the importance of epidemiologic studies assessing orthodontic treatment need through normative criteria has found literature support.[10]

In Brazil, in particular, there are few epidemiologic studies on the issue. This is partly due to the fact that public health dental services still do not effectively include orthodontic treatment in their strategic actions. This study thus aimed to assess the normative orthodontic treatment need (using the DAI) in 12-year-old schoolchildren of the municipality of Juiz de Fora, Minas Gerais, Brazil, and compare with the need as perceived by the children themselves and their caregivers, identifying putative associated sociodemographic factors.

MATERIAL AND METHODS

Study sample

Four hundred and fifty one children were selected from a population of 7,993 schoolchildren regularly attending the public and private educational sectors of Juiz de Fora, a middle-sized city in the state of Minas Gerais, in Southeastern Brazil. The stratified random sample was represented, at the first stage, by a sample of selected schools, out of a universe of 150 schools in the municipality. In order to assure sample representativeness, the distribution of the children in proportion to the population in both sectors was established through data from sampling calculation. Likewise, in order to assure similar participation odds for each child, a random raffling of the individuals was performed.[14] Sample size was calculated based on demographic data from SB Brasil 2003,[4] taking into account the representativeness for a 58.14% estimated malocclusion prevalence rate at the age of 12 years, with 95% confidence interval and 5% standard error.

The following exclusion criteria were defined: Previous orthodontic treatment or craniofacial malformations or syndromes with dentofacial manifestations.

The study was approved by the Institutional Ethics Committee (number 414/2008).

Data collection

Data were collected by means of a clinical oral examination and 2 questionnaires, one sent to the caregivers and the other applied to the children after clinical assessment. The questionnaires aimed to categorize the economical status of the study population and identify the treatment need as perceived by the children and their caregivers. The categorization system used provided 8 possible classifications, which were further grouped under 5 categories: A, B, C, D, and E.[2] Treatment need, as perceived by the children and their caregivers was assessed through a direct question, with 3 possible answers: High need, little need and no need.

The normative criteria used to assess malocclusion prevalence and orthodontic treatment need were those from the Dental Aesthetic Index (DAI),[11,28] complemented by the Index of Orthodontic Treatment Need-Aesthetic Component (IOTN-AC).

The DAI is a normative instrument which is widely used in epidemiological studies to assess orthodontic treatment need.[4] This index assesses, in a single recording, physical and aesthetic features of the occlusion, defining, along its scale, the severity of malocclusion, in a way that approximates orthodontists' judgment. DAI scores equal to 25 or lower refer to normal occlusions, with little, if any, treatment need. Scores of 26 to 30 represent defined malocclusion, with elective treatment need. Scores of 31 to 35 represent malocclusion with high treatment need. Scores of 36 or higher represent more severe malocclusion, with obligatory treatment. The obtained values can thus be organized in a continuous scale from 13 to 80 or higher. This continuous scale makes the DAI sensitive enough to differentiate cases with more or less

treatment need within levels of malocclusion severity. Eligibility to public-funded health programs can thus be finely tuned to match available resources.[11]

The clinical dental examinations were performed in the school, by a single orthodontist, with a helper responsible for registering the data, and in compliance with all biosafety guidelines. The examiner's reliability was checked in a pilot study of 15 children, examined twice within a 2-week interval period, and assessed with the Kappa statistics. Mean intraobserver and interobserver agreements were 96% and 91.3%, respectively. After the examination, each child was questioned about their own perception of orthodontic treatment need, the IOTN-AC being then applied.

The IOTN-AC consists of a 10-point scale, illustrated with a series of numbered photographs, organized according to their attractiveness. Opinions are allocated more according to the aesthetic impact of each deviation than by specific morphological similarities, thus reflecting the psychosocial component of the orthodontic treatment need.[23] The results were divided in 3 groups, according to the treatment need: No need (1-4), borderline cases (5-7) and defined need (8-10).[9]

Furthermore, other sociodemographic variables, such as gender, skin color and caregivers' schooling, were obtained.

Data analysis

The SPSS program, version 8.0, including rate distribution and association tests, was used for statistical analysis. The prevalence of malocclusion and the normative orthodontic treatment need were compared, through the chi-square test and association measure (odds ratio – OR), with the variables: Gender, skin color, caregivers' schooling, type of school, and orthodontic treatment need as perceived by the children and their caregivers, besides isolated occlusal features. The statistically significant variables ($p < 0.20$) were then inserted into a logistic regression model, being kept in the model if they remained significant ($p < 0.05$).

RESULTS

Four hundred and fifty one schoolchildren aged 12 years were enrolled in the study, being 215 (47.7%) males and 236 (52.3%) females, without any previous orthodontic treatment. With respect to skin color, 299 (66.3%) were white and 152 (33.7%) non-white.

Regarding the economic categorization and caregivers' perception of treatment need, 373 caregivers (82.7%) adequately answered the questionnaire. Belonged to class A 8.6% of the children (n = 32), 32.2% (n = 120) to class B, 45.2% (n = 169) to class C, 13.7% (n = 51) to class D, and 0.3% (n = 1) to class E (Table 1).

Orthodontic treatment need according to the normative criteria from the DAI and IOTN-AC, and the need as perceived by the children and caregivers are shown in Table 2.

The absolute and relative rates of isolated malocclusion findings are shown in Table 3.

Orthodontic treatment need rates, as perceived by the children and as perceived by their caregivers, were both higher than the normative values ($p < 0.001$), being 83.8% (n = 378) and 85.6% (n = 320), respectively.

Normative need (DAI) was significantly ($p < 0.001$) higher than the IOTN-AC. Nevertheless, both had a strong statistical association ($p = 0.002$; OR=2.8; CI= 1.3 - 5.7). With the exception of posterior cross-bite, anterior cross-bite, absence of teeth in the lower arch and spacing in one or more segments, all the other occlusal alterations had a statistically significant association ($p < 0.01$ for anterior open bite, and $p < 0.001$ for all the others) compared to the normative orthodontic treatment need.

Bivariate analysis showed a significant statistical association between normative orthodontic treatment need and the variables: Treatment need as perceived by the child ($p < 0.001$) and their caregivers ($p < 0.001$). Biological indicators, such as gender ($p = 0.251$) and skin color ($p = 0.563$), and social indicators, such as caregivers' schooling ($p = 0.193$), type of school ($p = 0.414$), and economic level ($p = 0.081$) were not associated with orthodontic treatment normative need (Table 4).

Multiple logistic regression analysis with the statistically significant variables ($p < 0.20$) showed that only treatment need as perceived by the caregivers remained significantly associated with normative treatment need, when adjusted to the caregivers' schooling and economic level ($p = 0.023$).

DISCUSSION

Normative orthodontic treatment need was observed in 296 (65.6%) study subjects, a figure similar to the ones reported by other researchers.[1,18] Lower[15,24] and higher[5,19] prevalence rates were reported from

Table 1 - Sample characterization as for gender, skin color, economic level and type of school.

SAMPLE CHARACTERIZATION	ABSOLUTE FREQUENCY (n)	RELATIVE FREQUENCY (%)
Gender		
Male	215	47.7
Female	236	52.3
Skin color		
White	299	66.3
Non-white	152	33.7
Economic level		
High	152	40.8
Intermediate	169	45.2
Low	52	14.0
Type of school		
Private	126	27.9
Municipal	162	35.9
State	153	33.9
Federal	10	2.2

Source: Study data (n = number; % = percentage).

Table 2 - Normative orthodontic treatment need and need as perceived by 12-year-old schoolchildren and their caregivers, in the municipality of Juiz de Fora, MG, Brazil

ORTHODONTIC TREATMENT NEED	ABSOLUTE FREQUENCY (n)	RELATIVE FREQUENCY (%)
Normative need (DAI)	**296**	**65.6**
No need or slight need	155	34.4
Elective treatment	148	32.8
Highly desirable treatment	86	19.1
Obligatory treatment	62	13.7
Normative need (IOTN-AC)	**89**	**19.7**
No need	362	80.3
Borderline cases	57	12.6
Defined need	32	7.1
Children's perception	378	83.8
Caregivers' perception	320	85.6

Source: Study data (n = number; % = percentage; DAI = Dental Aesthetic Index; IOTN-AC = Index of Orthodontic Treatment Need – Aesthetic Component).

Table 3 - Absolute and relative frequencies of occlusal alterations observed in 12-year-old schoolchildren of the municipality of Juiz de Fora, MG, Brazil.

TYPE OF OCCLUSAL ALTERATION	(n)	(%)
Absent teeth in the upper arch		
None	426	94.5
One or more	25	5.5
Absent teeth in the lower arch		
None	447	99.1
One or more	4	0.9
Anterior segment crowding		
None	136	30.2
One or more segments	315	69.8
Spacing in one or more segments		
None	304	67.4
One or more segments	147	32.6
Upper incisor misalignment		
< 2 mm	284	63.0
≥ 2 mm	167	37.0
Lower incisor misalignment		
< 2 mm	277	61.4
≥ 2 mm	174	38.6
Midline diastema		
< 2 mm	409	90.7
≥ 2 mm	42	9.3
Maxillary overjet		
< 4 mm	245	54.3
≥ 4 mm	206	45.7
Mandibular overjet		
Absent	440	97.6
Present	11	2.4
Anterior open bite		
Absent	435	96.5
Present	16	3.5
Molar relationship		
Class I	167	37.0
Class II	244	54.1
Class III	40	8.9
Posterior crossbite		
Absent	374	82.9
Present	77	17.1
Bilateral	17	3.8
Unilateral	60	13.3
Gingival smile		
< 4 mm	430	95.3
≥ 4 mm	21	4.7

Source: Study data (n = number; % = percentage; < = smaller; mm = millimeter; ≥ = larger than or equal to).

other Brazilian and international studies. Lopes and Gangussu[15] and Marques et al[17,18], who also used the DAI to assess orthodontic treatment need, reported prevalence rates of 45.76%, 52.3% and 77%, respectively. The wide variability of malocclusion prevalence rates is mainly due to the different methods and indices used. Furthermore, differences among the age ranges studied may also have contributed to the variability of the reported results. This notwithstanding, the high prevalence rate of malocclusion leading to orthodontic treatment need is present in all these studies.

Categorization of orthodontic treatment need according to malocclusion severity is particularly important for the planning of corresponding public policies.[16,28] Even when only severe malocclusions with highly desirable and obligatory treatment need are considered, there is wide variability among the different epidemiologic studies. Nevertheless, in most studies[1,6,15,18,26] the prevalence rate of orthodontic treatment need is consistently close to our findings (32.8%).

Among the malocclusions found, crowding in one or more segments was the most frequent type, with 69.8% (n = 315) prevalence rate, followed by Class II molar relationship (54.1%) and horizontal maxillary overjet equal to 4 mm or greater, which was observed in 45.7% (n = 206) of the children. Because of the aesthetic relevance of these malocclusions, they have received high social value,[21,22] and an important cause of demand for orthodontic treatment.[13] Although crowding has been the most frequently reported

Table 4 - Distribution of frequency and bivariate analysis. Orthodontic treatment need in scholars 12-years-old from the city of Juiz de Fora, Minas Gerais.

Variable	Orthodontic treatment need (DAI)				Odds Ratio (IC 95%)	*p*
	Yes		No			
	(n)	(%)	(n)	(%)		
Gender						
Male	145	67.4	70	32.6	1	
Female	151	64.0	85	36.0	1.1 (0.7 - 1.7)	0.251
Skin color						
White	199	66.6	100	33.4	1	
Non-white	97	63.8	55	36.2	1.1 (0.7 - 1.6)	0.563
Caregivers' schooling						
≥ 8 years	146	64.3	81	35.7	1	
< 8 years	95	69.3	42	30.7	1.2 (0.7 - 1.9)	0.193
Economic Level						
High	96	25.8	56	15.0	1	
Intermediate	108	29.0	61	16.4	1.0 (0.6 - 1.6)	0.491
Low	39	10.5	13	3.4	1.7 (0.8 - 3.5)	0.081
School type						
Private	79	62.7	47	37.3	1	
Public	217	66.8	108	33.2	1.1 (0.7 - 1.8)	0.414
Perception of treatment need (child)						
With need	262	69.3	116	30.7	1	
No need	34	46.6	39	53.4	2.5 (1.5 - 4.3)	<0.001
Perception of treatment need (caregiver)						
With need	220	68.8	100	31.3	1	
No need	24	44.4	30	55.6	2.7 (1.5 - 4.9)	0.001

Source: Study data (DAI = Dental Aesthetic Index; CI = Confidence interval; n = number; % = percentage; ≥ = higher or equal to; < = lower).

malocclusion,[6,20] our rates (69.8%) were higher than those reported by Dias and Gleiser[6] (45.5%), Sousa et al[25] (28.3%) and Marques[18] (37.8%), among others, and similar to those reported by Freitas et al[7] (69%) and Lopes and Gangussu[15] (65%). A possible explanation could be due to the age range assessed, once several studies investigated wider age ranges, with inclusion of subjects with mixed dentition. This fact was observed by Sousa et al,[25] who found increased crowding rates during the transition from deciduous to mixed and permanent dentitions.

The same variability may be observed for the molar relationship and maxillary overjet. While Lopes and Gangussu[15] reported a low prevalence rate of Class II molar relationship (19.1%) in the 12-15 years age range, Almeida et al[1] found a prevalence rate of 48%, that was closer to our results. The largest discrepancy among the study measures, however, was related to maxillary overjet. The 45.7% prevalence rate we found was similar to those reported by Marques et al[18] (37.5%) and Cavalcanti et al[5] (48%), although different from those reported by Dias and Gleiser[6] (29.7%) and Lopes and Gangussu,[15] who found a prevalence rate over 90% in their samples.

Normative indices of orthodontic treatment need have been criticized. Besides overestimating the prevalence of occlusal problems and orthodontic treatment need,[8,20] normative instruments have proved inefficient to identify social and emotional aspects related to tooth positioning and their impact on malocclusion as perceived by the individual.[8,20]

Contrary to the tendency towards overestimation of orthodontic treatment need determined by normative indexes, when comparing with social and dental measures and malocclusion self-perception[8,20] in our study, treatment need perceived both by the children and their caregivers, was higher than normative treatment need, in agreement with other studies.[12]

Different from what was reported elsewhere,[9,12] our results showed a wide difference between the rates of treatment need assessed by the IOTN-AC (7.1%) and those assessed by the DAI (65.6%) and the children's perception (83.8%), although they remained statistically associated. Such difference between the objective and subjective indices for malocclusion assessment was also reported by Souames et al.[24] Dias and Gleiser[6] found an IOTN-AC assessed normative treatment need of 84.3 % of their study sample, much higher than ours (19.7%), although equivalent to treatment need as perceived by the children (83.8%).

The higher need perceived by the children and their caregivers may reflect increased access to this type of therapy, which aggregates a social and cultural value to the orthodontic appliance. Orthodontic treatment may thus be associated with cultural trends and social status,[3] which may subjectively foster an increased perception of orthodontic treatment need, through and additional effect of the desire to undergo such treatment.

The high rate of malocclusions with orthodontic treatment need and the perception of such need by the children and their caregivers reinforce the importance of including orthodontic treatment in public health policies. Such inclusion assumes adequate resource allocation, better use of human resources and professional creativity, and institutional liaison between public and private institutions.[16]

CONCLUSION

From our data and discussion, the following conclusions can be made:

- There is a high prevalence rate (65.6%) of malocclusions with orthodontic treatment need among 12-year-old schoolchildren in the municipality of Juiz de Fora, MG, Brazil.
- Crowding in one or more segments, Class II molar relationship and a horizontal maxillary overjet were the malocclusions most frequently found.
- Orthodontic treatment need as perceived by the children and their caregivers was significantly higher ($p < 0.001$) than that suggested by normative criteria.
- Orthodontic treatment need as perceived by the caregivers was significantly associated with normative treatment need, when adjusted to parents' schooling and economic level ($p = 0.023$).
- There were no significant differences concerning the variables gender, skin color, parents' schooling and type of school.
- IOTN-AC assessed dental aesthetic perception was significantly lower than the DAI assessed normative treatment need ($p < 0.001$). Nevertheless, both had a strong statistical association ($p = 0.002$; OR=2.8; CI= 1.3 -5.7).

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