Orthodontics

Orthodontic treatment need in a group of 9-12-year-old Brazilian schoolchildren

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Abstract: The present study aimed to evaluate the need for orthodontic treatment in Brazilian schoolchildren presenting both late mixed dentition and early permanent dentition as well as to determine the possible factors associated with this necessity. Our randomly selected sample consisted of 407 schoolchildren aged between 9 and 12 years from Nova Friburgo (State of Rio de Janeiro), Brazil. All the children were evaluated according to the two components of the Index of Orthodontic Treatment Need (IOTN), namely, the Dental Health Component (DHC) and the Aesthetic Component (AC). Data analysis involved multiple logistic regression. Definite need for orthodontic treatment was found in 34.2% and 11.3% of the children according to, respectively, DHC and AC. The most prevalent malocclusions included the following: contact point displacement (crowding), crossbite, and increased overjet. Male gender, permanent dentition and aesthetic reasons were factors associated with a great need for orthodontic treatment. It was concluded that about one-third of the children evaluated had a definite need for orthodontic treatment. This necessity was greater in the permanent dentition, thus emphasizing the importance of an early identification of malocclusions and a timely referral of patients for treatment. The correlation between AC and DHC was considered important since they involve distinctive characteristics.

Descriptors: Severity of illness index; Malocclusion; Epidemiology; Public health; Child.

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Introduction

As the demand for orthodontic treatment increases, the importance of performing epidemiological studies in order to obtain knowledge about both the prevalence of different types of malocclusions and the need for orthodontic treatment among populations is evidenced.[1] These estimations are crucial for planning an orthodontic care service as regards human and financial resources, and also for monitoring the oral health programs offered.[2-4]

Several occlusal indexes have been developed over the years in order to help professionals to objectively categorize malocclusion severity and to provide criteria indicating which patients should have treatment priority,[5,6] mainly in those places where this treatment is unevenly spread.[7] Among these indexes, the Index of Orthodontic Treatment Need (IOTN)[8,9] consists of two separate components which can be used for assessing dental and functional health (Dental Health Component - DHC) as well as aesthetic impairment due to malocclusion (Aesthetic Component - AC).[10]

However, evaluation of the orthodontic treatment need should consider not only the severity of malocclusion traits, but also age group and dentition period of the children to be treated.[11] This way, treatment initiated early on during the late mixed dentition or at the beginning of the permanent dentition can avoid further damage to the latter.[11,12] No similar study of Brazilian children in these developmental phases was found in the literature. Therefore, the present study aimed to evaluate the need for orthodontic treatment in schoolchildren aged between 9 and 12 years who live in Nova Friburgo (State of Rio de Janeiro, Brazil) as well as to determine the possible factors associated with this necessity.

Material and Methods

The present study involved 407 children aged between 9 and 12 years, with no history of orthodontic treatment. They were selected from 6,684 schoolchildren of the same age group who had been enrolled in public schools from Nova Friburgo (State of Rio de Janeiro, Brazil). A minimum sample size consisting of 308 individuals was calculated according to a prevalence of 30% for a great orthodontic treatment need, with a standard error of 5% and a 95% confidence interval. In order to compensate a possible conglomeration effect, the sample was increased by 30% (design effect = 1.3), thus totaling 400 schoolchildren. The sample was further increased by 25% so that any eventual loss could be offset, and then 500 children were invited to take part in the study. They were grouped and randomly selected according to age and school location (7 urban and 3 rural schools) in order to assure a representative sample in relation to the original population.

Angle's molar relationship, presence of malocclusions, and need for orthodontic treatment (using both IOTN components)[8,9] were all evaluated by a single examiner, who performed this evaluation in a reserved room arranged by the staff from each school. The present study was previously approved by the Local Ethics Committees, and the informed consent of the children's parents as well as the children's approval were obtained before starting the procedures. The examiner was calibrated and the intra-examiner reliability was found to be excellent (kw = 0.944 for DHC and kw = 0.933 for AC).[13] Socio-economic and demographic data were gathered by means of a questionnaire sent to the parents.

The data were entered into and analysed by the SPSS software (Statistical Package for the Social Sciences), version 11.0 (Statistical Products and Service Solutions, Chicago, IL, USA), which was used for testing the relationship between the variables. Multiple logistic regression was employed for testing the association between orthodontic treatment need and independent variables. A significance level of 5% was considered.

Results

Seventy three of the 500 children had not returned the informed consent forms signed by their parents, 13 were absent on the day of evaluation, and 7 had already initiated orthodontic treatment. The 407 remaining children were grouped according to age and gender (Table 1). The majority of them (84.3%) were from low socio-economic backgrounds and only 78 children (19.2%) had no type of malocclusion.

The differences in the IOTN scores regarding

Table 1 - Gender and age of the 407 children evaluated.

|		Age				Total
		9 years	10 years	11 years	12 years	
Sex	male	45	41	52	53	191 (46.9%)
	female	56	61	52	47	216 (53.1%)
Total		101 (24.8%)	102 (25.1%)	104 (25.5%)	100 (24.6%)	407 (100%)

χ^2; $p > 0.05$.

Table 2 - Prevalence of malocclusions according to the level of orthodontic treatment need (DHC).

Malocclusion	Total		Treatment need - DHC					
			No/Little		Moderate		Definite	
	n	%	n	%	n	%	n	%
Increased overjet *	121	29.7	27	6.6	42	10.3	52	12.8
Reverse overjet	16	3.9	9	2.2	2	0.5	5	1.2
Contact point displacements *	185	45.5	46	11.3	56	13.8	83	20.4
Open bite	59	14.5	24	5.9	12	2.9	23	5.7
Increased overbite	44	10.8	11	2.7	14	3.4	19	4.7
Crossbite *	137	33.7	20	4.9	47	11.5	70	17.2
Tooth absence *	27	6.6	-		-		27	6.6
Supernumerary teeth	3	0.7	-		-		3	0.7
Partially erupted, tipped or impacted teeth *	49	12	-		-		49	12
Impeded eruption of teeth *	30	7.4	-		-		30	7.4
Submerged deciduous teeth	5	1.2	-		-		5	1.2

* χ^2; $p < 0.001$.

Graph 1 - Orthodontic treatment need evaluated by IOTN components (DHC and AC).
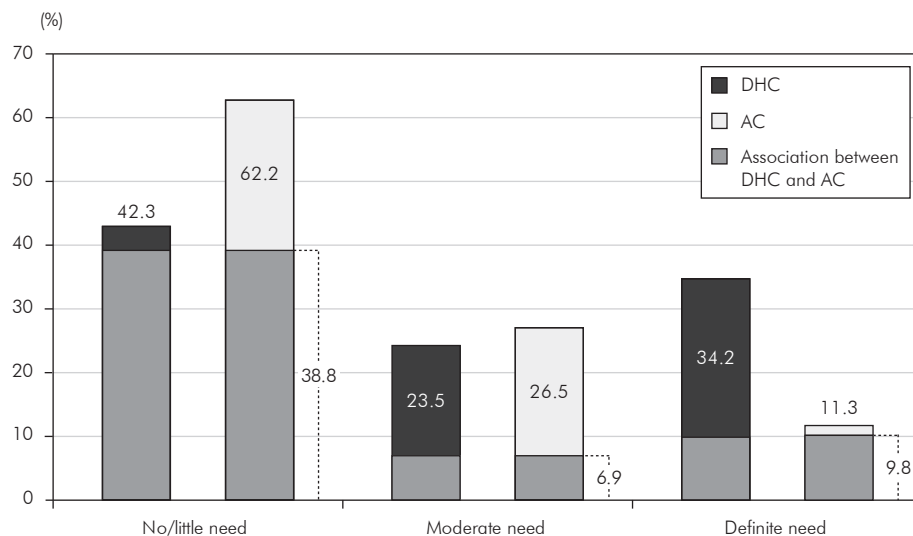
either the dental health component (DHC) or the aesthetic component (AC) were found to be statistically significant (Stuart-Maxwell χ^2; $p < 0.001$), and only 9.8% of the children were evaluated as having a definite need for treatment by both components (Graph 1).

Table 2 shows the frequencies of malocclusion according to DHC scores. The most prevalent mal-

occlusions for the group of definite need for orthodontic treatment were the following: contact point displacement (crowding) (20.4%), crossbite (17.2%), increased overjet (12.8%), and partially erupted, tipped or impacted teeth (12%). In Table 3, in regard to gender, one can observe that there were only significant differences in DHC scores, increased overbite and tooth absence. At the dentition phase, however, these differences were also observed in DHC scores, molar relationship, reverse overjet, increased overbite, tooth absence, and partially erupted, tipped or impacted tooth.

Multiple logistic regression (Table 4) showed that male gender, permanent dentition and need for aesthetic treatment (AC) were factors associated with the group of definite need for treatment, although no statistically significant interaction between these factors was observed in the final model. Other variables were also associated with the need for orthodontic treatment when a univariate model was employed, but such an isolated effect disappeared by using multivariate models, thus indicating some error level resulting from other covariables.

Discussion

In this study the need for orthodontic treatment was assessed in 9-12-year-old children coming from low socioeconomic classes who study at the Nova Friburgo public schools (State of Rio de Janeiro, Brazil) and, therefore, they are those who would benefit the most from a public dental health program. Although the sample was only representative for this population, the study can provide an overview about the orthodontic treatment needs of the local children in this age group.

The proportion of definite need for orthodontic treatment was similar to that found in previous studies, either regarding DHC (34.2%)[3,8,14-16] or AC (11.3%).[15,17,18] The variations between the present AC scores and those found in the literature may be the result of possible cultural differences regarding the aesthetics perceived by different populations.[1]

The significant difference observed between DHC and AC scores regarding the number of children needing orthodontic treatment is due to the fact that both IOTN components evaluate distinctive characteristics. There are malocclusions defined as being harmful to oral health according to DHC, although no aesthetic impairment is involved, such as crossbite or absence of posterior teeth, non-erupted or impacted canines and premolars.[14,15,19] On the other hand, there are cases defined only by AC as being of great treatment need because certain malocclusions considered to produce unattractive aesthetics are not evaluated by DHC (e.g. anterior spacing).[14,19] As AC is more subjective, it also brings difficulties in assessing some parameters, such as degrees of overjet and overbite.[2,10]

The statistical differences in DHC scores regarding gender and dentition were confirmed in the multiple logistic regression. The fact that the male gender is more likely to have a definite need of orthodontic treatment was an interesting finding, since other studies[16,20] found no statistically significant difference regarding the gender distribution of DHC. Tooth absence (always classified by DHC as being a definite treatment need) was also more prevalent among boys than girls, who are more concerned about their appearance and consequently tend to take better care of their oral health, thus resulting in less tooth extractions. A greater incidence of tooth absence and partially erupted, tipped or impacted teeth in the permanent dentition in comparison to the mixed dentition can also explain the reason why the former is more likely to have a definite need of orthodontic treatment than the latter.

Thilander *et al*.[1] (2001), likewise, showed that increased overbite was more prevalent in the mixed dentition and in boys. Such an overbite reduction from the mixed dentition to the permanent dentition is due to both occlusal stabilization involving full eruption of premolars and second molars[5] and the more pronounced mandibular growth.[3,11] This also explains the reduction in Class II cases as well as the increase in Class III cases (reverse overjet as well) during the period of changing dentition.[1]

In the present study the prevalence of malocclusions in the group of definite orthodontic treatment need is not much different from that found elsewhere,[4,14,17,19,21] except for the frequency variations, which are possibly due to ethnically differ-

Table 3 - Distribution of molar relationship, AC, DHC, and malocclusions in relation to gender and dentition phase.

Variables		Sex				P-value of χ^2 test	Dentition				P-value of χ^2 test
		Male		Female			Mixed		Permanent		
		n	%	n	%		n	%	n	%	
Angle's molar relationship	Class I	141	45.2	171	54.8	0.128	180	57.7	132	42.3	0.009*
	Class II	44	56.4	34	43.6		50	64.1	28	35.9	
	Class III	6	35.3	11	64.7		4	23.5	13	76.5	
AC	No/Little need	110	43.5	143	56.5	0.194	148	58.5	105	41.5	0.112
	Moderate need	56	51.9	52	48.1		66	61.1	42	38.9	
	Definite need	25	54.3	21	45.7		20	43.5	26	56.5	
DHC	No/Little need	80	46.5	92	53.5	0.002*	110	64	62	36.0	0.018*
	Moderate need	32	33.3	64	66.7		57	59.4	39	40.6	
	Definite need	79	56.8	60	43.2		67	48.2	72	51.8	
Malocclusion assessed by DHC	Increased overjet (> 3.5 mm)	60	49.6	61	50.4	0.485	69	57	52	43	0.901
	Reverse overjet (0 - 1 mm)	6	37.5	10	62.5	0.441	3	18.8	13	81.3	0.001*
	Contact point displacements (> 1 mm)	85	45.9	100	54.1	0.717	109	58.9	76	41.1	0.595
	Anterior or posterior open bite (> 1 mm)	26	44.1	33	55.9	0.634	31	52.5	28	47.5	0.405
	Increased overbite (> 3.5 mm)	30	68.2	14	31.8	0.003*	35	79.5	9	20.5	0.002*
	Anterior or posterior crossbite	61	44.5	76	55.5	0.489	79	57.7	58	42.3	0.96
	Tooth absence	18	66.7	9	33.3	0.033*	7	25.9	20	74.1	0.001*
	Supernumerary teeth	1	33.3	2	66.7	0.636	2	66.7	1	33.3	0.747
	Partially erupted, tipped or impacted teeth	25	51.0	24	49.0	0.541	18	36.7	31	63.3	0.002*
	Impeded eruption of teeth	19	63.3	11	36.7	0.061	13	43.3	17	56.7	0.103
	Submerged deciduous teeth	2	40.0	3	60.0	0.755	4	80.0	1	20	0.306

* Statistically significant difference at the 5% level.

ent groups, age groups of the individuals evaluated, and variation in assessment criteria.[1] Indication for early treatment of some malocclusions cited above emphasizes the importance of evaluating children with both late mixed dentition and permanent dentition.

The high prevalence of contact point displacement (crowding) can be partially explained by the great incidence of carious lesions and extractions of deciduous molars, which favors migration of the first permanent molars as well as inclinations and rotations.[1] Early intervention while the second de-

ciduous molars are still functioning can prevent arch length discrepancies.[12,22] Crossbite was the second most prevalent condition and no difference between mixed and permanent dentitions was found, thus supporting its self-correction absence and perpetuation. In addition, early intervention prevents asymmetrical growth of both mandible and maxilla.[1,11,12] In relation to increased overjet, the most severe cases should be treated early in order to prevent dental traumas and to improve lip function, breathing, and self-esteem.[11,12]

One can note that the same type of malocclu-

Table 4 - Logistic regression models for the group with definite need for orthodontic treatment (DHC).

Variables	Univariated logistic models		Multivariated logistic model 1		Multivariated logistic model 2[†]	
	OR (95% CI)	p-value	OR_{adj} (95% CI)[‡]	p-value	OR_{adj} (95% CI)[‡]	p-value
Sex						
Male	1.83 (1.21-2.77)	0.004*	1.85 (1.05-3.26)	0.032*	1.92 (1.13-3.24)	0.015*
Female	1		1		1	
Age		0.259		0.771		
9 years	1		1			
10 years	1.49 (0.82-2.72)	0.188	1.39 (0.60-3.21)	0.443		
11 years	1.45 (0.80-2.64)	0.222	0.97 (0.40-2.37)	0.955		
12 years	1.83 (1.01-3.31)	0.047*	1.27 (0.47-3.43)	0.637		
Dentition						
Mixed	1		1		1	
Permanent	1.77 (1.17-2.69)	0.007*	2.60 (1.26-5.37)	0.010*	2.15 (1.26-3.67)	0.005*
AC		< 0.001*		< 0.001*		< 0.001*
No/Little need	1		1		1	
Moderate need	11.28 (6.60-19.31)	< 0.001*	14.39 (7.08-29.24)	< 0.001*	12.23 (6.99-21.39)	< 0.001*
Definite need	46.04 (18.08-117.24)	< 0.001*	54.84 (18.24-164.85)	< 0.001*	46.05 (17.73-119.60)	< 0.001*
Angle's molar relationship		< 0.001*		0.315		
Class I	1		1			
Class II	2.88 (1.73-4.78)	< 0.001*	1.77 (0.80-3.93)	0.157		
Class III	1.73 (0.64-4.68)	0.283	0.57 (0.07-4.45)	0.591		
Increased overjet						
None	1		1			
Yes	1.72 (1.11-2.67)	0.015*	0.89 (0.43-1.83)	0.745		
Reverse overjet						
None	1		1			
Yes	0.87 (0.30-2.56)	0.803	0.24 (0.03-2.05)	0.191		
Contact point displacements						
None	1		1			
Yes	2.41 (1.59-3.67)	< 0.001*	1.11 (0.62-1.99)	0.716		
Anterior or posterior open bite						
None	1		1			
Yes	1.28 (0.72-2.26)	0.398	0.53 (0.24-1.20)	0.130		
Increased overbite						
None	1		1			
Yes	1.54 (0.81-2.90)	0.184	0.87 (0.33-2.28)	0.781		
Anterior or posterior crossbite						
None	1		1			
Yes	3.04 (1.97-4.69)	< 0.001*	1.58 (0.85-2.94)	0.150		

* Statistically significant difference at the 5% level. †Including the covariables with p-values lower than 0.05 in the multivariated logistic model 1. ‡OR_{adj} = Odds Ratio adjusted.

sion falls into different levels of orthodontic treatment need according to its severity. Therefore, the degree and priority of orthodontic treatment need among populations, which are important factors in public health planning, cannot be fully known by just evaluating the malocclusion prevalence.[2,17] If no specific index is used, determination of who really needs treatment becomes difficult and arbitrary, particularly among dentists and pediatric dentists, who end up inappropriately referring their patients to orthodontic treatment.[20,23]

In the present study, however, the normative evaluation based on the Index of Orthodontic Treatment Need may not be enough because of the often inherent elective nature of this treatment. As a result, other factors such as perceptual, functional and social needs may interfere with treatment demand and service planning,[4,7,16,20] since those factors do not always coincide with the professional evaluation of treatment need.[6] Therefore, further studies investigating the patient's perception and his or her concern regarding orthodontic treatment should be carried out in order to enhance the IOTN efficacy.

Conclusions

1. According to the DHC of the IOTN, approximately one-third of the population has a definite need for orthodontic treatment.
2. This need was greater for the permanent dentition, and both an early diagnosis and a timely orthodontic referral can help reduce the possibility of more complex treatments, thus saving time and money.
3. In spite of the assessment differences in DHC and AC scores, their association was found to be very important, for the greater the aesthetic need, the greater the chance of a definite need for treatment.

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