Objective: This study aims at assessing the normative need for orthodontic treatment and the factors that determine the subjective impact of malocclusion on 12-year-old Brazilian school children. Methods: A total of 451 subjects (215 males and 236 females) were randomly selected from private and public schools of Juiz de Fora, Brazil. The collected data included sociodemographic information and occlusal conditions. The esthetic subjective impact of malocclusion was assessed by means of the Orthodontic Aesthetic Subjective Impact Score – OASIS, whereas the malocclusion and the need for orthodontic treatment were assessed by means of the Dental Aesthetic Index (DAI) and the Index of Orthodontic Treatment Need-Aesthetic Component (IOTN-AC). Results: Prevalence of normative need for orthodontic treatment was 65.6% (n = 155), and prevalence of orthodontic esthetic subjective impact was 14.9%. The following variables showed significant association with esthetic subjective impact of malocclusion: female (p = 0.042; OR = 0.5; CI = 0.2-0.9), public school student (p = 0.002; OR = 6.8; CI = 1.9-23.8), maxillary overjet ≥ 4 mm (p = 0.037; OR = 1.7; CI = 1-3) and gingival smile ≥ 4 mm (p = 0.008; OR = 3.4; CI = 1.3-8.8). Conclusion: The normative need for orthodontic treatment overestimated the perceived need. Occlusal and sociocultural factors influenced the dissatisfaction of schoolchildren with their dentofacial appearance. Keywords: Malocclusion. Orthodontics. Quality of life.
INTRODUCTION

Malocclusion is a craniofacial growth and development disorder that may lead to functional problems with esthetic impact and consequent psychosocial implications in children and adults. It is considered a public health concern and the third most frequent oral disorder after dental caries and periodontal problems. Thus, orthodontists must include in diagnosis and planning, instruments that highlight the influence of sociocultural components and their relation to the perception of the malocclusion developed by the individual.

Efforts to develop solid diagnostic criteria that allow patients to understand their problems have been the main focus of dentists and orthodontists; however, it is difficult to determine the importance of malocclusion as a facial problem and its impact on the quality of life of the individuals affected. This problem is particularly more complex during childhood due to constant changes in psychosocial and body characteristics and great variability in cognitive development that occur in children of the same age group.

Orthodontic treatment during childhood is generally associated with esthetic problems normally related to considerable diversity in patient’s perception process. Although the esthetic impact of malocclusion greatly influences a child’s biopsychosocial development, little attention has been given to its association with normative values of treatment needs.

This study aims at assessing the normative need for orthodontic treatment and the factors determining the subjective impact of malocclusion on 12-year-old Brazilian schoolchildren.

MATERIAL AND METHODS

This cross-sectional study was carried out with 12-year-old Brazilian schoolchildren randomly selected from public and private schools of Juiz de Fora — Minas Gerais/Brazil. Cluster sampling method was used with proportional raffling of school categories: public (local, state and federal) and private. The participating classes and schoolchildren were also raffled.

Sample size (n = 451) was calculated based on demographic data from the “Brazilian oral health report – 2010” considering 38% of estimated malocclusion prevalence at the age of 12, with 95% confidence interval and 5% standard error.

The following exclusion criteria were applied: Craniofacial malformation or syndromes with dento-facial manifestations, previous orthodontic treatment and mental or behavior disorders that could interfere in patient’s self-perception of the assessed factors. This project was approved by the Institutional Review Board of the Federal University of Juiz de Fora. Patients’ parents or guardians signed an informed consent form.

The collected data included sociodemographic information and clinical features concerning the subjects’ occlusal conditions. The schoolchildren answered a questionnaire that included a test to assess the esthetic subjective impact of malocclusion (Orthodontic Aesthetic Subjective Impact Score – OASIS). Malocclusion as well as the need for orthodontic treatment were assessed through the Dental Aesthetic Index (DAI) and the Index of Orthodontic Treatment Need-Aesthetic Component (IOTN-AC). For economic characterization, patients’ parents or guardians answered a self-applied questionnaire.

Dental examination

Dental examination followed the World Health Organization criteria for oral health research. All oral assessments were performed by the same orthodontist who was previously calibrated and trained for all indexes used in this study. Intra-observer agreement was calculated by Kappa coefficient (96%).

Dental aesthetic index (DAI)

DAI assesses the esthetic aspects of dental occlusion, identifying the need for orthodontic treatment based on malocclusion severity. Its scale defines severity in a similar manner to orthodontists’ judgment. DAI scores equal to or lower than 25 refer to malocclusions with a slight need for orthodontic treatment. Scores varying from 26 to 30 represent malocclusion with elective need for treatment. Scores varying from 31 to 35 represent malocclusion with a high need for treatment. Scores ≥ 36 represent severe malocclusion with compulsory need for treatment.

Orthodontic Aesthetic Subjective Impact Score – OASIS

OASIS measures the subjective aesthetic impact of malocclusion, assessing the degree of dissatisfaction...
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...of children with their teeth. OASIS has been validated and culturally adapted to Brazilian Portuguese. It comprises 5 questions, with the answers matching into the 7-point Likert scale. This dependent variable was dichotomized into satisfied or dissatisfied. Based on self-perception, the child was asked to identify in the IOTN-AC, the photography that best matched their oral condition. In order to facilitate children’s understanding, the Likert scale was reduced to 3 possible answers; maintaining the initial and final scoring limits (5 - 35 points) of the original instrument, which were further added to the answers of the IOTN-AC (1 to 10). Median was used as the cut-off point to define aesthetic malocclusion impact. According to the IOTN-AC criteria, assessment of the need for orthodontic treatment classified the subjects into 3 groups: no need (1-4), borderline cases (5-7) and definite need (8-10).

Statistical analysis

Initially, a descriptive analysis of results was performed. Next, associations between dependent and independent variables were tested by means of the univariate analysis (chi-square test and Fisher’s exact test) and both simple and multiple logistic regression analyses (stepwise forward procedure). The lack of an association between variables was considered as the null hypothesis (significance values greater than 0.05). The Statistical Package for the Social Sciences program (SPSS) - SPSS Inc., Chicago, USA, version 8.0, was used for statistical analysis.

RESULTS

The total sample of 451 schoolchildren comprised 215 (47.7%) males and 236 (52.3%) females. With regard to skin color, 299 (66.3%) were white and 152 (33.7%) were classified as non-white. As for their economic level, 373 guardians (82.7%) adequately answered the questionnaire, thus yielding the following results: 8.6% - class A (n = 32); 32.2% - class B (n = 120); 45.2% - class C (n = 169); 13.7% - class D (n = 51); and 0.3% - class E (n = 1) (Table 1).

The normative need for orthodontic treatment and aesthetic subjective impact of malocclusion are presented in Table 2.

Table 1 - Sample characterization according to sex, skin color, economic level and school category.

| Sample characterization | Absolute frequency (n) | Relative frequency (%) |
|-------------------------|------------------------|------------------------|
| Sex                     |                        |                        |
| Male                    | 215                    | 47.7                   |
| Female                  | 236                    | 52.3                   |
| Skin color              |                        |                        |
| White                   | 299                    | 66.3                   |
| Non-white               | 152                    | 33.7                   |
| Economic level          |                        |                        |
| High (Class A and B)    | 152                    | 40.8                   |
| Intermediate (Class C)  | 169                    | 45.2                   |
| Low (Class D and E)     | 52                     | 14.0                   |
| School category         |                        |                        |
| Private                 | 126                    | 27.9                   |
| Public                  | 162                    | 35.9                   |
| State                   | 153                    | 33.9                   |
| Federal                 | 10                     | 2.2                    |

Table 2 - Need for orthodontic treatment and aesthetic subjective impact of malocclusion in 12-year-old schoolchildren of Juiz de Fora/Minas Gerais.

| Variables                        | Absolute frequency (n) | Relative frequency (%) |
|----------------------------------|------------------------|------------------------|
| Orthodontic treatment need (DAI) |                        |                        |
| No or slight need                | 155                    | 34.4                   |
| Elective treatment               | 148                    | 32.8                   |
| Highly desirable treatment       | 86                     | 19.1                   |
| Compulsory need                  | 62                     | 13.7                   |
| Orthodontic treatment need (IOTN-AC) |                        |                        |
| No need                          | 362                    | 80.3                   |
| Borderline cases                 | 57                     | 12.6                   |
| Definite need                    | 32                     | 7.1                    |
| Aesthetic Subjective Impact of Malocclusion (OASIS) |                |                        |
| Very satisfied                   | 235                    | 52.1                   |
| Satisfied                        | 149                    | 33.0                   |
| Dissatisfied                     | 52                     | 11.5                   |
| Very dissatisfied                | 15                     | 3.4                    |
| Occlusal Alterations                  | Appearance Satisfaction (OASIS) | Odds Ratio (95% CI) | p     |
|---------------------------------------|---------------------------------|---------------------|-------|
|                                       | No (n) (%)                      | Yes (n) (%)         |       |
| Missing upper tooth                   |                                 |                     |       |
| Not observed                          | 62 (14.6)                       | 364 (85.4)          | 1     |
| Observed                              | 5 (20.0)                        | 20 (80.0)           | 1.4 (0.5-4.0) |
| Missing lower tooth                   |                                 |                     |       |
| Not observed                          | 66 (14.8)                       | 381 (85.2)          | 1     |
| Observed                              | 1 (25.0)                        | 3 (75.0)            | 1.9 (0.1-18.7) |
| Incisor crowding                      |                                 |                     |       |
| None                                  | 19 (14.0)                       | 117 (86.0)          | 1     |
| One or more segments                  | 48 (15.2)                       | 267 (84.8)          | 1.1 (0.6-1.9) |
| Incisor spacing                       |                                 |                     |       |
| None                                  | 43 (14.1)                       | 261 (85.9)          | 1     |
| One or more segments                  | 24 (16.3)                       | 123 (83.7)          | 1.1 (0.6-2.0) |
| Median diastema                       |                                 |                     |       |
| ≤ 1 mm                                | 58 (14.2)                       | 351 (85.8)          | 1     |
| ≥ 2 mm                                | 9 (21.4)                        | 33 (78.6)           | 1.6 (0.7-3.6) |
| Maxillary malalignment                |                                 |                     |       |
| ≤ 1 mm                                | 39 (13.7)                       | 245 (86.3)          | 1     |
| ≥ 2 mm                                | 28 (16.8)                       | 139 (83.2)          | 1.2 (0.7-2.1) |
| Mandibular malalignment               |                                 |                     |       |
| ≤ 1 mm                                | 36 (13.0)                       | 241 (87.0)          | 1     |
| ≥ 2 mm                                | 31 (17.8)                       | 143 (82.2)          | 1.4 (0.8-2.4) |
| Maxillary overjet                     |                                 |                     |       |
| ≤ 3 mm                                | 27 (11.0)                       | 218 (89.0)          | 1     |
| ≥ 4 mm                                | 40 (19.4)                       | 166 (80.6)          | 1.9 (1.3-3.3) |
| Anterior crossbite                    |                                 |                     |       |
| No                                    | 65 (14.8)                       | 375 (85.2)          | 1     |
| Yes                                   | 2 (18.2)                        | 9 (81.8)            | 1.2 (0.2-6.0) |
| Anterior openbite (mm)                |                                 |                     |       |
| = 0 mm                                | 63 (14.5)                       | 372 (85.5)          | 1     |
| ≥ 1 mm                                | 4 (25.0)                        | 12 (75.5)           | 1.9 (0.6-6.2) |
| Molar relationship                    |                                 |                     |       |
| Class I                               | 20 (12.0)                       | 147 (88.0)          | 1     |
| Class II                              | 44 (18.0)                       | 200 (82.0)          | 1.6 (0.9-2.8) |
| Class III                             | 3 (7.5)                         | 37 (92.5)           | 0.5 (0.1-2.1) |
| Posterior crossbite                   |                                 |                     |       |
| No                                    | 53 (14.2)                       | 321 (85.8)          | 1     |
| Yes                                   | 14 (18.2)                       | 63 (81.8)           | 1.3 (0.7-2.5) |
| Gingival smile (mm)                   |                                 |                     |       |
| ≤ 3 mm                                | 59 (13.7)                       | 371 (86.3)          | 1     |
| ≥ 4 mm                                | 8 (38.1)                        | 13 (61.9)           | 3.8 (1.5-9.7) |
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Table 4 - Association between socioeconomic variables (number and percentages) and appearance satisfaction of 12-year-old schoolchildren of Juiz de Fora/Minas Gerais.

| Sociodemographic variables | Appearance satisfaction (Oasis) | Odds Ratio | P |
|----------------------------|---------------------------------|------------|---|
|                            | No (%))                         | Yes (%)    | (95% CI) |
| Skin color                 | (n)                             | (n)        |          |
| Non-white                   | 27 (17.8)                       | 125 (82.2) | 1         | 0.216 |
| White                       | 40 (13.4)                       | 259 (86.6) | 0.7 (0.4-1.2) |
| Sex                        | (n)                             | (n)        |          |
| Female                      | 42 (17.8)                       | 194 (82.2) | 1         | 0.043 |
| Male                        | 25 (11.6)                       | 190 (88.4) | 0.6 (0.3-1.0) |
| Economic level              | (n)                             | (n)        |          |
| High                        | 11 (7.2)                        | 141 (92.8) | 1         | 0.004 |
| Intermediate                | 30 (17.8)                       | 139 (82.2) | 2.7 (1.3-5.7) | <0.001 |
| Low                         | 13 (25.0)                       | 39 (75.0)  | 11.9 (4.6-30.6) |
| School category             | (n)                             | (n)        |          |
| Private                     | 4 (3.2)                         | 122 (96.8) | 1         | 0.000 |
| Public                      | 63 (19.4)                       | 262 (80.6) | 7.3 (2.6-20.6) |

The dependent variable “aesthetic subjective impact of malocclusion” (OASIS), considering the occlusal alterations. Only maxillary overjet ≥ 4 mm, and gingival exposure at smile ≥ 4 mm were statistically associated with child’s tooth appearance dissatisfaction.

Regarding the relationship between the dependent variable and the sociodemographic variables, a statistically significant association was found for school category (p < 0.001), low economic level (p < 0.001), intermediate economic level (p = 0.004) and sex (p = 0.043) (Table 4).

Multiple logistic regression for occlusal and sociodemographic characteristics, which were significantly associated at bivariate analysis (p < 0.20), indicated the following variables as factors associated with the aesthetic subjective impact of malocclusion: female (p = 0.042; OR = 0.5; CI = 0.2-0.9), public school student (p = 0.002; OR = 6.8; CI = 1.9-23.8), maxillary overjet ≥ 4 mm (p = 0.037; OR = 1.7; CI=1-3) and gingival smile ≥ 4 mm (p = 0.008; OR = 3.4; CI = 1.3-8.8).

DISCUSSION

The need for orthodontic treatment is difficult to be recognized by professionals, given that the decision on the need for orthodontic treatment must integrate clinical criteria and perceptible needs. Several authors report a tendency to overestimate the need for orthodontic treatment when normative criteria are used. The present results confirm these findings when DAI values are compared to the aesthetic subjective impact of malocclusion (OASIS).
However, Marques et al\textsuperscript{19} found the opposite in a study conducted with Brazilian adolescents, probably due to the social status related to the use of orthodontic appliances and the free treatment offered by the public institution (as part of the Brazilian public health system) where the study was carried out.

Dental aesthetics has significant implications on an individual’s quality of life and psychosocial relationships, being an important factor for those who seek orthodontic treatment.\textsuperscript{3,5} In this study, however, the aesthetic subjective impact of malocclusion (OASIS) was significantly ($p < 0.001$) lower than normative needs. Only 14.9\% of individuals comprising the sample were not satisfied with their tooth appearance. Although the aesthetic subjective impact of malocclusion (OASIS) was strongly associated with normative impact (DAI), the difference in the frequencies found leads to important reflections on the need for orthodontic treatment. Once aesthetics is considered one of the most important aspects in orthodontic treatment,\textsuperscript{3,5} the instrument used to assess its impact should be more closely related to the self-perceived need for orthodontic treatment and appearance satisfaction than to normative indexes, only. Yet, they were significantly different in this study.

Normative need for treatment (DAI) was strongly associated with the aesthetic subjective impact of malocclusion ($p = 0.007$). However, when occlusal alterations were analyzed separately, only the variables overjet $\geq 4$ mm and gingival smile $\geq 4$ mm were statistically significant. Association between great overjet and gingival smile with appearance satisfaction has been reported in other studies.\textsuperscript{7,24-25} Increase in overjet is strongly associated with the risk of dental injuries due to lack of labial seal and exposure of upper teeth. Additionally, the social impact of this problem must be considered as an important factor for facial stigmatization. The same occurs when gingival smile is assessed.\textsuperscript{5,7} In the present study, these problems clearly affected patients’ dental dissatisfaction.

Except for skin color, all other sociodemographic variables showed statistically significant association with the aesthetic impact of malocclusion. In agreement with other studies, this impact was more significant in females\textsuperscript{23,26} and intermediate economic level. Yet, after logistic regression, only sex and school remained significantly associated with the impact of malocclusion.

Some occlusal conditions related to aesthetic impairment, such as incisor crowding, upper and lower misalignment and missing teeth, were not associated with the aesthetic subjective impact of malocclusion (OASIS). This finding was in disagreement with a previous study which showed an association between this instrument and occlusal alterations.\textsuperscript{23} This fact highlights the great variability and complexity of perception of facial aesthetics, with significant differences between normative and self-perceived values.\textsuperscript{27,30}

	extbf{Conclusions}

- The normative need for orthodontic treatment overestimated the perceived need.
- The variables sex, school category, maxillary overjet $\geq 4$ mm and gingival smile $\geq 4$ mm negatively influenced patient’s satisfaction with dentofacial appearance.
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