Original Article

# Association between maloclusion and self-perception of oral aesthetics in adolescents

Ana De Lourdes Sá de Lira[1],*, Joyce Pires Barros Da Cunha[1], Rebeca Maria Vieira Pereira[1], Alice Rodrigues Santos[1], Maria Karen Vasconcelos Fontenele[1], Ronaldo Carvalho Pinto de Almeida[1]

[1] Department of Clinical Dentistry, Area of Integrated Clinic, State University of Piauí – UESPI, School of Dentistry, Parnaíba, PI, Brazil.

Corresponding author:
Ana de Lourdes Sá de Lira
https://orcid.org/0000-0002-9299-1416
State University of Piauí,
School of Dentistry
Rua Senador Joaquim Pires 2076
Ininga.
Fone (86) 999595004
Zip code: 64049-590
Teresina-PI-Brazil
email: anadelourdessl@hotmail.com

**Aim:** To evaluate the aesthetic self-perception capacity of adolescents from public schools regarding the presence of oral alterations from malocclusions. **Methods:** Cross-sectional and quantitative study with 374 adolescents between 16 and 18 years old, belonging to public schools in the city of Parnaíba, Piauí. The adolescents were separated by gender (male and female) and examined for malocclusions. The problem identified for each participant was recorded for later comparison of the influence of its presence with aesthetic self-perception. Then, all adolescents, including those who demonstrated normal occlusion during the clinical evaluation, answered a questionnaire containing eight questions about their perception of their own smile and its impact on their interpersonal relationships. Self-perception was also analyzed by comparing the responses of those with normal occlusion with that of malocclusion individuals. Student's t-tests were used to verify if there was a difference between the groups. **Results:** The most prevalent malocclusions after clinical examination were midline deviations, crowding and diastemas, and the ones that most scored in the adolescents' perception were crowding, misalignment and diastemas. **Conclusion:** The adolescents were able to perceive the aesthetic alterations resulting from malocclusions, being determinants of dissatisfaction when smiling. They were not ashamed to smile, did not consider that the ideal smile would improve their self-esteem and that misaligned teeth would not interfere with flirting and interpersonal relationships.

**Keywords:** Adolescent. Body image. Malocclusion. Self concept.

# Introduction

Malocclusion is understood as a change in the growth and development of the cranio-facial complex that affects tooth occlusion. It has a multifactorial etiology and may be caused by acquired functional conditions, such as pasty diets, mouth breathing and deleterious oral habits or by the combination of environmental, congenital, morphological and biomechanical factors. If present, these changes cause aesthetic deviations in teeth and / or face and functional disorders in occlusion, chewing, swallowing, phonation and breathing, and may also trigger psychosocial disorders with repercussions on self-esteem and relationship of severely affected individuals[1-4].

Although such alterations can be found in individuals of any age, adolescents appear to be one of the groups most affected psychologically by the negative effects of malocclusions, as they are at a stage in life when aesthetic standards begin to have a direct influence on self-esteem and the way they relate and live in society[5,6].

According to the National Oral Health Survey, nearly 40% of adolescents in the country have occlusion problems at 12 years of age, some of which are milder and others more severe and these conditions require more immediate treatment[7].

Social life and self-perception play an essential role in a person's self-esteem regarding occlusal problems. Some patients with severe malocclusion are satisfied or indifferent to their aesthetics, while others with minor irregularities are very concerned about this. That is, the perception of adolescents regarding the severity of their malocclusions is an important factor that formulates their self-esteem levels, especially during adolescence, when the first concerns about appearance and physical attractiveness arise[8].

Historically, the need for orthodontic treatment was assessed using exclusively clinical criteria, which used the professional's technical perception. However, it is also necessary to consider the individual's subjective perception about oral health and how it affects daily life. Therefore, in 1986, the Dental Aesthetic Index was developed, an epidemiological instrument used to identify and classify malocclusions, as well as to recognize the dental and aesthetic need for orthodontic treatment in a given population[9,10].

In attempt to reestablish the function of the stomatognathic system and maintain the health of the teeth and the supporting structures, orthodontists began to include social and psychological well-being as one of the main goals of orthodontic treatment, corroborating the idea that the use of braces most often aims to meet patients' expectations for improving their self-confidence and social contact[11].

Based on this context, it is believed that adolescents can identify if they have malocclusion and that the more noticeable it is, the more likely it will influence their self-esteem. The objective of this research was to evaluate the aesthetic self-perception capacity of adolescents from public schools regarding the presence of oral alterations arising from malocclusions.

## Material and Methods

This study was approved by the Research Ethics Committee, under number 2.583.526. It was cross-sectional study, whose sample size was based on the target

audience: adolescent students from the city of Parnaíba-PI, attending high school in public schools in 2018. The sample size calculation was according to a survey conducted by the Brazilian Institute of Geography and Statistics, which showed an estimated 15.000 adolescents living in the city of Parnaíba-PI aged 16 to 18 years.

From this, the sample size formula was performed, resulting in a number of 374. This minimum number of participants is considered sufficient considering the proposed analyzes, the sample error of 5%, in addition to the 95% level of confidence, indicating that the probability of the mistake made by the survey does not exceed 5%[12].

The researchers were trained at the Clinical School of Dentistry (CEO) of the State University of Piauí through calibration exercises with 20 adolescents not participating in the sampling plan, who received dental care at the CEO during their routine operation to identify normal occlusion, malocclusions, and if this analysis was in accordance with the methodology described by Peres et al.[13].

Subsequently, they carried out the research with a letter of consent from the principals of the municipal high schools, chosen by lot, who authorized the development of the research after the ethical opinion of the approval of the Research Ethics Committee of the State University of Piauí - CEP / UESPI.

The inclusion criteria adopted were adolescents between 16 and 18 years old, who were attending high school in Parnaíba public schools and accepted to participate in the research. And as an exclusion criterion, all students who were not part of the chosen age group and those unable to understand and answer the questionnaires, such as those with cognitive impairment, syndromes or hearing or visual impairment, those who did not wish to participate or those that parents didn't allow.

The pilot study involving 20 adolescents participating in the sample, 10 for each gender, aimed to test the proposed methodology. As a result, its viability was observed without adjustment. To measure intra- and inter-examiner diagnostic reproducibility, 10% of the total sample was double-checked by each of the examiners, with the Kappa coefficient for intra- and inter-examiner agreement being 0.97 and 0.98, respectively.

All students were examined for dental health component (DHC) of the IOTN[14] for assessment of children's normative treatment need, assessing several traits of malocclusion (Table 1). In each class, the adolescents were divided into two groups: normal occlusion (G1) and malocclusion (G2). Adolescents who did not present any of these dental changes specified in Table 1 were considered to have normal occlusion.

Participants were examined by researchers to identification and registration of malocclusion, and subsequent comparison of the influence of its presence with aesthetic self-perception. Secondly, the self-perception of the oral aesthetics of these adolescents was assessed by self-examination when smiling in front of a 30cm x 30cm mirror, at a distance of 30cm for 1 minute. They answered a questionnaire consisting of eight questions, using the Likert scale, which had five alternatives: "Completely Agree" (right answer), "Partially agree" (Not sure), "Completely Disagree" (showing negative certainty), "Partially disagree" (partial negative certainty, doubt) and "I don't agree or disagree" (the interviewed professional has no opinion on the subject). All adolescents in the described age group answered the questionnaire, even those who did

Table 1. Malocclusions observed by teenagers and researchers from March to December 2018

| | Teenagers | | | Researchers | | |
|---|---|---|---|---|---|---|
| | Male | Female | Total | Male | Female | Total |
| Crowding | 34 | 34 | 68 | 62 | 66 | 128 |
| Dental absences | 1 | 1 | 2 | 27 | 29 | 56 |
| Canines in Classe II | 0 | 0 | 0 | 18 | 32 | 50 |
| Canines in Classe III | 0 | 0 | 0 | 2 | 8 | 10 |
| Misalignments | 10 | 11 | 21 | 22 | 24 | 46 |
| Unevenness | 4 | 1 | 5 | 7 | 7 | 14 |
| Midline offset | 1 | 0 | 1 | 89 | 118 | 207 |
| Ectopic teeth | 1 | 4 | 5 | 3 | 4 | 7 |
| Diastems | 21 | 21 | 42 | 53 | 59 | 112 |
| Giroversions | 6 | 9 | 15 | 27 | 32 | 59 |
| Dental impactions | 3 | 12 | 15 | 4 | 13 | 17 |
| Anterior open bite | 0 | 1 | 1 | 15 | 29 | 44 |
| Posterior open bite | 0 | 0 | 0 | 6 | 9 | 15 |
| Anterior crossbite | 1 | 0 | 1 | 3 | 1 | 4 |
| Posterior crossbite | 0 | 0 | 0 | 21 | 22 | 43 |
| Bite end to end | 0 | 0 | 0 | 20 | 14 | 34 |
| Overjet | 0 | 5 | 5 | 3 | 17 | 20 |
| Overbite | 0 | 0 | 0 | 7 | 13 | 20 |
| Incisor vestibularization | 4 | 17 | 21 | 16 | 30 | 46 |
| Incisor lingualization | 0 | 1 | 1 | 3 | 3 | 6 |

not present malocclusion, since these data would serve as a means to evaluate their oral aesthetic self-perception, comparing it with that presented by young people with some malocclusion[7].

Likert scale is a type of psychometric response scale commonly used in question-naires, and it is the most used scale in opinion polls. When responding to a question-naire based on this scale, respondents specify their level of agreement with a statement. The questionnaire applied in this research was previously tested and applied by Costa et al.[7] to carry out an integrative review of the literature on the self-perception of malocclusions by adolescents.

The results were stored in the Excel Windows 2010 Microsoft® database and arranged in graphs and tables for better interpretation and discussion, after applying the appropriate statistical analysis. Means, dispersion and Student's t test were obtained to compare the results between G1 and G2 with software SPSS 24.

## Results

From the analysis of the results, it was observed that the prevalence of adolescents with malocclusion was 95.72%, corresponding to 358 participants, and normal occlu-

sion was 4.28%, corresponding to 16 participants, out of a total of 374 participants. They had an average age of 16.56 years (SD = 1.19 years).

Table 1 shows the types of malocclusions found by the researchers during the intraoral exam and the perceived by the adolescents themselves, as well as the amount recorded.

Midline deviation (55.35%), dental crowding (34.2%) and diastema between incisors (29.9%) were the most prevalent malocclusions in both genders. Crowding (53.1%), misalignment (45.6%) and diastema (37.5%), in this order, were the malocclusions that most influenced the aesthetic perception of young people in both genders (Table1).

Table 2 shows the aspects that cause aesthetic dissatisfaction among 8 of 16 adolescents with normal occlusion (G1).

Then, we sought to compare both groups G1 and G2 regarding their self-perception of oral aesthetics, measuring it through eight questions. The results are described in Table 3.

Tables 4 and 5 showed differences between G1 and G2 regarding male and female gender, respectively. Figures 1 to 5 showed the groups' graphic arrangement of questions according to the Likert scale.

## Discussion

The research hypothesis was proven, since the adolescents were able to self-assess themselves regarding malocclusions and the more visible they were, the more they

**Table 2.** Dissatisfaction of 8 teenagers with normal occlusion from March to December 2018

|  | Male | Female | Total |
|---|---|---|---|
| Teeth color (yellow smile) | 2 | 2 | 4 |
| Teeth size | 1 | 0 | 1 |
| Teeth shape | 1 | 1 | 2 |
| "Teeth forward" | 0 | 1 | 1 |

**Table 3.** Variables, mean and standard deviation, T-test. p-value between G1XG2 from March to December 2018

| Variables | G1 | G2 | _t_ Test | Significance |
|---|---|---|---|---|
| 1.Dissatisfaction with my teeth | 1,81(0,98) | 2,74(1,29) | 3,64 | _p_ = 0,01* |
| 2.Judge my beaultiful smile | 1,56(0,63) | 2,76(1,33) | 6,93 | _p_ = 0,01* |
| 3.Confortable to smile | 4,43(0,63) | 3,74(1,02) | 2,70 | _p_ = 0,01* |
| 4.Shamed/withdrawn while smiling | 3,87(1,15) | 3,36(1,25) | 1,62 | _p_ = 0,10 |
| 5.I would use aesthetic orthodontic braces | 2,50(1,59) | 1,80(1,24) | 2,16 | _p_ = 0,03* |
| 6.A dream smile would improve my self-esteem | 2,43(1,71) | 2,09(1,30) | 1,02 | _p_ = 0,44 |
| 7.I would flirt with someone with misaligned teeth | 3,25(1,53) | 3,31(1,31) | 0,17 | _p_ = 0,84 |
| 8.The smile with aligned teeth is important in the relationship | 2,12(1,31) | 2,52(1,45) | 1,07 | _p_ = 0,28 |

Table 4. Comparisons between G1 and G2 regarding male gender from March to December 2018

| Variables | G1 | G2 | t Teste | Significance |
|---|---|---|---|---|
| 1.Dissatisfaction with my teeth | 1,75(1,03) | 2,73(1,25) | 2,58 | $p = 0,03$* |
| 2.Judge my beaultiful smile | 1,75(0,70) | 2,85(1,31) | 4,06 | $p = 0,01$* |
| 3.Confortable to smile | 4,37(0,74) | 3,81(1,03) | 1,51 | $p = 0,13$ |
| 4.Shamed/withdrawn while smiling | 4,13(1,13) | 3,41(1,19) | 1,66 | $p = 0,10$ |
| 5.I would use aesthetic orthodontic braces | 3,37(1,76) | 1,77(1,15) | 2,54 | $p = 0,01$* |
| 6.A dream smile would improve my self-esteem | 3,25(1,66) | 2,07(1,25) | 2,53 | $p = 0,12$ |
| 7.I would flirt with someone with misaligned teeth | 2,87(1,73) | 3,30(1,32) | 0,88 | $p = 0,38$ |
| 8.The smile with aligned teeth is important in the relationship | 2,75(1,38) | 2,36(1,39) | 0,77 | $p = 0,45$ |

Table 5. Comparisons between G1 and G2 regarding female gender from March to December 2018

| Variables | G1 | G2 | t Teste | Significance |
|---|---|---|---|---|
| 1.Dissatisfaction with my teeth | 1,87(0,99) | 2,75(1,32) | 2,40 | $p = 0,04$* |
| 2.Judge my beaultiful smile | 1,37(0,51) | 2,69(1,36) | 6,38 | $p = 0,01$* |
| 3.Confortable to smile | 4,50(0,53) | 3,68(1,02) | 2,25 | $p = 0,02$* |
| 4.Shamed/withdrawn while smiling | 3,62(1,19) | 3,32(1,29) | 0,65 | $p = 0,52$ |
| 5.I would use aesthetic orthodontic braces | 1,62(0,74) | 1,83(1,30) | 0,44 | $p = 0,05$* |
| 6.A dream smile would improve my self-esteem | 1,62(1,41) | 2,10(1,33) | 0,99 | $p = 0,32$ |
| 7.I would flirt with someone with misaligned teeth | 3,62(1,30) | 3,32(1,32) | 0,64 | $p = 0,52$ |
| 8.The smile with aligned teeth is important in the relationship | 1,50(0,93) | 2,63(1,49) | 3,32 | $p = 0,10$ |

influenced their self-esteem. Crowding, misalignment and diastema were the most common occlusal abnormalities perceived by adolescents (Table 1, Figure 1), as they were the ones that caused them the most dissatisfaction when smiling.

Only one adolescent detected the midline deviation diagnosed by the researchers, in 207 sample participants. It suggests that this type of malocclusion is hardly noticeable by a layperson, contrasting with space problems such as crowding and diastemas.

In the study by Martins et al.[15] (2019), it was found that 51.9% of their sample had crowding and 23.7% had diastemas. Despite the considerable existence of dental removals, for him, crowding and discrepancies in dental overhang are the disorders that most affect the psychological well-being of adolescents. Silveira et al.[3] (2016) also achieved similar results. Corroborating our research, Marques et al.[16] (2005) and Martins et al.[15] (2019) identified crowding as one of the most prevalent clinical defects
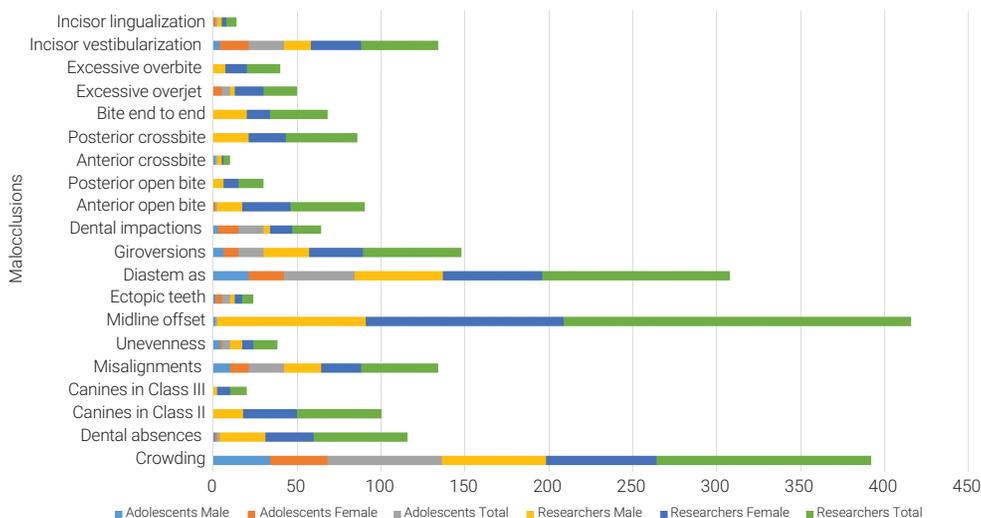
**Figure 1.** Graphic representation of the type of malocclusion observed by adolescents and researchers.
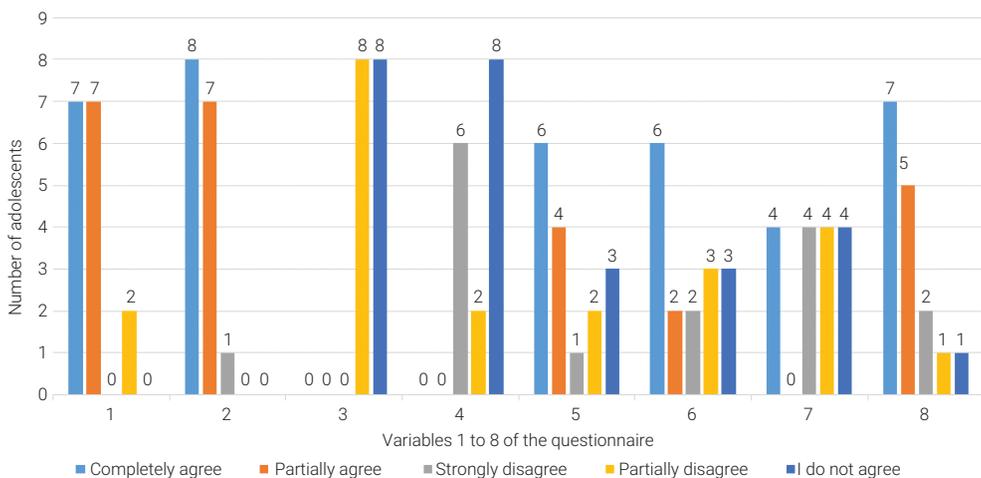


**Figure 2.** Number of adolescents of G1 who answered the 8 variables of the questionnaire (1 to 8) according to the Likert scale.

in the study population, ensuring that dissatisfaction with their appearance is considered the main reason for seeking orthodontic treatment. On the other hand, according to Nunes Neto et al.[17] (2014), the dental space problems represented by the diastemas, especially the upper interincisal ones, are the most annoying adolescents.

All of these malocclusions are seen predominantly in the anterior region of the arch, compromising aesthetics, and therefore become more easily perceived by those who have them[18,19]. In this study, individuals with normal occlusion demonstrated some type of dissatisfaction with dental color, size and shape of teeth (Table 2). These aesthetic factors confirm the great importance that these issues have on people's lives.
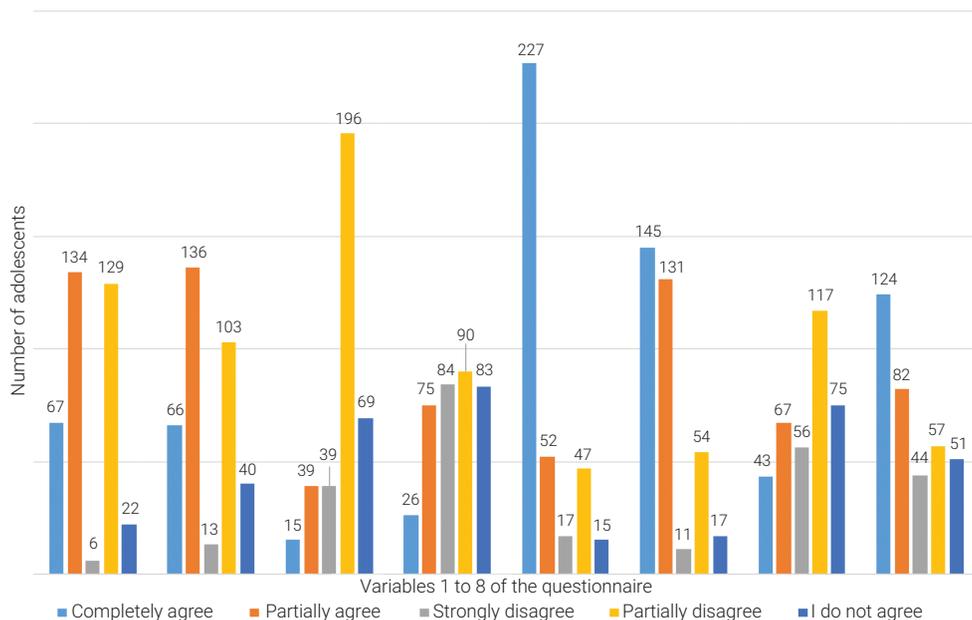
**Figure 3.** Number of adolescents of G2 who answered the 8 variables of the questionnaire (1 to 8) according to the Likert scale.
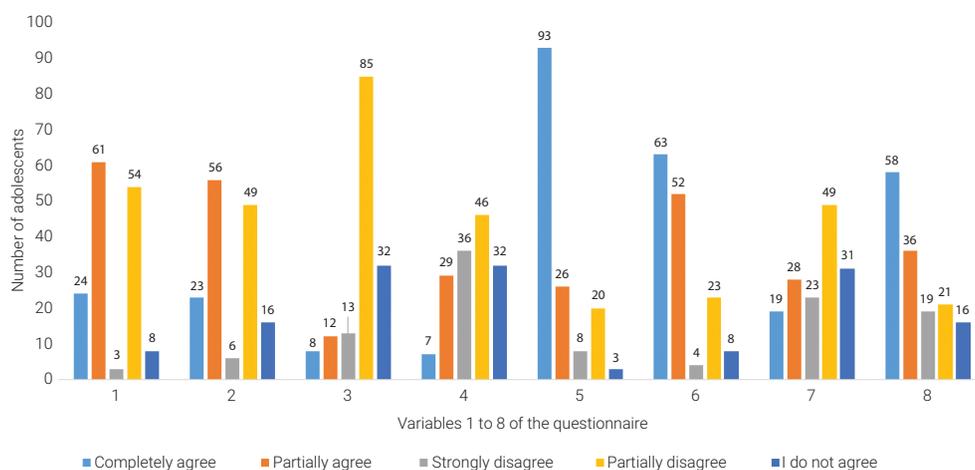


**Figure 4.** Graphical representation of number of adolescents of G2 who answered the 8 variables of the questionnaire (1 to 8) according to the Likert scale for males.

This study showed the adolescents' self-perception capacity when malocclusion is present. This was confirmed by the greater dissatisfaction of this group with its own smile and a negative judgment about its beauty. Both G2 genders showed less content to smile than G1 (Table 3, Figures 2 and 3). Costa et al.[7] (2017), about the self-perception of dental aesthetics and its impact on adolescents' lives, stated that there is a significant correlation between malocclusion and self-perception, as well as high smile dissatisfaction with severe malocclusions.
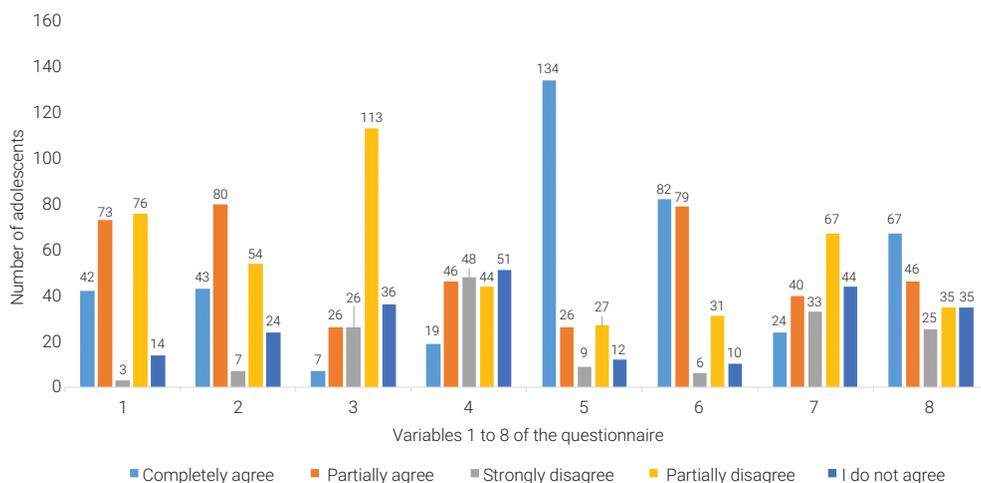
**Figure 5.** Graphical representation of number of adolescents of G2 who answered the 8 variables of the questionnaire (1 to 8) according to the Likert scale for females.

The adolescents in both groups, but more significantly in G2, stressed feeling uncomfortable when smiling, being able to identify the present changes and point out what actually displeased them. Highlighting the female gender, evidencing to have a stronger self-perception capacity than the male gender under the same clinical conditions (Tables and Figures 3, 4 and 5).

In adolescence, changes in beauty standards can undermine self-esteem and damage interpersonal relationships, as it is at this stage of life that the first concerns about appearance and physical attractiveness arise[19]. Sharma et al.[8] (2017) showed an expressive association between self-esteem levels and dental aesthetic perception, in stating that those who considered their teeth less attractive had lower self-esteem. Gatto et al.[6] (2017) also achieved this result and found that young people with severely affected dental aesthetics are often victims of bullying, a factor that helps lower their level of self-esteem. They also stated that bullying and its negative consequences on self-esteem affect adolescents more intensely, since at this stage they tend to overestimate the opinion of others regarding their physical image.

These facts contradict our study, since there was no significant difference between both groups G1 and G2 regarding questions 4, 6, 7 and 8 (Table 3), not even when genders were evaluated separately (Tables 4 and 5). In other words, for the most part, adolescents with malocclusion and those with normal occlusion did not feel ashamed when smiling, did not consider that the ideal smile would improve their self-esteem and that misaligned teeth would not interfere with flirting and interpersonal relationships.

Our results also showed that adolescents from G2 were able to recognize the importance of orthodontic treatment to improve their dental problems, while those from G1 stated that they would hardly use braces because they were already satisfied with their own smile (Table 3). This perception was more observed among boys than girls (Tables 4 and 5). Similar results were obtained in the study by other authors[18-22] which

found a positive association between the need for orthodontic treatment observed by specialists and that perceived by patients. It was noted that individuals who did not report desire to use orthodontic appliance actually had less indication of treatment.

According to Mail et al.[1] (2015), 86% of the students evaluated in their research said they wanted to go through an orthodontic intervention, while only 52% of them had a real need. These data corroborate another study18 pointed out in the literature, in which 87.7% of respondents assumed the desire to receive orthodontic treatment. This suggests a discrepancy between the orthodontic clinical criteria that determine the need for malocclusion treatment and the individual's self-perception, showing that the adolescents' need for treatment is associated with dissatisfaction with appearance or aesthetic fads, since the setbacks involving these questions always have a greater impact on adolescents' lives than those related to the stomatognathic system function.

Interpretation of the results should consider some limitations inherent in this research. Future studies on the relationship between malocclusion and aesthetic self-perception among adolescents are important.

The following conclusions can be drawn:

- The adolescents were able to perceive the aesthetic alterations resulting from malocclusions, being determinants of dissatisfaction when smiling.

- Malocclusions predominantly located in the anterior region of the arch, such as crowding, misalignment and diastemas, are among the most easily perceived occlusal problems by young people, as they are situated in an area of great aesthetic importance.

- All adolescents with malocclusion and those with normal occlusion were not ashamed to smile, did not consider that the ideal smile would improve their self-esteem and that misaligned teeth did not interfere with flirting and interpersonal relationships.

### References

1. Mail LR, Donassollo SH, Donassolo TA. Malocclusion Diagnosis: Normative Criteria and Self-Perception of Adolescents. Braz Res Pediat Dent Integr Clin. 2015;15(1):197-203. doi:10.4034/PBOCI.2015.151.21.

2. Eslamipour F, Afshari Z, Najimi A. Prevalence of malocclusion in permanent dentition of Iranian population: a review article. Iran J Public Health 2018 Feb;47(2):178-87.

3. Silveira MF, Freire RS, Nepomuceno MO, Martins AMEBL, Marcopito LF. Severity of malocclusion in adolescentes: population-based study in the north of Minas Gerais, Brazil. Rev Saude Publica. 2016;50(11):1-11. doi:10.1590/S1518-8787.2016050005861.

4. Brizon VSC, Cortellazzi KL, Vasquez FL, Ambrosano GMB, Pereira AC, Gomes VE, et al. [Individual and contextual factors associated with malocclusion in Brazilian children]. Rev Saude Publica. 2013 Dec;47 Suppl 3:118-28. doi: 10.1590\s0034-8910.2013047004426. Portuguese.

5. Almeida AB, Leite ICG, Melgaço CA, Marques LS. Dissatisfaction with dentofacial appearance and the normative need for orthodontic treatment: determinant factors. Dental Press J Orthod. 2014 May-Jun;19(3):120-6. doi:10.1590/2176-9451.19.3.120-126.oar.

6.  Gatto RCJ, Garbin AJI, Corrente JE, Garbin CAS. Self-esteem level of Brazilian teenagers victims of bullying and its relation with the need of orthodontic treatment. RGO. 2017 Jan-Mar;65(1):30-6. doi: 10.1590\1981-863720170001000053304.

7.  Costa AC, Rodrigues FS, Heimer MV. [Self concept of dental aesthetics and its impact on the life of adolescents]. Adolesc Saude. 2017 Oct-Dec;14(4):157-66. Portuguese.

8.  Sharma A, Mathura A, Batra M, Makkara DK, Aggarwala VP, Goyal N, et al. Objective and subjective evaluation of adolescent's orthodontic treatment needs and their impact on self-steem. Rev Paul Pediatr. 2017 Jan-Mar;35(1):86-91. doi: 10.1590/1984-0462/;2017;35;1;00003.

9.  Soto KLZP, Ely HC, Mallmann FH, Abegg C. [Need for orthodontic treatment in adolescents from the state of Rio Grande do Sul, Brazil: association between self-perception and clinical need]. RFO. 2018 May-Aug;23(2):186-92. doi: 10.5335\rfo.v23i2.8345. Portuguese.

10. Freitas CV, Souza JGS, Mendes DC, Pordeus IA, Jones KM, Martins AMEBL. Need for orthodontic treatment in Brazilian adolescents: health-based assessment public. Rev Paul Pediatr. 2015 Apr/Jun;33(2):204-10. doi: 10.1016/j.rpped.2014.04.006.

11. Abualella M, Abuaffan AH. Psychosocial impact of dental aesthetics among sudanese high school students. Braz Dent Sc. 2016 Abr-Jun;19(2):32-9. doi: 10.14295/bds.2016.v19i2.1225.

12. Luchesa CJ. Chaves Neto A. [Calculation of sample size in administration research]. Curitiba: Edição do autor; 2011 [cited 2019 Aug 12]. 27p. Available from: https://www.unicuritiba.edu.br/images/calculo_do_tamanho_da_amostra_-_texto_final_para_impressapso1.pdf. Portuguese.

13. Peres MA, Traebert J, Marcenes W. [Calibration of examiners for dental caries   epidemiology studies]. Cad Saude Publica. 2001 Jan-Feb;17(1):153-9. Portuguese.

14. Brook PH, Shaw WC. The development of an index of orthodontic treatment priority. Eur J Orthod. 1989 Aug;11(3):309-20. doi:10.1093/oxfordjournals.ejo.a035999

15. Martins LP, Bittencourt JM, Bendo CB, Vale MP, Paiva SM. Malocclusion and social vulnerability: a representative study with adolescents from Belo Horizonte, Brazil. Cien Saude Colet. 2019 Feb;24(2):393-400. doi: 10.1590/1413-81232018242.33082016.

16. Marques LS, Barbosa CC, Ramos-Jorge ML, Pordeus IA, Paiva SM. Malocclusion prevalence and orthodontic treatment need in 10-14-years-old schoolchildren in Belo Horizonte, Minas Gerais State, Brazil: a psychosocial focus. Cad Saude Publica. 2005 Jul-Aug;21(4):1099-106. doi: 10.1590/S0102-311X2005000400012. Portuguese.

17. Nunes Neto TA, Thomaz EBAF, Ferreira MC, Santos AM, Queiroz RCS. [Dental spacing problems and associated factors among Brazilian adolescents]. Cien Saude Colet. 2014 Nov;19(11):4555-68. doi: 10.1590\1413-812320141911.15932013. Portuguese.

18. Danaei SM, Salehi P. Association between normative and self-perceived orthodontic  treatment need among 12- to 15-year-old students in Shiraz, Iran. Eur J Orthod. 2010 Oct;32(5):530-4. doi: 10.1093/ejo/cjp139.

19. Choi SH, Kim JS, Cha JY, Hwang CJ. Effect of malocclusion severity on oral health –  related quality of life and food intake ability in a Korean population. Am J Orthod Dentofacial Orthop 2016 Mar;149(3):384-90. doi: 10.1016/j.ajodo.2015.08.019.

20. Rodrigues FS, Costa AC, Heimer MV. [Impact of malocclusions in the quality of life of adolescents]. Adolesc Saude. 2016 Aug/Sep;13(1):110-7. Portuguese.

21. Lira ALS, Sousa FDC. Evaluation of the influence of malocclusion in interpersonal relations among adolescentes. Braz Dent Sci. 2020 Jan-Mar;23(1):1-9. doi: 10.14295/bds.2020.v23i1.1799.

22. Sotto KLZP, Hely HC, Mallmann FH, Abegg C. [Need for orthodontic treatment in adolescents from the state of Rio Grande do Sul, Brazil: association between self-perception and clinical need]. RFO. 2018 May-Aug;23(2):86-92. doi:10.5335/rfo.v23i2.8345. Portuguese.