The Impact of Malocclusion on Quality of Life and Life Satisfaction

Antonio Franklin Cordeiro Neto¹, Roberto Carlos Mourão Pinho¹, Raulison Vieira de Sousa¹, Bruna de Carvalho Farias Vajgel¹, Renata Cimões¹

Abstract

Introduction: The concept of quality of life is related to the individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns.

Objective: The aim of this study was to evaluate whether the type of malocclusion affects the perception of quality and satisfaction with people's lives. Three questionnaires were applied: the first one assessed the social and economic factors and the diagnosis of malocclusion through Angle's classification, the second was the OHIP-14, and the third was the Satisfaction With Life Scale (SWLS).

Results: This study involved 444 patients aged 18 to 72 years. According to the classification of malocclusion 48.65% was Class I, 22.75% was Class II division 1, 12.16% was Class II division 2 and Class III 16.44%. The malocclusion did not have negative impact on the level of satisfaction with life, but in all dimensions analyzed by OHIP-14, malocclusion had negative impact on quality of life and was statistically significant. The most severe malocclusions such as Class II and Class III represent a more negative impact when compared to Class I malocclusion. Moreover, for the dimensions assessed by the OHIP-14, physical pain and psychological discomfort were those who showed a greater negative impact on quality of life.

Conclusions: Malocclusions do not interfere with the judgment of the level of satisfaction with life, but they produce a negative impact on quality of life.
Introduction
The concept of quality of life is related to the individuals perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns [1, 2, 3].

Oral conditions can cause pain and discomfort, with a consequent impact on the functional, social and psychological wellbeing of the individuals [4]. In the last decade there has been increased interest in investigating the relationship between oral conditions and their impact on people’s life. Thus, quality of life assessment has become an integral part of the evaluation of health programmes [4].

Several instruments have been developed in an attempt to understand and evaluate how the oral problems have affected the daily lives of people [4]. Such indices are standardized ways of providing information and quantifying the effects of oral disorders on the patient’s social, psychological and functional well-being [5, 6, 7, 8, 9].

With the marked decline in dental caries prevalence, ten other oral health conditions have received increased attention in recent decades [10], including malocclusions, which has been reported by WHO as the third most important public dental health problem, with functional and aesthetic effects that exert an impact on quality of life [11].

Indeed, malocclusions represent one of the problems studied, over time, through different classifications and in different populations. Most of these studies led to the confirmation of their prevalence and etiology, and to determining treatment measures [12]. Therefore, the aim of this study was to evaluate whether the type of malocclusion interfered with the perception of quality of life and life satisfaction.

Materials and Methods

Study Design
This cross-sectional study was conducted to assess the impact of malocclusion on the quality of life and life satisfaction of individuals in the city of Recife, the state capital of Pernambuco in the northeastern region of Brazil.

Sample
The sample size was calculated using the statistics programs in Epi Info, adopting a confidence interval of 95% and a significance level of 5%. The calculation used a prevalence of Class I malocclusion (55%) [13], and considered a sample loss of up to 20% with no loss of significance, therefore a minimum of 381 individuals had to be included.

Patients were randomly selected and met the following inclusion criteria: have at least 18 years of age; be literate; have at least 20 natural teeth, including the first molars; and agree to participate in the study. Individuals who underwent previous orthodontic treatment and who had some facial deformity were excluded.

Ethical Approval
The research project was approved by the Human Research Ethics Committee of Federal University of Pernambuco (Brazil), under process number 0414.0.172.000-11 in compliance with the 196/96 Resolution of the Brazilian National Ministry of Health.

Data Collection
A single researcher conducted all the interviews, using a questionnaire for the assessment of social and economic factors including: individual income, family income (based on number of minimum wages - BRL 622,00), gender, age, marital status and education.

Angle’s classification [14] system was used for the diagnosis of malocclusion. The instruments adopted
in the present study were the Oral Health Impact Profile, in its simplified version (OHIP-14), developed by Slade [15] and validated for Portuguese by Oliveira and Nadanovsky [16], and the Satisfaction With Life Scale (SWLS), developed by Diener [17] and validated by Gouveia (18) in Brazil.

The OHIP-14 [15] is a questionnaire containing 14 questions that address the following subject dimensions based on a theoretical and conceptual model of oral health developed by Locker [19]: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap in performing daily activities. The data collected provided information on the perceived oral health impact. For each question there were 5 possible answers from which the patient could choose: 0 - never; 1 - rarely; 2 - sometimes; 3 - often; 4 - always. Overall OHIP-14 scores could range from 0 to 56.

The SWLS [17] is a five-item scale that assesses a cognitive component of the subjective well-being (e.g. In most ways my life is close to my ideal, If I could live my life over, I would change almost nothing). Respondents are instructed to rate each item using a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree), resulting in 5 values which were summed to form the final score. The final score could range from 5 to 35, i.e., from extremely unsatisfied to highly satisfied. A score of 20 is regarded as neutral, while scores in excess of 20 represent satisfaction (21-25=slightly satisfied; 26-30= satisfied), and scores of less than 20 represent dissatisfaction (15-19=slightly dissatisfied; 5-9=extremely dissatisfied) [20].

Statistical analysis
For the analysis of associations, OHIP-14 scores were dichotomized as the presence of impact on quality of life (at least one “sometimes”, “often” or “always” response) or absence of impact (only “never” and “rarely” responses on all items). The presence of impact of the OHIP-14 indicates respondents perceive major oral problems and the impact of these problems on their quality of life.

Family income was divided according to IBGE’s (Brazilian Institute of Geography and Statistics) 2012 analysis, based on number of minimum wages (BRL 622,00) earned as shown in Table 1.

Table 1. Family social classification according to IBGE 2012.

| Class | Minimum Wages | Family Income |
|-------|---------------|---------------|
| A     | More than 20  | R$ 12,440 or more |
| B     | 10 to 20      | From R$ 6,220 to R$ 12,440 |
| C     | 4 to 10       | From R$ 2,488 to R$ 6,220 |
| D     | 2 to 4        | From R$ 1,244 to R$ 2,488 |
| E     | Up to 2       | Up to R$ 1.244 |

For categorical analysis, the statistical tests used were Pearson’s chi-square test (for comparing proportions), and Fisher’s Exact test for 2X2 tables. The binary logistic regression analysis was used to measure the relationship between independent and dependent variable. A p-value of 0.05 was used for the entry of independent variables into the model, and for the permanence of the variable in the final model, a 20% significance level was adopted. A 95% confidence interval (CI) was used to estimate the precision of the Odds Ratio. The statistical test of Hosmer and Lemeshow test was used to evaluate the model.

Two models were used: one with satisfaction with life as the dependent variable, and the other with impact on quality of life as the dependent variable. SPSS software package release 17.0 was used for all analyses.

Results
Four hundred and forty-four patients aged 18-72 years (mean age: 33.78 (± 12.53) participated in the study, most were less than 31 years old (51.47%);
239 (53.83%) were male and 205 (46.17%) were female. More than half of the patients were married (50.45%). Most of them had completed high school (38.15%). The average individual income was BRL 2,335.89 (± BRL 2,222.05) and median of BRL 1,500.00; and the average household income was BRL 4,138.71 (± BRL 3,684.70) and median of BRL 3,000.00. In terms of social classes, 17.32% belonged to classes A and B, 42.73% belonged to class C, and 39.95% belonged to classes D and E. According to Angle’s classification of malocclusion, Class I was the most frequent (48.65%), followed by Class II Division 1 (22.75%), Class III (16.44%), and Class II Division 2 (12.16%).

A total of 31.81% of the patients had a negative impact on quality of life. Figure 1 shows the percentage distribution of patients with a negative impact on quality of life according to OHIP-14. Physical pain (70.72%) and psychological discomfort (70.50%) were the items that had the greatest negative impact on quality of life. The item handicap in performing daily activities (19.59%), which includes difficulty in performing tasks and life satisfaction, had the lowest percentage.

According to Table 2, there were statistically significant differences between patients who had positive impacts and those who had negative impacts on life satisfaction related to the independent variables.

Table 2. Distribution of patients according to the impact on life satisfaction in relation to gender, malocclusion classification, family social class, marital status, education, individual income and age.

| Variables                      | No Positive Impact | Positive Impact* | Total | p-value |
|--------------------------------|--------------------|------------------|-------|---------|
|                                | n  | %   | n  | %   | n  | %  |     |
| Gender                         |    |     |    |     |     |     |       |
| Male                           | 24 | 10.04 | 215 | 89.96 | 239 | 100 | 0.039 |
| Female                         | 33 | 16.10 | 172 | 83.90 | 205 | 100 |       |
| Malocclusion                   |    |     |    |     |     |     |       |
| Class I                        | 23 | 11.06 | 185 | 88.94 | 208 | 100 | 0.461 |
| Class II                       | 20 | 13.07 | 133 | 86.93 | 153 | 100 |       |
| Class III                      | 12 | 16.67 | 60  | 83.33 | 72  | 100 |       |
| Family Social Class            |    |     |    |     |     |     |       |
| A or B                         | 5  | 6.67 | 70  | 93.33 | 75  | 100 | 0.002 |
| C                              | 16 | 8.65 | 169 | 91.35 | 185 | 100 |       |
| D or E                         | 34 | 19.65 | 139 | 80.35 | 173 | 100 |       |
| Marital Status                 |    |     |    |     |     |     |       |
| Married                        | 22 | 10.95 | 179 | 89.05 | 201 | 100 | 0.173 |
| Single/ Divorced/ Widow        | 35 | 14.40 | 208 | 85.60 | 243 | 100 |       |
| Education                      |    |     |    |     |     |     |       |
| Completed High School          | 31 | 14.98 | 176 | 85.02 | 207 | 100 | 0.136 |
| Complete or Incomplete Degree  | 26 | 11.02 | 210 | 88.98 | 236 | 100 |       |
| Individual Income              |    |     |    |     |     |     |       |
| Up to 2 MW                     | 24 | 14.20 | 145 | 85.80 | 169 | 100 | 0.268 |
| More than 2 MW                 | 24 | 11.54 | 184 | 88.46 | 208 | 100 |       |
| Age                            |    |     |    |     |     |     |       |
| Up to 31 years of age          | 24 | 10.53 | 204 | 89.47 | 228 | 100 | 0.085 |
| Above 31 years of age          | 33 | 15.35 | 182 | 84.65 | 215 | 100 |       |

* positive impact: slightly satisfied, satisfied and very satisfied; negative impact: very dissatisfied, dissatisfied, neither satisfied nor dissatisfied.
Table 3. Distribution of patients according to the impact on quality of life in relation to gender, malocclusion classification, family social class, marital status, education, individual income and age.

| Variables                      | No Positive Impact | Positive Impact* | Total | p-value |
|--------------------------------|--------------------|------------------|-------|---------|
|                                | n      | %    | n     | %    | n      | %    |
| Gender                         |        |      |       |      |        |      |
| Male                           | 42     | 17.57| 197   | 82.43| 239    | 100  |
| Female                         | 17     | 8.29 | 188   | 91.71| 205    | 100  |
| Malocclusion                   |        |      |       |      |        |      |
| Class I                        | 38     | 18.27| 170   | 81.73| 208    | 100  |
| Class II                       | 14     | 9.15 | 139   | 90.85| 153    | 100  |
| Class III                      | 7      | 9.72 | 65    | 90.28| 72     | 100  |
| Family Social Class            |        |      |       |      |        |      |
| A or B                         | 9      | 12.00| 66    | 88.00| 75     | 100  |
| C                              | 24     | 12.97| 161   | 87.03| 185    | 100  |
| D or E                         | 26     | 15.03| 147   | 84.97| 173    | 100  |
| Marital Status                 |        |      |       |      |        |      |
| Married                        | 18     | 8.96 | 183   | 91.04| 201    | 100  |
| Single/Divorced/Widow          | 41     | 16.87| 202   | 83.13| 243    | 100  |
| Education                      |        |      |       |      |        |      |
| Completed High School          | 26     | 12.56| 181   | 87.44| 207    | 100  |
| Complete or Incomplete College Degree | 33 | 13.98 | 203 | 86.02 | 236 | 100 |
| Individual Income              |        |      |       |      |        |      |
| Up to 2 MW                     | 35     | 20.71| 134   | 79.29| 169    | 100  |
| More than 2 MW                 | 14     | 6.73 | 194   | 93.27| 208    | 100  |
| P< 0.001                       |        |      |       |      |        |      |
| Age                            |        |      |       |      |        |      |
| Up to 31 years of age          | 50     | 21.93| 178   | 78.07| 228    | 100  |
| Above 31 years of age          | 9      | 4.19 | 206   | 95.81| 215    | 100  |

* Negative impact: occasionally, hardly ever and ever; No negative impact: never and almost never.

Table 3 shows that there were statistically significant differences between the patients who did not have negative impacts and those who did have negative impacts on quality of life according to the OHIP-14 for the independent variables: gender, classification of malocclusion, marital status, individual income and age. Female patients were the ones who had greatest negative impact on quality of life. In terms of malocclusion classification, patients from Classes II and III had greater negative impact than patients from Class I. Married individuals also had greater negative impact when compared to unmarried, divorced and widowed individuals. Patients aged over 31 years had greater impact compared to younger patients and also to those with higher income. There were no significant differences between the impact on life satisfaction for the items family social class and education.

In order to measure the Odds Ratio (OR) of having a positive impact on satisfaction with life and a negative impact on quality of life, a multivariate analysis was performed using the binary logistic regression model, where the variables that were significant in the analysis were taken to the bivariate logistic model: gender and social class for the model on satisfaction with life and sex, classification of malocclusion, Marital Status, level of education, individual income and age for the model on impact on quality of life.

The Hosmer-Lemeshow test was used to assess the fit of the model. If the p-value of this statistical test is greater than 0.05 it indicates a good fit of the model.
Multivariate analysis showed that the variables associated with positive impact on life satisfaction were age group and social class. The model is shown in Table 4 and indicates that patients from social classes A and B are 3.88 times more likely to be satisfied with life than those from classes D and E. Patients from class C are 2.9 times more likely to be satisfied with life than those from classes D and E. Patients aged up to 31 are 2.04 times more likely to be satisfied with life than those aged over 31 years.

Multivariate analysis demonstrated that the classification of malocclusion was the only variable associated with negative impact on quality of life. Therefore, in the logistic regression model the individual income, marital status, sex and age did not reach a significance level to enter the model. The model is shown in Table 5 and indicates that patients in Class II malocclusion are 2.22 times more likely to have a negative impact on quality of life compared to patients in Class I, and also that patients in Class III are 2.08 times more likely to have negative impact on quality of life than patients in Class I.

Table 4. Final logistic regression model on the positive impact on satisfaction with life considering family social classes and age as explanatory variable.

| Domains/Facets                  | B    | S.E.  | Wald  | df  | p-value | OR   | 95% CI for Odds Ratio |
|---------------------------------|------|-------|-------|-----|---------|------|-----------------------|
|                                 |      |       |       |     |         |      | Lower limit | Upper limit |
| Up to 31 years of age           | 0.714| 0.305 | 5.465 | 1   | 0.019   | 2.041| 1.122     | 3.713      |
| Classes D and E (reference)     |      |       |       |     |         |      |            |            |
| Classes A and B                 | 1.357| 0.507 | 7.170 | 1   | 0.007   | 3.883| 1.439     | 10.483     |
| Class C                        | 1.076| 0.332 | 10.500| 1   | 0.001   | 2.932| 1.530     | 5.619      |
| Constant                        | 1.161| 0.231 | 25.354| 1   | 0.000   | 3.194|           |            |
| Model adjustment*               | 0.605|       |       |     |         |      |            |            |

* Model adjustment by Hosmer-Lemeshow statistical test.

Table 5. Final logistic regression model on the impact on satisfaction with life considering gender and malocclusion classification as explanatory variable.

| Domains/Facets                  | B    | S.E.  | Wald  | df  | p-value | OR   | 95% CI for Odds Ratio |
|---------------------------------|------|-------|-------|-----|---------|------|-----------------------|
|                                 |      |       |       |     |         |      | Lower limit | Upper limit |
| Class I (Reference)             |      |       |       |     |         |      |            |            |
| Class II                        | 0.797| 0.333 | 5.735 | 1   | 0.017   | 2.219| 1.156     | 4.262      |
| Class III                       | 0.730| 0.436 | 2.800 | 1   | 0.094   | 2.076| 0.882     | 4.882      |
| Constant                        | 1.498| 0.179 | 69.713| 1   | 0.000   | 4.474|           |            |
| Model adjustment*               | 1.000|       |       |     |         |      |            |            |

* Model adjustment by Hosmer-Lemeshow statistical test.

Figure 2: Percentage distribution of patients with a negative impact on quality of life according to OHIP-14 (subscores) in relation to malocclusion classification.
Table 6. Distribution of patients according to malocclusion classification in relation to the negative impact on quality of life (subscores).

| Quality OHIP-14 | Malocclusion Classification | p-value* |
|-----------------|-----------------------------|----------|
|                 | Class I | Class II | Class III |          |
| subscores       | n | % | n | % | n | % |
| Functional Limitation | No impact | 150 | 72.12 | 78 | 50.98 | 34 | 47.22 | <0.001 |
| Impact          | 58 | 27.88 | 75 | 49.02 | 38 | 52.78 |
| Physical Pain   | No impact | 80 | 38.46 | 32 | 20.92 | 16 | 22.22 | <0.001 |
| Impact          | 128 | 61.54 | 121 | 79.08 | 56 | 77.78 |
| Psychological Discomfort | No impact | 77 | 37.02 | 34 | 22.22 | 16 | 22.22 | <0.001 |
| Impact          | 131 | 62.98 | 119 | 77.78 | 56 | 77.78 |
| Physical Disability | No impact | 154 | 74.04 | 88 | 57.52 | 43 | 59.72 | <0.001 |
| Impact          | 54 | 25.96 | 65 | 42.48 | 29 | 40.28 |
| Psychological Disability | No impact | 136 | 65.38 | 65 | 42.48 | 31 | 43.06 | <0.001 |
| Impact          | 72 | 34.62 | 88 | 57.52 | 41 | 56.94 |
| Social Disability | No impact | 174 | 83.65 | 109 | 71.24 | 50 | 69.44 | <0.001 |
| Impact          | 34 | 16.35 | 44 | 28.76 | 22 | 30.56 |
| Handicap in Performing Daily Activities | No impact | 185 | 88.94 | 111 | 72.55 | 51 | 70.83 | <0.001 |
| Impact          | 23 | 11.06 | 42 | 27.45 | 21 | 29.17 |

* Pearson’s chi-square test

Discussion

The analysis of the results presented by the interviewed patients who had some type of malocclusion allowed the evaluation of the impact of this condition on their satisfaction with life and on the quality of life using the Satisfaction With Life Scale (SWLS) [17] and OHIP -14 [15] respectively.

In literature there are several instruments that have been developed to assess subjective well-being [17, 20, 21]. However most of these instruments present some limitations such as relying on a single item, have been built for specific populations (e.g., children and the elderly) and cover factors other than specifically satisfaction with life [17]. The SWLS has been widely used in several countries [22, 23, 24, 25]. Its factor structure and reliability have been proven in several studies [17, 26, 27, 28], including in Brazil [18], therefore it is a valid measure for assessing how much people are satisfied with their lives.

Another research instrument used in this study was OHIP, which according to the literature, is one of the most widely used and reliable questionnaires to assess the impact of oral diseases on the quality of life [29].

The results of the present study indicate that satisfaction with life was affected by the independent variables gender, and family social class. Men were more satisfied with life than women, contrary to previous studies results, where there was no statistically significant difference between the gender of participants [18, 20, 30]. Family social classes with higher income showed greater satisfaction with life compared to family social classes with lower income, and this was confirmed by logistic-regression analysis. In other studies the relationship between age and satisfaction with life showed that older people are more satisfied with life [18, 31], contrary to the results observed in this study, where there was no statistically significant difference between the dichotomized age groups. Likewise, the present study showed no statistically significant difference

Malocclusion obtained negative impact on quality of life and was statistically significant (Table 6) in all dimensions analyzed by OHIP-14. Among these dimensions physical pain and psychological discomfort were the ones that had greater negative impact, while handicap in performing daily activities had the lowest impact (Figure 2).
between the different types of malocclusion and satisfaction with life.

In this study the OHIP-14 showed that malocclusion interfered negatively with quality of life. Such conclusion is in agreement with other studies conducted in Brazil which claim that malocclusion had a negative impact on the quality of life of individuals [32, 33], regardless of the severity of their aesthetic condition as assessed by the orthodontist [34].

Several studies have reported that oral conditions affect quality of life, e.g., people with periodontal problems [35, 36], suffer negative impacts on quality of life. But in the literature there are few studies on the influence of malocclusion on quality of life. Malocclusion is one of the most prevalent oral conditions [11], and in this study the results showed that 48.65% of the individuals interviewed were Class I, 22.75% were Class II Division 1, 12.16% were Class II division 2 and 16.44% were Class III. These results are similar to those found in other Brazilian studies [13, 32].

Individuals with Class II malocclusion were the ones with the greatest negative impact, followed by individuals with Class III and Class I, respectively. These data are consistent with similar studies conducted with Brazilian [32] and Iranian [37] adolescents. Through a logistic regression analysis it was possible to calculate that people with malocclusion class II and III are more likely to have a negative impact on quality of life than individuals with class I. This was probably due to the fact that individuals with most severe malocclusions are more likely to suffer physical and psychosocial problems [38] such as dental traumas [39] and bullying [40] which directly interfere with the quality of life. A meta-analysis on the social effects of bullying associated with malocclusion suggested that victims suffer from psychological problems [41], and the present study shows that physical pain and psychological discomfort, followed by psychological disability (Figure 03), were the items that caused the greatest negative impact on quality of life. Furthermore, individuals with severe malocclusion feel worthless, ashamed and inferior [42], and the more severe the malocclusion, more the individual feels ashamed [43, 44]. A longitudinal study suggests that there is no relationship between malocclusion and work [45], and this study has shown that the handicap in performing daily activities was the dimension that suffered less impact on quality of life related to malocclusion.

Other factors that influenced the negative impact on quality of life were age and gender. In this study the results showed that the older the individuals, the greater the negative impact on quality of life, and that women have a worse quality of life than men. Another study conducted in Brazil, obtained similar results related to age, but contrary results related to gender [38].

Although widely used and accepted worldwide, the Angle’s classification [14] only evaluates the anteroposterior relationships, and it is probable that other deformities such as posterior unilateral or bilateral cross bite and open bite, may also interfere with quality of life. In addition, other factors such as caries and pain that are not related to malocclusion, which may have a negative influence on quality of life, were not considered in the sample.

Conclusions

• Malocclusions do not interfere with the judgment of the level of satisfaction with life of people.
• Malocclusions negatively impact quality of life.
• Regarding the dimensions measured by OHIP-14, physical pain related to malocclusion and psychological discomfort were those who had greater negative impact on quality of life.

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