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ORIGINAL ARTICLE

Oral health-related quality of life in individuals with severe asthma

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ABSTRACT

Objective: To evaluate oral health-related quality of life (OHRQoL) among individuals with severe asthma, comparing it with that observed among individuals with mild-to-moderate asthma and individuals without asthma. **Methods:** We conducted a cross-sectional study of 125 individuals: 40 with severe asthma; 35 with mild-to-moderate asthma; and 50 without asthma. We calculated the decayed, missing, and filled teeth (DMFT) index, as well as the Periodontal Screening and Recording index, and determined the stimulated salivary flow rate. We applied three structured questionnaires: the 14-item Oral Health Impact Profile (OHIP-14); the Medical Outcomes Study 36-Item Short-Form Health Survey, version 2 (SF-36v2); and the Work Ability Index (WAI). **Results:** Periodontitis and reduced salivary flow were both more common in the severe asthma group than in the mild-to-moderate asthma and no-asthma groups. In addition, the WAI scores were lower in the severe asthma group than in the mild-to-moderate asthma and no-asthma groups, as were the scores for all SF-36v2 domains. The individuals with severe asthma also scored lower for the OHIP-14 domains than did those without asthma. Although the mean DMFT index did not differ significantly among the groups, the mean number of missing teeth was highest in the severe asthma group. Strong correlations between the SF-36v2 Component Summaries and poorer OHRQoL were only observed in the severe asthma group. **Conclusions:** Severe asthma appears to be associated with poorer oral health, poorer OHRQoL, a lower WAI, and lower scores for SF-36v2 domains.

Keywords: Oral health; Periodontal diseases; Asthma.

INTRODUCTION

Asthma is a variable, heterogeneous condition, characterized mainly by respiratory symptoms, including cough, wheezing, dyspnea, chest tightness, and (usually) reversible airflow limitation that is typically related to airway inflammation.[1] Chronic respiratory diseases affect more than one billion people worldwide, including three hundred million people with asthma.[2] In 2011, the Brazilian National Ministry of Health registered 175,000 hospitalizations for asthma in the country, where asthma accounts for more than 2,000 deaths per year.[3] Although approximately 23% of adults in Brazil presented with wheezing in 2017, only 12% received a physician diagnosis of asthma.[3] According to the World Health Organization (WHO),[4] asthma is underdiagnosed and its prevalence is therefore underestimated.

Because of the high prevalence of chronic respiratory diseases, the WHO recommends that the surveillance, prevention, and control of such diseases be expanded worldwide.[4] Many environmental and genetic factors influence their progression.[5] There is a strong association between respiratory diseases and periodontal disease, which has multiple determinants.[6]

The use of inhaled corticosteroids reduces the risk of severe asthma exacerbations and controls asthma symptoms in adults and adolescents.[1] However, corticosteroids can suppress the local immune system and increase individual susceptibility to infection with certain pathogens.[7] The cells of the immune system produce inflammatory cytokines when activated by pathogens. Those cytokines stimulate macrophages and osteoclasts to release hydrolases, collagenases, and matrix metalloproteinases. Metalloproteinases originating from periodontal disease-related inflammatory processes can affect the tissue structure of the respiratory system, exacerbating bronchial inflammation and worsening the manifestations of asthma.[8-11]

Asthma-related bone resorption is associated with the development of periodontal disease. Regular use of an inhaled corticosteroid can affect bone architecture by initiating a cascade of cellular and tissue events that predispose to bone loss.[12] Pro-inflammatory mediators of periodontal disease may also be associated with bronchial remodeling in individuals with severe asthma.[11] However, there is a gap in knowledge regarding the effect that severe asthma has on oral health-related quality

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of life (OHRQoL). We aimed to compare individuals with severe asthma, individuals with mild-to-moderate asthma, and individuals without asthma, in terms of their OHRQoL.

METHODS

Study design and population

We conducted a cross-sectional study from February of 2017 to November of 2019. The sample consisted of 125 patients, in three groups: a study group—comprising 40 patients enrolled in the *Programa para o Controle da Asma na Bahia* (ProAR, Bahia State Program for the Control of Asthma) with previously-untreated asthma that was categorized as severe in accordance with previous definitions of severity described elsewhere[13]—and two comparison groups—respectively comprising 35 patients with mild-to-moderate asthma, as defined in the Global Initiative for Asthma classification,[14] and 50 individuals without asthma. All of the patients with mild-to-moderate asthma were recruited from among those being followed at the ProAR Referral Outpatient Clinic and were using an inhaled corticosteroid. The individuals without asthma were recruited from among those being treated for other conditions at the ProAR Oral Health Clinic. The study was approved by the Research Ethics Committee of the Federal University of Bahia School of Medicine (Reference no. 2.663.115), in accordance with Brazilian National Health Council Resolution no. 466/2012 and with the 2013 World Medical Association Declaration of Helsinki. All participants gave written informed consent.

Information about demographic and socioeconomic characteristics, as well as about oral hygiene habits and associated comorbidities, were collected by a trained multidisciplinary team. During the anamnesis and clinical examination, the same dentist determined the decayed, missing, and filled teeth (DMFT) index, as well as the Periodontal Screening and Recording (PSR) index, for all participants. The dentist performed the PSR examination with a WHO-approved periodontal probe in the gingival sulcus, evaluating the probing depth (in millimeters) at six sites per tooth, excluding the third molars. The PSR examination can identify gingival bleeding, gingival recession, and calculi. For the identification of gingivitis or periodontitis, we applied the criteria established by the WHO[15] and the European Association of Dental Public Health.[16] Although there is no reference cutoff point for the frequency of tooth brushing, all patients are instructed to brush after meals. At 2 h after breakfast, we collected stimulated saliva samples by conducting salivary mechanical stimulation with sialogogues for 2 min, and asking participants to deposit the accumulated saliva into a graduated sterile tube. The quantity of saliva collected is expressed in mL/min. We defined reduced stimulated salivary flow as < 1 mL/min.[17]

We applied three structured questionnaires[18-20]: the 14-item Oral Health Impact Profile (OHIP-14) to assess OHRQoL; the Medical Outcomes Study 36-Item Short-Form Health Survey, version 2 (SF-36v2) to assess general health-related quality of life (HRQoL); and the Work Ability Index (WAI) to assess the perception that individuals have of their ability to work.

OHIP-14

The OHIP-14 is a comprehensive self-report measure of dysfunction, discomfort, and disability attributed to oral health status, being widely used for evaluating OHRQoL.[18] The OHIP-14 consists of 14 items stratified into seven domains: functional limitation; physical pain; psychological discomfort; physical disability; psychological disability; social disability; and handicap. The responses were classified with a Likert scale, ranging from "never" to "very often". Higher scores translate to a greater impact of oral health and poorer OHRQoL.

SF-36v2

The SF-36v2 consists of 36 items, covering eight domains: physical functioning; role-physical; bodily pain; general health; vitality; social functioning; role-emotional; and mental health. The grouping of these factors generates the Physical Component Summary (PCS) and Mental Component Summary (MCS).[19] We used the software PRO CoRE, version 1.3 (Optum, Inc., Johnston, RI, USA) to score the SF-36v2 survey and obtain the normalized scores.[19] The normalized SF-36v2 scores are adjusted to a mean of 50 with a standard deviation of 10, enabling comparisons between domains. OptumInsight Life Sciences Inc. (Johnston, RI, USA) granted permission to reproduce the output (License no. QM025905).

WAI

The WAI questionnaire[20] has seven components: current work ability in relation to lifetime best; work ability in relation to the demands of the job; current number of physician-diagnosed diseases; estimated work impairment due to disease; sick leave during the last 12 months; own prognosis of work ability 2 years from now; and mental resources. The cumulative WAI ranges from 7 points to 49 points, being categorized as follows[21]: poor (7-27 points); moderate (28-36 points); good (37-43 points); or excellent (44-49 points). The WAI has been translated to Portuguese,[22] as well as having been shown to have satisfactory construct validity for use in Brazil.[23]

Statistical analysis

We used the main outcome variable (OHIP-14 scores) to calculate the power of the test by using the MultNonParam package for RStudio, version 1.2.5019 (RStudio, Inc., Boston, MA, USA). We also used the nonparametric Kruskal-Wallis test, as previously described,[24] employing bootstrap (Monte Carlo) techniques to produce a power estimate based on

the empirical cumulative distribution functions of the sample data. We performed a simulation with three groups: severe asthma (n = 40); mild-to-moderate asthma (n = 35); and no asthma (n = 50). The calculated power of the test was 99%, at a p-value of 0.01. Continuous variables are expressed as means and standard deviations, whereas categorical variables are expressed as absolute and relative frequencies. In 10% of the sample, the level of interobserver agreement was determined by calculating the kappa statistic.[25] The internal consistency and reliability of the scales were assessed by Cronbach's alpha, the values of which were considered satisfactory if 0.70-0.80 and ideal if 0.80-0.90.[26] The Kolmogorov-Smirnov test was used in order to evaluate the normality of the distribution. The Kruskal-Wallis test was used in order to determine the magnitude of differences among the three groups, and the Mann-Whitney U test was used in order to compare two independent samples. We evaluated the correlations among the OHIP-14 domains and the SF-36v2 Component Summary scores by using Pearson's correlation coefficient.[27] All statistical analyses were performed with the IBM SPSS Statistics software package, version 21.0 (IBM Corporation, Armonk, NY, USA).

RESULTS

The mean age in the severe asthma group (n = 40) was 51.8 ± 10.8 years, whereas it was 42.5 ± 14.2 years in the mild-to-moderate asthma group (n = 35) and 48.2 ± 12.4 years in the no-asthma group (n = 50).

Female and black/racially mixed individuals respectively accounted for 85.0% and 95.0% of those in the severe asthma group and 85.7% and 94.3% of those in the mild-to-moderate asthma group, compared with 48.0% and 76.0%, respectively, in the no-asthma group. There were no significant differences among the groups in terms of the level of education ($p > 0.05$) and tooth brushing frequency ($p > 0.05$). Most (90.0%) of the individuals in the no-asthma group were receiving a salary above the Brazilian national minimum wage, compared with 57.5% and 54.3% of those in the severe and mild-to-moderate asthma groups, respectively (Table 1).

The proportions of individuals with periodontitis and reduced salivary flow were 92.5% and 80.0%, respectively, in the severe asthma group, higher than the 54.3% and 74.3%, respectively, observed in the mild-to-moderate asthma group and the 14.0% and 26.0%, respectively, observed in the no-asthma group. Only 45.0% of the individuals in the severe asthma group had a sedentary lifestyle, compared with 97.1% of those in the mild-to-moderate asthma group and 60.0% of those in the no-asthma group. The proportion of individuals with a good or excellent WAI was highest (66.0%) in the no-asthma group, whereas that of those with a poor WAI was highest (47.5%) in the severe asthma group (Table 1). The interobserver agreement was substantial (kappa = 0.68).

Cronbach's alpha was ≥ 0.70 for the SF-36v2 domain scores and for the WAI. The WAI was consistently lower among the individuals in the severe asthma group than among those in the mild-to-moderate asthma and no asthma groups, as were the scores for the SF-36v2 HRQoL domains, as well as the PCS and MCS scores (Table 2). There were statistically significant differences among the groups for the SF-36v2 domains physical functioning, role-physical, bodily pain, general health, vitality, and role-emotional, as well as for the WAI ($p < 0.05$ for all). The DMFT index did not differ significantly among groups. However, the mean number of missing teeth was highest in the severe asthma group ($p < 0.05$) and the mean number of decayed teeth was highest (2.5 ± 2.0) in the no-asthma group ($p = 0.03$).

Cronbach's alpha was 0.80 for the OHIP-14 score. The mean scores for all OHIP-14 domains were significantly lower in the severe asthma group than in the no-asthma group (Table 3).

Strong negative correlations between the SF-36v2 Component Summary scores and the OHIP-14 scores (better OHRQoL in the presence of poorer HRQoL) were observed only in the severe asthma group (Table 4). The OHIP-14 domains functional limitation, psychological disability, and social disability correlated significantly with the PCS score, as did the total OHIP-14 score. The OHIP-14 psychological disability domain score and the total OHIP-14 score showed significant negative correlations with the MCS score.

DISCUSSION

In this cross-sectional study, we found that individuals with asthma showed poorer OHRQoL, higher numbers of missing teeth, and lower WAIs than did those without. We also found that individuals with severe asthma showed poorer OHRQoL, lower WAIs, and poorer HRQoL than did those with mild-to-moderate asthma and those without asthma. Negative correlations between the OHIP-14 scores and the SF-36v2 Component Summary scores were seen only in the severe asthma group, underscoring the need to use specific and general instruments in order to assess OHRQoL in individuals with asthma. It is noteworthy that all instruments presented good internal consistency, with Cronbach's alpha values ≥ 0.70. Although monthly incomes were highest in the no-asthma group, there were no significant differences among the groups in terms of the level of education, frequency of tooth brushing, or number of filled teeth. Individuals in the severe asthma group showed much higher numbers of missing teeth, as well as being much more likely to have periodontitis and reduced salivary flow. Access to dental treatment and oral health care was not found to minimize or avoid such alterations.

Table 1. Clinical and demographic characteristics of individuals with severe asthma, individuals with mild-to-moderate asthma, and individuals without asthma. Salvador, Brazil, 2017-2019.

Characteristic	Group			p*
	SA (n = 40)	MMA (n = 35)	NA (n = 50)	
Gender, n (%)				< 0.001
Female	34 (85.0)	30 (85.7)	24 (48.0)	
Male	6 (15.0)	5 (14.3)	26 (42.0)	
Skin color, n (%)				< 0.05
Black	17 (42.5)	16 (45.7)	14 (28.0)	
White	2 (5.0)	2 (5.7)	12 (24.0)	
Other	21 (52.5)	17 (48.6)	24 (48.0)	
Marital status, n (%)				< 0.001
Single	19 (47.5)	26 (74.3)	15 (30.0)	
Married/stable relationship	21 (52.1)	9 (25.7)	35 (70.0)	
Level of education, n (%)				NS
< 9 years of schooling	9 (22.5)	4 (11.4)	12 (24.0)	
9-12 years of schooling	28 (70.0)	27 (77.1)	31 (62.0)	
> 12 years of schooling	3 (7.5)	4 (11.4)	7 (14.0)	
Family income, n (%)				< 0.001
< the minimum wage†	17 (42.5)	16 (45.7)	5 (10.0)	
≥ the minimum wage†	23 (57.5)	19 (54.3)	45 (90.0)	
Smoking status, n (%)				NS
Current smoker	0 (0.0)	1 (2.9)	2 (4.0)	
Former smoker	15 (37.5)	6 (17.1)	19 (38.0)	
Alcohol consumption, n (%)				< 0.001
Current drinker	13 (32.5)	18 (51.4)	3 (6.0)	
Former drinker	7 (17.5)	6 (17.1)	31 (62.0)	
Physical activity, n (%)				< 0.05
Sedentary lifestyle	18 (45.0)	27 (77.1)	30 (60.0)	
Regular activity	22 (55.0)	8 (22.9)	20 (40.0)	
Work Ability Index, n (%)				< 0.001
Poor	19 (47.5)	8 (22.9)	5 (10.0)	
Moderate	18 (45.0)	26 (74.3)	12 (24.0)	
Good/Excellent	3 (7.5)	1 (2.9)	33 (66.0)	
Tooth brushing frequency, n (%)				NS
≤ 2 times a day	19 (47.5)	20 (57.1)	25 (50.0)	
> 2 times a day	21 (52.5)	15 (42.9)	25 (50.0)	
Dental flossing, n (%)	19 (47.5)	17 (48.6)	18 (36.0)	NS
Salivary flow, n (%)				< 0.001
Normal	8 (20.0)	9 (25.7)	37 (74.0)	
Reduced	32 (80.0)	26 (74.3)	13 (26.0)	
Periodontal disease, n (%)				< 0.001
Gingivitis	2 (5.0)	9 (25.7)	15 (30.0)	
Periodontitis	37 (92.5)	19 (54.3)	7 (14.0)	
Systemic arterial hypertension, n (%)	21 (52.5)	6 (17.1)	7 (14.0)	< 0.001
Diabetes, n (%)	3 (7.5)	1 (2.9)	2 (4.0)	NS

SA: severe asthma; MMA: mild-to-moderate asthma; NA: no asthma; NS, not significant.
*Pearson's chi-square test. †Brazilian national minimum wage = 241 USD/month.

Saliva has a number of functions in the oral cavity, including lubrication, mechanical cleaning, buffering capacity, antimicrobial activity, and tissue repair. Low salivary flow reduces the efficacy of these functions[28] and can therefore be considered a possible mediator of the worsened OHRQoL in individuals with asthma. In the present study, 80.0% and 74.3% of the individuals in the severe and mild-to-moderate asthma groups presented with reduced salivary flow, which may contribute to the development of periodontal disease and tooth loss. Monitoring salivary flow helps prevent oral health problems and preserve OHRQoL in patients with asthma. In a previous study, reduced salivary flow was associated with periodontal disease and poor HRQoL in

Table 2. Oral health, general health-related quality of life, and work ability in individuals with severe asthma, individuals with mild-to-moderate asthma, and individuals without asthma. Salvador, Brazil, 2017-2019.

Variable	Cronbach's alpha	Group			p			
		SA (n = 40) Mean ± SD	MMA (n = 35) Mean ± SD	NA (n = 50) Mean ± SD	Overall*	SA vs. MMA†	MMA vs. NA†	SA vs. NA†
Decayed teeth	-	1.4 ± 2.0	1.3 ± 1.5	2.5 ± 2.0	0.003	0.755	0.006	< 0.05
Missing teeth	-	7.9 ± 7.2	5.0 ± 6.2	4.9 ± 2.6	0.031	0.017	0.134	NS
Filled teeth	-	4.2 ± 3.7	4.0 ± 4.0	4.7 ± 4.0	0.632	0.781	0.319	NS
DMFT index	-	13.5 ± 6.5	10.3 ± 6.9	12.0 ± 5.1	0.119	0.059	0.137	NS
OHIP-14 score	0.8	11.0 ± 10.5	6.2 ± 7.4	1.4 ± 2.6	0.001	0.013	0.003	< 0.001
SF-36v2 domain scores								
Physical functioning	0.9	41.5 ± 9.7	47.6 ± 8.6	51.5 ± 7.2	0.001	0.005	0.011	< 0.001
Role-physical	0.9	46.1 ± 10.5	52.3 ± 5.3	48.6 ± 9.1	0.020	0.012	0.016	NS
Bodily pain	0.8	42.6 ± 13.7	46.0 ± 12.0	53.3 ± 9.3	0.001	0.185	0.001	< 0.001
General health	0.7	42.8 ± 8.1	50.0 ± 8.3	50.6 ± 8.2	0.001	0.001	0.491	< 0.001
Vitality	0.7	47.0 ± 12.7	52.0 ± 10.1	55.3 ± 6.0	0.006	0.232	0.064	< 0.05
Social functioning	0.7	45.9 ± 13.0	50.5 ± 7.9	50.3 ± 7.9	0.101	0.229	0.024	NS
Role-emotional	0.9	42.8 ± 15.1	50.01 ± 9.4	45.2 ± 11.2	0.028	0.110	0.006	NS
Mental health	0.8	44.1 ± 14.4	48.6 ± 12.2	50.5± 6.2	0.180	0.181	0.661	NS
SF-36v2 summary scores								
PCS	-	43.5 ± 7.9	48.8 ± 7.0	52.3 ± 7.1	0.001	0.004	0.055	< 0.001
MCS	-	45.7 ± 13.8	50.6 ± 10.3	49.0 ± 5.4	0.224	0.265	0.061	NS
Work Ability Index	0.8	26.3 ± 8.1	30.9 ± 4.2	38.0 ± 37.5	0.001	0.022	0.016	< 0.001

SA: severe asthma; MMA: mild-to-moderate asthma; NA: no asthma; NS: not significant; DMFT: decayed, missing, and filled teeth; OHIP-14: 14-item Oral Health Impact Profile; SF-36v2: Medical Outcomes Study 36-Item Short-Form Health Survey, version 2; PCS: Physical Component Summary; and MCS: Mental Component Summary. *Kruskal-Wallis test. †Mann-Whitney U test.

patients with other systemic diseases.[29] We also found an association between poor OHRQoL and poor overall HRQoL in individuals with severe asthma. Nevertheless, further studies, analyzing the latent characteristics of the SF-36v2 and OHIP-14 constructs assessed,[30] are needed in order to confirm that correlation.

The association between periodontal infection and systemic conditions, such as respiratory tract diseases, has been investigated in recent decades. However, to our knowledge, there have been no studies investigating the impact that periodontal disease has on the OHRQoL of individuals with asthma. Some studies have suggested that there is a strong positive association between periodontitis and asthma severity.[11,31] However, there is as yet no evidence of a cause and effect relationship; it is not even known whether such an association would be bidirectional. In addition, those studies did not evaluate OHRQoL.

To our knowledge, this is the first study to evaluate OHRQoL, oral health profiles, and work ability in individuals with asthma. When HRQoL, oral health, and the WAI were considered, the individuals in the severe asthma group had lower normalized scores for all SF-36v2 domains, lower WAIs, and poorer OHRQoL than did those in the mild-to-moderate asthma and no-asthma groups. In a study of patients with chronic liver diseases,[29] poor oral health was also found to be associated with poor HRQoL and low work ability.

To understand and evaluate the effect that poor oral health has on the OHRQoL and functionality of individuals with asthma, we used various questionnaires. A psychometric analysis of the Portuguese-language version of the OHIP-14 suggested that the instrument is unidimensional and that the total score more precisely reflects the OHRQoL of individuals than do the individual domain scores.[32] However, we found that the OHIP-14 domain scores and total scores were both highest in the patients with severe asthma, regardless of whether the analysis is unidimensional or multidimensional.

Previous psychometric analyses of the SF-36 and OHIP-14 have shown significant correlations between the two.[30] However, our correlation analyses showed that the OHIP-14 scores correlated with the SF-36v2 Component Summary scores only in the severe asthma group. These findings underscore the need for dental care in patients with severe asthma.

Our study has some limitations. Because it was a cross-sectional study, it was not possible to identify associations between exposure and effect. In addition, it was not possible to recruit patients with asthma randomly from the ProAR cohort. It is noteworthy that all instruments we used presented good reliability. Furthermore, our study was performed at a referral center for asthma, and its population may therefore reflect the overall characteristics of patients with

Table 3. Oral health-related quality of life in individuals with severe asthma, individuals with mild-to-moderate asthma, and individuals without asthma. Salvador, Brazil, 2017-2019.

OHIP-14 scores	Group			p			
	SA (n = 40) Mean ± SD	MMA (n = 35) Mean ± SD	NA (n = 50) Mean ± SD	Overall	SA vs. MMA†	MMA vs. NA†	SA vs. NA†
Total score	11.0 ± 10.5	6.2 ± 7.4	1.4 ± 2.6	0.001	0.013	0.003	< 0.001
Domain scores							
Functional limitation	1.2 ± 2.0	0.3 ± 0.8	0.3 ± 0.6	0.027	0.021	0.529	< 0.05
Physical pain	3.0 ± 2.4	2.0 ± 2.5	1.0 ± 1.7	0.001	0.064	0.024	< 0.001
Psychological discomfort	1.8 ± 2.5	1.9 ± 2.7	0.1 ± 0.4	0.001	0.786	0.001	< 0.001
Physical disability	2.1 ± 2.3	0.8 ± 1.5	-	0.001	0.005	0.001	< 0.001
Psychological disability	2.6 ± 2.3	0.8 ± 1.6	-	0,001	0.020	0.001	< 0.001
Social disability	1.1 ± 0.8	1.0 ± 0.6	0.6 ± 0.5	0.037	0.215	0.008	NS
Handicap	0.6 ± 1.6	0.1 ± 0.2	-	0,001	0.020	0.247	< 0.001

SA: severe asthma; MMA: mild-to-moderate asthma; NA: no asthma; OHIP-14: 14-item Oral Health Impact Profile; and NS: not significant. *Kruskal-Wallis test. †Mann-Whitney U test.

Table 4. Pearson's correlation coefficients for the relationships between oral health-related quality of life scores and general health-related quality of life scores in individuals with severe asthma, individuals with mild-to-moderate asthma, and individuals without asthma. Salvador, Brazil, 2017-2019.

OHIP-14 scores	Group					
	SA (n = 40)		MMA (n = 35)		NA (n = 50)	
	SF-36v2 summary score		SF-36v2 summary score		SF-36v2 summary score	
	PCS	MCS	PCS	MCS	PCS	MCS
Domain scores						
Functional limitation	−0.438*	−0.294	0.208	−0.243	−0.082	0.104
Physical pain	−0.183	−0.108	−0.193	−0.256	−0.250	0.010
Psychological discomfort	−0.298	−0.198	−0.022	−0.110	0.153	0.081
Physical disability	−0.265	0.013	0.083	−0.254	0.000	0.000
Psychological disability	−0.351†	−0.360†	−0.296	−0.123	0.000	0.000
Social disability	−0.331†	−0.169	−0.339	−0.152	0.003	−0.054
Handicap	−0.033	0.077	−0.082	0.129	0.000	0.000
Total score	−0.400*	−0.318†	−0.178	−0.219	−0.200	0.082

SA: severe asthma; MMA: mild-to-moderate asthma; NA: no asthma; SF-36v2: Medical Outcomes Study 36-Item Short-Form Health Survey, version 2 (general health-related quality of life measure); OHIP-14: 14-item Oral Health Impact Profile (oral health-related quality of life measure); PCS: Physical Component Summary; and MCS: Mental Component Summary. *Correlation significant at 0.01 (two-tailed). †Pearson's correlation coefficient significant at 0.05 (two-tailed).

asthma only in the state of Bahia. Moreover, the fact that we did not evaluate treatment data (total daily or cumulative dose of inhaled corticosteroids) or functional data (from tests such as spirometry) also limited our conclusions. However, to our knowledge, this was the first study to investigate the associations among OHRQoL, HRQoL, and WAI in individuals with severe asthma.

Severe asthma appears to be associated with poorer oral health, poorer OHRQoL, a lower WAI, and lower scores for the SF-36v2 HRQoL domains. Our findings underscore the need to provide periodontal care to patients with severe asthma.

AUTHOR CONTRIBUTIONS

RBO, VAS, and LLK: study conception and design; data analysis; drafting/revision of the manuscript; and final approval of the manuscript. AAC, ASM, and GPP: drafting/revision of the manuscript; and final approval of the manuscript. DSI: final approval of the manuscript.

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