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ORIGINAL ARTICLE

Periodontal therapy on the oral health-related quality of life of obese and non-obese individuals

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Abstract

Oral diseases such as periodontitis can have a more negative influence on the quality of life of obese than in normal-weight patients. The objective of the present study was to assess the impact of one-stage full-mouth disinfection (OSFMD) therapy on the oral health-related quality of life (OHRQL) of obese and non-obese individuals with periodontitis. Fifty-five obese and thirty-nine non-obese patients were evaluated. The questionnaires oral impacts on daily performance (OIDP) and oral health and quality of life (OHQoL) were given to all patients at baseline and 6 months after periodontal treatment by the OSFMD protocol. For statistical analysis, Chi-square, the two-factor repeated-measures ANOVA, and correlation tests were used. At baseline, mean global OHQoL and OIDP scores were similar for both groups ($p > 0.05$). At 6 months, OSFMD resulted in OHQoL and OIDP global scores improvements in both groups ($p < 0.05$), with no significant difference between groups. The most impaired activity at baseline was eating and cleaning teeth for both groups. Periodontal parameters were associated with worse values in the OHQoL and OIDP questionnaires only in obese patients. In conclusion, OSFMD yielded similar improvements in overall OHRQL in both obese and non-obese individuals. Periodontal parameters were associated with a worse quality of life in obese patients. Periodontal treatment can be an important component to improve the OHRQL of obese individuals, and clinicians should expect similar results as those obtained with non-obese patients.

Keywords Obesity · Periodontitis · Quality of life · Periodontal disease

Introduction

Periodontitis is characterized by complex interactions between the host's inflammatory immune response and the subgingival dysbiotic microbiota, resulting in periodontal tissue breakdown and tooth loss [1, 2]. Several diseases and conditions can impact the severity and progression of periodontal diseases, such as tobacco smoking, diabetes mellitus, stress, medications, and obesity [3–5].

Obesity is a chronic disease that negatively affects the individual's general health, triggering or aggravating many pathologies [6, 7]. An obese individual is classified by a body mass index (BMI) greater than or equal to 30, and/or waist circumference values > 102 cm for men and > 88 cm for women [8].

There is a positive relationship between weight gain and new cases of periodontal disease [9]. Most individuals with obesity have some deficient oral hygiene characteristics, such as low brushing frequency, irregular flossing, mouthwashes, and interdental brush [10]. Moreover, obesity is associated with increased inflammatory cytokines, which take the individual to a hyperinflammatory state capable of influencing the severity and progression of periodontal disease. In fact, the increased systemic inflammatory cytokines such as TNF-α, interleukin-6 (IL-6) and IL-8, leads the adipose tissue to act as a reservoir of these cytokines playing a crucial role in regulating the metabolic process [11–13].

Both periodontal disease and obesity can negatively influence the individual's quality of life. For obesity, impacts on a person's health status regarding physical, mental, and social functioning have been reported, in addition to some measures such as spirituality, sexual function, and satisfaction

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with life [14, 15]. Regarding periodontal disease, greater severity and extension of the disease are related to a more significant impairment on an individual's quality of life [16]. Further, oral diseases such as periodontitis can have a more negative influence on the quality of life of obese than in normal-weight patients [17].

In the last 2 decades, several studies have measured the impact of oral health-disease on quality of life. These measures of oral quality of life, which were initially designated as socio-dental indicators or subjective oral health indicators, are now more usually referred to as measures of oral health-related quality of life (OHRQL) [18]. OHRQL can be assessed through several types of questionnaires. OHQoL-UK (Oral Health and Quality of Life—United Kingdon) [19] assesses the quality of life in relation to oral health associated with appearance, aesthetics, social concern, dissatisfaction with appearance and self-confidence concerning dental aesthetics; and OIDP (oral impacts on daily performance) [20] is considered a reliable method of quantifying the impact of oral health with daily activities and measuring the individual's perception of that impact.

Nonsurgical periodontal treatment consists in the decontamination of the root surface through scaling and root planing [21]. In the one-stage full-mouth disinfection (OSFMD) protocol, periodontal therapy is performed over a 24-h period divided into two sessions of scaling and root planing associated with chlorhexidine local applications and daily mouthwash [22–24]. Although this protocol provides similar results in the treatment of periodontitis when compared with the conventional approach, the advantages of applying this protocol are attributed to the lower number of sessions, shorter treatment time, and increased adherence to therapy from the patient [25, 26]. A recent study by our group demonstrated that OSFMD is equally effective in the treatment of periodontitis in obese and non-obese individuals (Peralta et al. 2020); however, there is limited evidence regarding the impact of periodontal treatment on the OHRQL of individuals with periodontitis [19, 27]. Further, to the best of our knowledge, there are no studies comparing the impact of periodontal therapy by the OSFMD protocol on the OHRQL of obese and non-obese individuals with periodontitis.

Thus, since obese people have a worse general quality of life and periodontal disease can negatively potentialize this impact, it is of great interest for this population to verify what is the impact of periodontal treatment on their OHRQL and if the benefits are comparable to a non-obese population. We hypothesize that obese patients with periodontitis have a worse OHRQL, and when compared with non-obese patients, periodontal treatment by the OSFMD may result in a minor OHRQL benefit for this population. Up to 3–4 months (short term), there is still high variability in periodontal parameters. We aimed to provide a medium-term evaluation of the impact of periodontal treatment on the OHRQL, because 6 months is a reliable follow-up time to assess periodontal disease's stability and the possible benefit in these patients' quality of life. Therefore, the aim of this 6 months prospective clinical study was to assess the impact of OSFMD therapy on the OHRQL of obese and non-obese individuals with periodontitis, using the OHQoL and OIDP questionnaires.

Materials and methods

The present prospective clinical study presents data on the impact of OSFMD therapy on the quality of life of obese and non-obese patients with periodontitis at baseline and 6 months after therapy. This study was initially approved by the Research Ethics Committee of the University of Taubaté, in accordance with the Declaration of Helsinki (protocol nº 36,828,114.4.0000.5501). All individuals were instructed on the nature and purpose of the study, its stages, and duration, as well as the potential benefits and possible risks. Individuals who accepted voluntary participation signed the free and informed consent form. The protocol for this study was previously registered with ClinicalTrials.gov: NCT03103204.

Study population

The study sample consisted of ninety-four individual users of the Unified Health System (SUS), referred to the Dental Specialties Center (CEO II) of Joinville-SC from January 2014 to December 2016.

The inclusion criteria were as follows: individuals from both gender, age over 45 years, at least 12 teeth, BMI higher than 18.5 kg / m^2, and the presence of moderate to advanced generalized periodontitis (Stage II-IV), according to Tonetti et al. [28].

Participants were excluded from the study if they had chronic renal failure, stroke history, not controlled diabetes, rheumatism, osteoporosis, HIV, acute myocardial infarction 6 months preceding the start of the study, pregnant and lactating women, and periodontal treatment in last year until the initial evaluation. After patients met the inclusion criteria, sociodemographic characteristics were assessed in an interview conducted by a single examiner (F.S.P.).

Groups were divided according to their body mass index (BMI) and waist circumference.

(1) Non-obese group, BMI $\leq$ 29,9 kg/m^2 and waist circumference < 102 cm for men and < 88 cm for women (n = 39). This group consisted of normal-weight and overweight individuals.

(2) Obese group, BMI $\geq$ 30 kg/m^2 and waist circumference >102 cm for men and >88 cm for women. (n=55). This group consisted of obese individuals.

Obesity assessment

Obesity diagnosis was defined based on the records of anthropometric measurements of each individual, in which they were wearing light clothing and without shoes. BMI was calculated as the obesity indicator, dividing weight (kilograms) by the square of body height (meters), with $BMI = Kg/m^2$. The obesity indicator considered was $BMI \geq 30$ and waist circumference values greater than 102 cm for men and greater than 88 cm for women [8]. The groups were composed of individuals according to BMI values and waist circumference measurements.

Periodontal examination and treatment

Periodontal clinical examinations were performed by a single examiner (F.S.P.), which was trained and calibrated by a gold standard examiner (J.R.C), according to the standard error measurement system (EPM). Clinical calibrations were performed to determine intra-examiner reproducibility, following the training method described by Araujo et al. [29]. The following periodontal parameters, clinical attachment level (CAL), pocket depth (PD), plaque index (PI), and gingival index (GI) were obtained with a manual periodontal probe (Hu-friedy—Chicago, IL, USA) of all teeth.

A trained periodontist (F.S.P) performed periodontal therapy according to the OSFMD therapeutic protocol recommended by Quirynen et al. [22]. Briefly, the steps of the therapeutic protocol were: (a) scaling and root planing with Gracey 1–2; 3–4; 11–12 and 13–14 curettes (HuFriedyTM, Chicago, IL, USA), of all dental elements present in two sessions in the 24-h period, under local anesthesia with 4% articaine hydrochloride with adrenaline 1: 100,000 (Articaíne®, DFL-Brasil); (b) dental polishing with a rubber bowl (Viking, KG Sorensen, Barueri, Brazil) and fluoride paste Herjos (Vigodent® SA, Indústria e Comércio, Rio de Janeiro, RJ, Brazil); (c) mouthwashes with 0.2% chlorhexidine solution (Medicamentum Farma Ltda, Joinville, Santa Catarina, Brazil) for 30 s (gargle in the last ten seconds) at the beginning and end of each session; (d) tongue brushing with 1% chlorhexidine gel (Medicamentum Farma Ltda, Joinville, Santa Catarina, Brazil) for one minute and spraying the pharynx with 0.12% chlorhexidine solution (Medicamentum Farma Ltda, Joinville, Santa Catarina, Brazil); (e) subgingival irrigation of all periodontal pockets three consecutive times (without interruption), with 1% chlorhexidine gel (Medicamentum Farma Ltda, Joinville, Santa Catarina, Brazil) after the scaling and root planing sessions. Subgingival irrigation was repeated seven days after periodontal therapy.

The oral hygiene instructions were conducted in the therapeutic phase, and oral hygiene kits were provided for all participants. Subsequently, patients were instructed to use their mouthwashes with 10 ml of 0.2% chlorhexidine (Medicamentum Farma Ltda, Joinville, Santa Catarina, Brazil) twice a day, for one minute, and for two consecutive weeks. The research group provided the mouthwashes for all patients.

Every 3 months, all patients underwent new instruction on oral hygiene, prophylaxis, and supragingival debridement.

Quality of life assessment

The impact of the OSFMD protocol on the quality of life of individuals was assessed by a single examiner using two questionnaires, the quality of life relating to oral health (OHQoL) and impacts oral performance in daily performance (OIDP—Oral Impacts on Daily Performance), at baseline and 6 months after periodontal therapy.

The OHQoL questionnaire consists of 16 questions that aim to specify the effects of dental and gingival conditions on the quality of life of individuals, considering the following aspects: pain or discomfort, functional limitations, psychological aspects, social and behavioral. The answers obtained by the questionnaire vary from 1 (very bad) to 5 (very good), totaling a "score" that varies between 16 (worst quality of life) to 80 (best quality of life). Summing up responses from each of the 16-items produced the overall (global) OHQoL-UK scores. The Brazilian Portuguese version of the OHQoL questionnaire demonstrated good validity and reliability (internal and external) [30].

The OIDP questionnaire refers to the impact of individuals' oral condition on daily activities, such as eating, talking, brushing teeth, smiling, sleeping, maintaining emotional balance, working, studying, performing physical activity. It aims to assess the severity of responses and the frequency (duration) of the episodes. The severity ranges from 0 (without severity) to 5 (extremely severe). The frequency varies from 1 (less than once a month) to 5 (all or almost every day). The maximum score is 200, which indicates a worse quality of life, determined by the frequency and severity of the episodes [31]. Studies showed that OIDP in the Portuguese language is a valid instrument because of its positive association with self-reported health measurements [32, 33].

Statistical analysis

For sample size calculation, we selected by simple randomization the answer of eight individuals in the two questionnaires (OHQoL and OIDP). With the aid of biostat 5.2 software, a t-test with 95% significance and 90% power was applied for independent samples. The highest statistical demand occurred for the OHQoL questionnaire, where a minimum of 32 individuals was needed. Assuming a 10% dropout, the analysis showed a minimum of 37 individuals per group needed.

The statistical analysis was performed with the aid of the statistical program Graphpad Prism 5.0 (GraphPad Software, La Jolla, CA, USA). Initially, data were submitted to the Kolmorogov–Smirnov normality test. Demographic data were accessed by Chi-square test to verify the groups' homogeneity. Intra and inter-group comparisons were assessed by the two-factor repeated-measures ANOVA and t-tests. Correlations between clinical variables and quality of life were assessed with Spearman and Pearson tests. *P* values less than 0.05 were considered statistically significant.

Results

A total of 94 individuals with baseline assessment (55 in the obese group and 39 in the non-obese) were included. One patient of the obese group did not attend the 6 months follow-up evaluation.

Table 1 depicts the demographic data and baseline characteristics from patients in this study.

Periodontal clinical and microbiological data were previously published by our group [25]. Briefly, at baseline, obese patients presented mean values of clinical attachment level (CAL) of 4.0 ± 0.9, probing depth (PD) 2.90 ± 0.3, gingival index (GI) 0.37 ± 0.25 and plaque index (PI) 0.51 ± 0.36. Non-obese patients presented similar values, being CAL 4.23 ± 1.2, PD 2.98 ± 0.5, GI 0.32 ± 0.32 and PI 0.54 ± 0.32. In both obese and non-obese patients, periodontal treatment by OSFMD resulted in significant improvements in all periodontal clinical parameters ($p < 0.05$) (data not shown). Periodontal treatment by OSFMD was equally effective in both groups (data not shown).

Impact of OSFMD on the quality of life of obese and non-obese people

At baseline, mean global OhQoL and OIDP scores were similar for both groups ($p > 0.05$). At 6 months, OSFMD resulted in OhQoL and OIDP global scores improvements in both groups ($p < 0.05$). No significant difference was observed between obese and non-obese patients at 6 months. The mean OhQoL and OIDP global scores for obese and non-obese patients at baseline and 6 months are shown in Table 2.

Table 3 presents the correlation between the quality of life indexes and clinical variables at baseline and 6 months for obese and non-obese patients. At baseline, worse OhQoL and OIDP global scores were correlated with increased CAL and PD values only for obese patients ($p < 0.05$). These correlations were not observed at 6 months. In addition, PI was correlated with OIDP global score at baseline in the non-obese group.

Dissatisfaction with appearance was the most prevalent OIDP intermediate impact observed at baseline in both groups. The second most prevalent was discomfort, followed by pain and function limitation. There was no significant difference between obese and non-obese patients as regards all OIDP intermediate impacts at baseline and 6 months ($p > 0.05$). However, OSFMD was associated with a decrease in pain in both groups ($p < 0.05$), as well as a decrease in discomfort and function limitation in the obese group ($p < 0.05$). Table 4 shows the prevalence of OIDP intermediate impacts in obese and non-obese patients at baseline and 6 months.

Table 5 presents the prevalence of oral impacts on daily activities (ultimate impacts) in obese and non-obese patients at baseline and 6 months. Intergroup comparison showed no significant difference as regards all OIDP ultimate domains at baseline and 6 months ($p > 0.05$).

Table 1 Sociodemographic data and baseline characteristics of non-obese and obese patients

Variables	Non-obese ($n = 39$)	Obese ($n = 55$)	*p* value
Age mean (SD)	50.7(7.1)	48.9(7.8)	0.94
Gender: male (%)	14(35.9)	19(34.5)	0.89
BMI in mean (SE)	25.8(0.5)	36.12(0.57)	0.001*
Waist circumference mean and (SE)	90.34(1.86)	110.89(1.4)	0.001*
Diabetes *n* (%)	2(5.1)	9(16.4)	0.11
n (%) of arterial hypertension	3(7.7)	30(54.5)	0.001*
Number of smokers (%)	5(12.8)	4(7.3)	0.48
PD mean (SD)	2.98 ± 0.5	2.90 ± 0.3	0.553
CAL mean (SD)	4.23 ± 1.2	4.03 ± 0.9	0.525
PI mean (SD)	0.54 ± 0.32	0.51 ± 0.36	0.624
GI mean (SD)	0.32 ± 0.32	0.37 ± 0.25	0.431

n number, *SE* standard error, *SD* standard deviation, *PD* probing depth, *CAL* clinical attachment level, *PI* plaque index, *GI* gingival index

Table 2 Means ± SD and mean difference of OHQoL and OIDP indexes

Variable	Time point	Non-Obese $n = 39$	Obese $n = 55$	p values
OHQoL	Baseline	41.33 ± 7.49	40.76 ± 5.69	0.9769
	6 months	45.71 ± 7.32*	44.88 ± 6.46*	0.9413
	Mean diff. within groups	−4.381 (SE 1.55)	−4.11 (SE 1.30)	*T* test 0.938
OIDP	Baseline	36.28 ± 44.95	43.24 ± 56.49	0.884
	6 months	15.83 ± 26.99*	18.66 ± 42.41*	0.992
	Mean diff. within groups	20.45 (SE 10.59)	24.58 (SE 8.88)	*T* test 0.802

OHQoL oral-related health quality of life, *OIDP* oral impacts on daily performances, *SE* standard error

*Indicate significant differences when compared with baseline by repeated-measures ANOVA and Tukey's tests ($p < 0.05$)

Table 3 Correlation with r values between quality of life indexes and clinical variables at baseline and 6 months

Variable/time point	Group	PD	CAL	PI	GI
OHQoL/baseline	Obese	−0.328*	−0.371*	−0.232	−0.112
	Non-obese	0.069	−0.011	−0.242	−0.044
OHQoL/6 months	Obese	−0.160	−0.164	−0.006	−0.037
	Non-obese	−0.116	−0.114	−0.103	0.310
OIDP/baseline	Obese	0.407*	0.417*	0.240	0.204
	Non-obese	−0.071	0.102	0.340*	0.287
OIDP/6 months	Obese	0.263	0.273	0.113	0.063
	Non-obese	0.217	0.128	0.140	−0.312

OHQoL oral health quality of life, *OIDP* oral impacts on daily performances, *PD* pocket depth, *CAL* clinical attachment level, *PI* plaque index, *GI* gingival index

*Indicate a significant correlation by Spearman test ($p < 0.05$)

Table 4 Prevalence of OIDP intermediate impacts in obese and non-obese patients at baseline and 6 months

Intermediate impact	Non-obese *n* (%) total = 39	Obese *n* (%) total = 55	Intergroup *p* value
Pain			
Baseline	11 (28.20%)	20 (36.36%)	0.505
6 months	1 (2.56%)*	2 (3.63%)*	1
Discomfort			
Baseline	16 (41.02%)	31 (56.36%)	0.208
6 months	10 (25.64%)	12 (21.81%)*	1
Functional limitation			
Baseline	2 (5.12%)	6 (10.90%)	0.462
6 months	0 (0.0%)	0 (0.0%)*	1
Dissatisfaction with appearance			
Baseline	23 (58.97%)	35 (63.63%)	0.672
6 months	22 (56.41%)	27 (49.09%)	0.533

*Indicate a significant difference in the same group when compared with baseline (Chi-Square or Fisher tests—$p < 0.05$)

However, in both groups, OSFMD was associated with a decrease in the prevalence of oral impacts on daily activities, such as impacts on eating and enjoying food and cleaning teeth ($p < 0.05$). In addition, OSFMD decreased the prevalence of non-obese patients that presented an impact of maintaining the usual emotional state without being irritable ($p < 0.05$).

Table 5 Prevalence of oral impacts on daily activities (ultimate impacts) in obese and non-obese patients at baseline and 6 months

Impact in daily activity	Non-obese *n* (%) Total = 39	Obese *n* (%) Total = 55	*p* value Chi-Square/ Fisher tests
Eating and enjoying food			
Baseline	18 (46.15%)	25 (45.45%)	1.000
6 months	9 (23.07%)*	8 (14.54%)*	0.415
Speaking and pronouncing clearly			
Baseline	8 (20.51%)	12 (21.81%)	1.000
6 months	6 (15.38%)	7 (12.72%)	0.767
Cleaning teeth			
Baseline	20 (51.28%)	19 (34.54%)	0.137
6 months	3 (7.69%)*	8 (14.54%)*	0.3521
Smiling, laughing and showing teeth without embarrassment			
Baseline	17 (43.58%)	29 (52.72%)	0.409
6 months	15 (38.46%)	20 (36.36%)	1.000
Sleeping and relaxing			
Baseline	6 (15.38%)	7 (12.72%)	0.767
6 months	4 (10.25%)	7 (12.72%)	1.000
Maintain usual emotional state without being irritable			
Baseline	11 (28.20%)	10 (18.18%)	0.316
6 months	2 (5.12%)*	7 (12.72%)	0.297
Studing			
Baseline	4 (10.25%)	5 (9.09%)	0.481
6 months	2 (5.12%)	5 (9.09%)	0.695
Enjoying contact with people			
Baseline	12 (30.76%)	16 (29.09%)	1.000
6 months	7 (17.94%)	7(12.72%)	0.562

*Indicate a significant difference in the same group when compared with baseline (Chi-square or Fisher tests—$p < 0.05$)

Discussion

The present study investigated the impact of periodontal therapy by the OSFMD protocol on the quality of life of obese and non-obese patients with periodontitis. The main results demonstrated that OSFMD therapy improves the quality of life in both groups measured by the OHQoL and OIDP questionnaires. In addition, OSFMD yielded similar improvements in overall OHRQL in both obese and non-obese individuals.

Clinical studies and systematic reviews showed that the OSFMD protocol results in the control of inflammation and disease progression in patients with periodontitis [22, 25, 26]. It has also been demonstrated that OSFMD is equally effective in treating periodontitis and present similar improvements in OHRQL compared with the conventional scaling and root planing per quadrant protocol [34]. However, so far, the effects of periodontal treatment on the OHRQL of individuals with periodontitis are still scarce, particularly in obese patients. In fact, since obese people already present a worse quality of life than non-obese people, it is speculated that periodontal treatment may result in a minor OHRQL benefit for this population. To the best of our knowledge, this is the first study to assess the impact of the OSFMD on the OHRQL of obese and non-obese individuals with periodontitis.

In this study, we applied two widely used instruments for evaluating the OHRQL in our population [35–38]. OHQoL assesses both positive (health) and negative (disease) aspects of the disease status, which includes appearance, aesthetics, social concern, and self-confidence [39], while OIDP questionnaire provides information as regards only the negative aspects such as disease-preventing, dysfunction, and failure [31]. OHIP-14 is another instrument used to evaluate the OHRQL [39, 40]. This last instrument mentioned above shares the same model of OIDP, and, therefore, was not applied in the present study.

At baseline, the mean OHQoL observed in this study was 41.33 for non-obese and 40.76 for obese individuals, with no significant differences between groups ($p > 0.05$).

These results indicate that obesity may not impact the quality of life assessed by the OHQoL questionnaire. Moreover, in the present study, we found that OSFMD leads to a similar improvement of ~ 10% in the OHQoL of obese and non-obese individuals with periodontitis at 6 months after therapy. Other clinical studies have also observed a positive impact of periodontal treatment in the OHQoL of systemically healthy individuals with periodontitis [38, 41]. Moreover, a recent systematic review [42] showed that nonsurgical periodontal therapy improves the OHRQL of systematically healthy individuals with periodontitis in the short-term follow-up (3 months). However, it should be pointed out the differences in follow-up, and that the above-mentioned review included only interventional studies, while our results were provided from an observational study designed to compare obese and non-obese individuals.

Regarding the OIDP questionnaire, at baseline, the non-obese patients presented a mean of 36.28, whereas a mean of 43.24 was observed in obese patients. There was no statistically significant difference between groups ($p > 0.05$). The most impaired activity at baseline was eating and cleaning teeth for both groups; this result is in agreement with other clinical studies [38, 43]. However, reports of periodontal disease's impact on cleaning the mouth, sleeping, and smiling have also been conducted by several authors [44, 45]. Further, the OSFMD significantly reduced the prevalence of patients in both groups that reported impairments on eating and cleaning teeth.

Additionally, OSFMD resulted in OIDP improvements at 6 months, with no overall significant differences between groups. Concerning OIDP intermediate impacts, the periodontal treatment was associated with improvements in pain for both groups, and discomfort and functional limitation only for obese patients. A randomized clinical trial with 3 months of follow-up assessed the impact of periodontal treatment on the quality of life of obese patients [19]. Although they found no overall improvements in the quality of life measured by the OHIP-14, functional limitation and psychological discomfort domains were improved in obese patients with periodontitis. However, no major comparisons can be made with the present study since there are significant differences as regards study design, follow-up period, treatment protocol, and the instrument used for assessing the oral health quality of life.

Interestingly, correlation analysis demonstrated that the periodontal parameters such as PD and CAL were associated with worse values in the OHQoL and OIDP questionnaires only in obese patients. In addition, these correlations were lost after periodontal treatment by the OSFMD. These results indicate that in these populations, which already suffers from the reduced physical and mental quality of life compared with individuals with normal weight [15], periodontal disease should be considered a condition capable of negatively influence even more the quality of life of obese patients.

Obese individuals usually attend irregularly to dental appointments [46]. These individuals should be motivated not only to achieve oral health but also a better quality of life. A relevant alternative for the conventional periodontal treatment, the OSFMD protocol, may serve as a good approuch for the treatment of obese patients since it requires fewer dental appointments. Thus, clinicians should consider the use of OSFMD in the treatment of obese patients with periodontitis to obtain control of periodontal inflammation and disease progression, and improve the OHRQL of this population, since the results can be comparable to non-obese individuals.

Finally, the results of the present study should be interpreted with caution. Some limitations should be taken into consideration, such as the absence of a control group without periodontal treatment and the medium-term follow-up.

Conclusion

The present study demonstrated that OSFMD therapy improves the quality of life in obese and non-obese patients with periodontitis. In addition, OSFMD yielded similar improvements in overall OHRQL in both obese and non-obese individuals. Periodontal parameters were associated with worse quality of life in obese patients, indicating that these individuals should be motivated not only to achieve oral health but also a better quality of life.

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Author contributions SCC: conception and design of the work, data acquisition and analysis and interpretation, critical revision of the article, final approval of the version to be published. FSP: conception of the work, data analysis and interpretation, critical revision of the article, final approval of the version to be published. LMRN: data acquisition and analysis, drafting the article and final approval of the version to be published. FOC: conception and design of the work, data analysis and interpretation, critical revision of the article, final approval of the version to be published. DRA: conception and design of the work, data analysis and interpretation, critical revision of the article, final approval of the version to be published. ESR: data analysis and interpretation, drafting the article and final approval of the version to be published. JRC: conception and design of the work, data analysis and interpretation, critical revision of the article, final approval of the version to be published.

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Declarations

Conflict of interest Author Sheila C Cortelli declares that he has no conflict of interest. Author Felipe S Peralta declares that he has no conflict of interest. Author Leticia M.R. Nogueira declares that he has no conflict of interest. Author Fernando O Costa declares that he has no conflict of interest. Author Davi R Aquino declares that he has no conflict of interest. Author Emanuel S Rovai declares that he has no conflict of interest. Author José R Cortelli declares that he has no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. (protocol nº 36828114.4.0000.5501).

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