



Impact of Bariatric Surgery on the Oral Health of Patients with Morbid Obesity

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Abstract

Background The present study assessed the impact of bariatric surgery on the oral health.

Methods All of the patients who underwent Roux-en-Y gastric bypass at Nossa Senhora da Conceição Hospital between October 2009 and January 2011 were invited to participate. In this longitudinal study, oral examinations and interviews were conducted in two stages. A descriptive analysis, McNemar's test, Student's *t* test for paired samples, and the Wilcoxon test were performed.

Results Thirty-nine patients completed the protocol. There was a statistically significant reduction in the number of medications taken daily, sensation of dry mouth, and increased stimulated salivary flow rate.

Conclusions The oral health of patients who underwent bariatric surgery improved; moreover, the sensation of dry mouth decreased.

Keywords Morbid obesity · Epidemiology · Oral health · Saliva · Xerostomia

Background

Brazilian data, obtained from a telephone survey (Vigitel) to assess risk and protective factors for chronic diseases, show that 48.5 % of adults older than 18 years are overweight (BMI \geq 25) and 15.8 % are obese (BMI \geq 30) [1].

Bariatric surgery is currently the only effective treatment for morbid obesity. The goal of bariatric surgery is not only weight loss but also the reduction of comorbidities and mortality and an increase in the quality of life [2]. There is an association between oral health and general health. Poor oral health can affect general health. Nutrition can be affected by

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the impaired ability to eat and chew [3]. The effects of post-operative bariatric surgery include a high level of acids in the oral cavity and an increased frequency of meals throughout the day, which can result in dental caries and dental erosion [4].

Few studies have investigated the effects of bariatric surgery on the oral health of patients with morbid obesity. In a longitudinal study, Marsicano et al. found no significant differences in the saliva flow volume, prevalence of caries, or dental wear between obese patients and patients submitted to bariatric surgery [5]. In a cross sectional study, Silva determined that the oral health profile of patients who have undergone bariatric surgery is similar to that of the general population; however, the weight reduction improves the patients' quality of life and self-esteem, improving their perceptions of their oral health [6].

Recent data have provided much support for the surgical treatment of obesity; however, questions regarding oral health status remain unanswered because few studies evaluating oral health in individuals who have undergone bariatric surgery are available [7].

Therefore, the aim of the present study was to investigate the association between bariatric surgery and changes in the oral health status of patients with morbid obesity.

Materials and Methods

Population and Sample

Individuals with morbid obesity who underwent Roux-en-Y gastric bypass in the Class III Obesity Care Center at Nossa Senhora da Conceição Hospital (HNSC), Porto Alegre, Brazil, during the period from October 2009 to January 2011 and who agreed to participate in this study were evaluated. During this period, 52 patients were invited to participate. Two of these patients were excluded (did not meet the inclusion criteria), and one refused to participate. We were unable to contact 6 of the remaining 49 patients within three attempts. Three patients were thrice scheduled for follow-up examinations but failed to attend, and two patients refused to undergo the follow-up examination, citing personal reasons.

The 39 subjects included in the present study were evaluated 1 day prior to the surgery and 6 months after its completion.

The inclusion criteria were being 18 years or older; having the cognitive ability to respond to the questionnaire and physical ability to travel to the location of the examination; and being hospitalized for bariatric surgery on the day after the oral examination. The research project was submitted to and approved by the Research Ethics Committee of Conceição Hospital (protocol 171/08), and all of the participants signed a free and informed consent form.

Study Design

The present investigation was a longitudinal study.

Measurements

Both questionnaires and oral examinations were performed in the same way at the baseline and follow-up and performed by the same examiner.

Questionnaires The questionnaire was administered via an interview, and the patients provided answers on their general and oral health histories, oral hygiene habits, socio-demographic information, and self-perception of oral health.

Oral Examination A dentist, who had been previously calibrated by an experienced dentist, performed all of the oral examinations in a dental chair under artificial light and using an air syringe, mouth mirror, and periodontal probe.

Medical Records Review Continuous medication taken daily, diabetes, hypertension, and BMI were assessed through questionnaires and subsequently confirmed by the medical records for all patients.

ICDAS The International Caries Detection and Assessment System (ICDAS) system was used for the diagnosis of dental caries on a given surface. The system consists of two criteria: one for ranking restorations and another for dental carious lesions, assessing the presence of carious lesions from early to advanced stages on a given surface [8]. The results were categorized as “healthy surface,” “non-cavitated carious lesion,” and “cavitated carious lesion.”

Salivary Flow The patients' stimulated salivary flow and salivary flow at rest were evaluated. The collection of saliva at rest was performed with the volunteer sitting in a relaxed position on a chair with the backrest upright. The volunteer was asked not to perform tongue, lip, or cheek movements. The saliva at rest was passively collected into a graduated cylinder for 5 min. The stimulated saliva collection was performed by masticatory stimulation using a sugarless and tasteless chewing gum. All of the saliva produced during the 5-min period was expelled and collected into a graduated cylinder. The values of the stimulated salivary flow and the salivary flow at rest were expressed in milliliters per minute.

Dry Mouth Sensation The subjective feeling of a dry mouth was assessed using the following questions [9]: (1) Does your mouth feel dry during the night or when you wake up? and (2) Does your mouth feel dry at other times of the day? (“never,” “sometimes,” or “always”).

Data Processing and Analysis

Descriptive analyses were performed for all of the variables. The intra-examiner reproducibility regarding the ICDAS index was measured before and during the study using the Kappa coefficient. The continuous variables were analyzed using Student's *t* test for paired samples or Wilcoxon nonparametric tests. The categorical variables were analyzed using McNemar's test. The value for rejecting the null hypothesis was $p \leq 0.05$.

Results

Thirty-nine patients with morbid obesity, who underwent bariatric surgery at HNSC during the period from October 2009 to January 2011, were evaluated in the present study. Thirty-eight (97.4 %) of the 39 evaluated patients were female, and the patients' ages ranged from 27 to 64 years, with a mean of 45.7 (± 9.5). Mean BMI was 50.7 (± 5.9) at baseline and 37.8 (± 6.6) at 6 months follow-up.

Twenty-seven (69.2 %) of the subjects were married, and 15 (38.5 %) subjects had completed secondary education. The individual incomes of the participants ranged from US\$0 to US\$1,650 per month, with a mean of US\$380 (\pm US\$356), whereas the mean family income was US\$817 (US\$ \pm 538) (Table 1). Regarding the ICDAS index, the kappa coefficient value for intra-examiner reliability before and during the study was 0.75 and 0.80, respectively.

Regarding general health, there was a statistically significant reduction in the prevalence of hypertension (from 74.4 to

28.2 %) and diabetes (from 41 to 11.3 %). The average number of medications taken daily was also significantly lower (from 3.59 to 2.1 drugs/day) (Table 2).

Regarding oral hygiene habits, 27 (69.2 %) patients at the baseline and 26 (66.7 %) patients at the follow-up reported brushing their teeth more than twice per day ($p=0.48$); In addition, 19 (48.7 %) patients and 21 (53.8 %) patients, respectively, reported flossing ($p=0.76$) (Table 2).

Dry mouth sensation (while sleeping or upon waking up) decreased from 30 (76.9 %) patients at the baseline to 18 (46.2 %) patients at the follow-up ($p<0.01$), and the frequency of dry mouth sensation throughout the day decreased from 26 (66.7 %) patients at the baseline to 11 (28.2 %) patients at the final examination ($p<0.01$).

Regarding dental caries, 11.14 (± 14.37) surfaces exhibited non-cavitated carious lesions at the baseline, and 10.05 (± 10.2) surfaces exhibited these lesions at the final examination ($p=0.12$). The average number of cavitated lesions was 9.16 (± 10.6) at the first examination and 8.42 (± 10.65) at the second examination ($p=0.76$). There was a statistically significant increase ($p=0.004$) in the stimulated salivary flow at the baseline examination compared with the follow-up examinations.

Discussion

The present investigation is one of the few longitudinal studies to assess the oral health status of patients undergoing bariatric surgery. Few studies which followed patients undergoing bariatric surgery assessed oral health, which limits the comparison of the results. The results of the present study suggest that bariatric surgery may be beneficial to oral health, given the decreased sensation of dry mouth and the increased salivary flow. Saliva plays a key role in oral homeostasis because it modulates the ecosystem within the oral cavity [10]. Other important salivary functions are food bolus lubrication, protection against viruses and bacteria, buffer capacity, protection and repair of the oral mucosa, and dental remineralization [11, 12], which can also have a long-term positive effect in the prevention of dental caries.

In a study of obese students, Panunzio et al. (2010) found no statistically significant difference in the stimulated salivary flow of obese children compared with the control group [13]. Marsicano et al. (2008) compared the mean salivary flow of patients who underwent bariatric surgery to obese patients and failed to find a significant difference [5]. The results of this study indicate an additional benefit of bariatric surgery that might be explained by the decreased use of medications following surgery. The pharmacological agents may mimic or antagonize the regulatory aspects of salivation, affecting both the salivary flow rate and the saliva composition [14].

Table 1 Baseline socio-demographic characteristics of the sample ($n=39$)

	Category	Number (%) or Mean (\pm standard deviation)
Gender	Female	38 (97.4)
Age	In years	45.7 (9.5)
BMI		50.69 (5.9)
Marital status	Married	27 (69.2)
	Single, divorced, widowed, and others	12 (30.8)
Education	Incomplete primary	10 (25.6)
	Complete primary	3 (7.7)
	Incomplete secondary	8 (20.5)
	Complete secondary	15 (38.5)
	Incomplete higher	2 (5.1)
	Complete higher	1 (2.6)
Personal income	In US\$	380 (356)
Family income	In US\$	817 (538)

Table 2 The study population's general and oral health characteristics, at the baseline and follow-up

Category		Number (%) Initial	Number (%) Final	<i>p</i>
General health				
	High blood pressure	29 (74.4)	11 (28.2)	<0.01
	Diabetes	16 (41)	4 (11.3)	<0.01
	BMI	50.7 (± 5.9)	37.8 (± 6.6)	<0.01
	Use of medications	35 (89.7)	33 (84.6)	0.49
	Medications (number/day)	3.6 (± 2.38)	2.1 (± 1.74)	<0.01
Oral health				
Access to dental care services	Never visits	1 (2.6)	1 (2.6)	0.48
	Visits when there is a problem	23 (59)	27 (69.2)	
	Visits occasionally	8 (20.5)	5 (12.8)	
	Visits regularly	7 (17.9)	6 (15.4)	
Toothbrushing frequency	Up to 1 time/day	2 (5.1)	1 (2.6)	0.76
	2 times/day	10 (25.6)	12 (30.8)	
	>2 times/day	27 (69.2)	26 (66.7)	
Flossing		19 (48.7)	21 (53.8)	0.68
Dry mouth sensation while sleeping or waking up		30 (76.9)	18 (46.2)	<0.01
Salivary flow at rest	mL/min	0.24 (± 0.20)	0.23 (± 0.17)	0.75
Stimulated salivary flow	mL/min	1.06 (± 0.62)	1.64 (± 0.99)	<0.01
Non-cavitated carious lesion	Mean total surfaces	11.14 (± 14.37)	10.05 (± 10.2)	0.12
Cavitated carious lesion	Mean total surfaces	9.16 (± 10.6)	8.42 (± 10.65)	0.76

Furthermore, several studies suggest that the prevalence of xerostomia increases with the increasing number of medications used [15, 16]. In the current study, a significant reduction in the mean number of medications used following bariatric surgery was found in the sample, which might explain the reduction in dry mouth sensation and the increased stimulated salivary flow at the follow-up examination.

The prevalence of hypertension and diabetes was significantly reduced 6 months after the bariatric surgery. These results are consistent with the previous literature. A systematic review of 52 studies involving 16,867 patients who underwent bariatric surgery reported a significant reduction in the risk factors for heart disease, including arterial hypertension, diabetes, and dyslipidemia [17].

Moura-Grec, in a literature review on the systemic consequences of bariatric surgery and its impact on oral health found that significant reduction of diabetes after surgery leads to improvement in xerostomia, corroborating our results [18].

One of the limitations of the current study was the 6-month follow-up period between the baseline examination and the final examination. This duration might have been a limiting factor in, for example, assessing the relationship between bariatric surgery and dental caries because the latter is a slowly progressing disease. Moreover, the small sample precluded performing a multivariate analysis.

Further investigations, including salivary tests assessing microbiological and biochemical parameters, cohort studies with longer follow-up periods, and interventional studies are suggested for evaluating whether oral health affects the clinical outcomes following surgery.

Conclusions

The present study's findings revealed improvements in the systemic health of patients who underwent bariatric surgery, including a reduction in diseases associated with obesity (diabetes and hypertension) and in the amount of medications used daily.

Regarding oral health, there was a decrease in the sensation of dry mouth and an increased stimulated salivary flow, which most likely were additional benefits of the improved general health.

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Conflicts of interest The authors declare that they have no conflicts of interest.

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