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TREATMENT

Oral health in patients who have undergone bariatric surgery

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Abstract

Bariatric surgery is the most effective treatment in morbidly obese patients and those who cannot lose weight employing traditional methods. However, it is associated with risk factors affecting oral health. Based on a review of the literature of the last 12 years, this study presents a summary of the oral complications after bariatric surgery and recommendations to effectively manage them. Patients after bariatric surgery are at higher risk of presenting dental caries, tooth wear and periodontal breakdown. A multi-disciplinary approach is necessary to perform a correct diagnosis of the oral status before surgery and develop subsequent prevention measures to minimize the oral complications after the procedure.

Keywords Bariatric surgery · Obesity · Obesity surgery · Gastrectomy · Oral health

Quick reference

Obesity is a chronic pathology characterized by an accumulation of body fat due to an energy imbalance. This pathology is a multifactorial phenomenon that includes metabolic, endocrine, genetic and psychological factors, among others [1–3]. It causes biochemical and physiological dysfunctions of tissues, and it is one of the most prevalent chronic diseases. According to the latest report of the World Health Organization (WHO), in 2016, more than 650 million adults were obese (body mass index [BMI] > 30 kg/m^2). Overall, about 13% of the world's adult population (11% of men and 15% of women) were obese. Since 1975, the worldwide prevalence of obesity has nearly tripled [4]. According to the Centers for Disease Control and Prevention, the US obesity prevalence was 42.4% in 2017–2018. This represents estimated medical costs per year of 174 billion dollars and, individually, these patients

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average $1429 more than patients with a healthy BMI [5]. Morbid obesity further increases the risk of obesity-related complications, such as coronary heart disease, end-stage renal disease [6, 7], type 2 diabetes and certain types of cancer [5].

Bariatric surgery (BS) is a procedure indicated for patients who have a BMI ≥ 40 or ≥ 35 kg/m^2, if it is accompanied by significant comorbidity and who cannot lose weight employing traditional methods [1, 8]. BS is considered the most effective treatment method in morbidly obese patients since it implies a rapid loss of excess weight and presents long-term benefits such as the resolution of obesity-related comorbidities and improved quality of life [1–3].

The popularity and number of BS have increased over the years. However, these procedures modify the anatomy, physiology, and oral habits of patients. Gastrointestinal complications are frequent, including nausea and vomiting, gastritis, and malnutrition. These complications may ultimately harm the oral cavity [9, 10]. These changes result in tooth wear, caries lesions and periodontal disease, among others [11, 12].

Different investigations have evaluated the oral health implications of BS. In recent years, studies are focusing on specific complications, but few are encompassing all of them. Some of the recent studies that attempted to provide a comprehensive review on the entirety of oral complications used a limited search strategy, excluding valuable studies. Therefore, the purpose of this study is to evaluate the current literature on the impact of BS on oral health.

Overview

Tooth wear in patients who have undergone BS

Dental wear after BS was reported in several studies [1, 13–16]. Studies on nausea and vomiting after BS found that obese patients undergoing BS experienced vomiting in 47.8% of the cases 3 months after the procedure and 56.3% after 6 months [13, 17]. Moreover, 1 year after BS, 92.3% of patients experienced vomiting and 76.9% of them vomited two or more times a day. On the 2-year follow-up, 65.4% of patients continued to experience vomiting. Nausea was present in 30.8% of patients after 2 years.

Vomiting and regurgitation create an acid environment that affects the buffer capacity of saliva, creating an oral pH imbalance [15]. In addition to the increased intake of sugars, it alters the oral microbiota and facilitates dental erosion [1, 18], secondary hypersensitivity and caries [19]. This erosion can affect the cervical area of the teeth, which due to the metabolism of the bacteria in the bacterial plaque, are highly susceptible to tooth mineral loss, therefore, increasing the risk of root caries [20]. Furthermore, a study evaluating non-carious cervical lesions (NCCLs) in BS patients observed a higher prevalence and higher risk of NCCLs than patients with morbid obesity [24].

Porcelli et al. [21] found that 90% of patients presented voluntary or involuntary regurgitation episodes after BS. In addition, 69% of these patients brushed their teeth after an episode of vomiting. Brushing right after vomiting produces abrasion

of the enamel and dentin due to the enamel being disorganized and demineralized, which contributes to the severity of tooth wear [22].

In 2016, Moura-Grec et al. [1] performed a cohort study evaluating the presence of tooth wear after BS. They found that 6 months after BS, there was a 6% increase in wear in dentin. Subsequently, Marsicano et al. [13] observed that 6 months after surgery 100% of the patients presented tooth wear involving dentin. When evaluating the presence of wear in enamel and dentin after surgery, a cross-sectional study [23] found that 21.15% of patients presented wear in enamel, while 76.93% presented wear in dentin.

Therefore, patients undergoing BS present a higher risk of tooth wear, secondary to a higher frequency of vomiting and regurgitation which create an imbalance in the salivary pH.

Dental Caries in patients who have undergone BS

Salgado-Peralvo et al. [11] performed a systematic review on the risk of dental caries after BS. The authors observed higher values of the DMF index (carious teeth, teeth absent or filled due to caries) in patients after BS [1, 8, 23, 24]. However, these differences were not statistically significant, potentially due to reduced periods of monitoring. On the other hand, when the number of teeth lost [8] or affected by caries [17] were evaluated independently, 25% of the patients undergoing BS had at least one cavity after 6 months compared with healthy patients, being these differences statistically significant [17]. In addition, Cardozo et al. [14] in 2014 found that BS patients presented an increase in active dental decay and salivary flow alterations compared with obese patients not undergoing BS, but this difference was not statistically significant.

Moreover, obese patients have less secretion of stimulated saliva compared with healthy patients [10, 23]. In this regard, Knas et al. [24] found a lesser stimulated salivary flow in obese patients after BS compared with healthy patients. Other authors did not find such differences [1, 10]. Regarding unstimulated salivary flow, no differences were found [13].

On the other hand, the microbiological counts of *Streptococcus mutans* increased significantly at 6-month follow-up in patients receiving BS while *Lactobacillus* spp counts did not increase significantly [10]. This increase in *S. mutans* might be explained by the more frequent consumption of extrinsic sugars, facilitating an oral environment favorable for these bacteria which ultimately increases the risk of caries and its progression [25].

These patients also have different dietary patterns after the procedure. Dietetic recommendations vary but usually include intake of 4 to 6 meals per day in separate sessions from liquid intake, and modification of the consistency of food to make it softer. This increases the time of exposition to sugars and the adherence to teeth, which ultimately increases the risk of caries [10].

Consequently, in light of the findings presented, it can be concluded that obese patients undergoing BS present a higher risk of developing dental caries due to qualitative and quantitative alterations in the saliva, salivary pH imbalances caused by a

higher frequency of vomiting and regurgitation which diminish the buffer capacity of saliva, and changes in the dietary patterns.

Periodontal disease in patients who have undergone BS

A systematic review and meta-analysis by Fontanille et al. [26] on the effects of BS on periodontal status were performed in 2018. There was a total of 1,159 patients with obesity, including 886 subjects in the bariatric group. This study showed a negative impact of BS on periodontal status at the 6-month follow-up. An increase in the percentage of moderate periodontal pocket sites and periodontal inflammation was seen. However, at the 12-month follow-up after BS, no significant differences were found in periodontal status compared with the baseline (before surgery). They suggested that during the first 6 months after BS there is a slight to moderate periodontal deterioration, but it resolves 1 year after the procedure.

Although no definitive causes have been found for these results, the first hypothesis is the lack of complete resolution of the pre-existing inflammation associated with obesity. Obesity may affect periodontal health, due to the mechanisms involved in low-grade systemic inflammation [27]. Also, microbiota could play a role. Some studies found a significant increase in the detection of *Porphyromonas gingivalis* 6 months after BS [28] and an increase in the red complex species in periodontally compromised patients after the procedure [12, 28]. On the other hand, these periodontal changes could be explained due to the nutritional deficiencies after BS and the rise of psychological changes [29]. On the other hand, nutritional and psychological changes after BS could potentially affect the periodontal status due to vitamin deficiencies, including vitamin C [30].

There was another systematic review and meta-analysis done in 2018 by de Souza et al. [31]. They included the same articles as in the systematic review and meta-analysis described above. However, the most significant difference between these studies is that Souza et al. found in their meta-analysis that the mean of the plaque index was lower after BS. They suggest that this outcome possibly comes from changes in the patient´s lifestyle, including diet changes, better hygiene, and psychological motivation [32].

The most recent systematic review and meta-analysis by Colak et al. [33] in 2021 analyzing the effect of BS on periodontal health found a statistically significant increase in bleeding on probing, clinical attachment level, probing depths, and percentage of probing depth sites of 4–5 mm, 6 months after BS. These parameters were not increased at the 12-month follow-up, which may indicate that during the recovery after BS, patients experience progression of periodontal destruction that can be reversible.

Furthermore, a study by Balogh [34] analyzing crevicular fluid samples of patients after BS found that there was a mean increase in germ count, although not significantly. *Candida albicans* and non-albicans species emerged after surgery, both in terms of the proportion of subjects and a significant germ count surge, but no overall periodontal abnormalities were found.

Therefore, we can affirm that patients undergoing BS present a higher risk of periodontal complications during the first-year post-surgery, possibly associated with a change in the dietary patterns that, inherently, affect oral hygiene habits. Subsequently, the presence of tooth wear increases the risk of dentin hypersensitivity, which hinders optimal dental brushing.

Procedure

Management of oral complications and recommendations after BS

As previously shown, patients after bariatric surgery have a higher risk of tooth wear, dental caries, and periodontal breakdown. Therefore, it is necessary to delve into the recommendations and propose preventative measures to successfully manage these patients. In this sense, a study by Porcelli et al. [35] evaluated the impact of an oral health promotion program after BS. There was a total of 109 patients undergoing BS and they were allocated into two groups: a control group and an intervention group. The latter participated in the oral health promotion program after surgery, while the control group received the usual care from the bariatric clinic staff. At the 6-month follow-up after surgery, the intervention group had lower gingival bleeding and dental caries, lower indices of plaque and an increase in salivary flow, compared with the control group. This exemplifies the benefits of including these patients in an oral health promotion program with close dental monitoring, which would contribute to preventing oral complications and improving their quality of life.

1. Dental visits every 3–4 months [21]—this consists of careful caries diagnosis, oral hygiene education. Patient education on brushing techniques and dental plaque control, chewing gums containing xylitol and the use of sialagogues to promote the secretion of saliva on patients with a significantly reduced salivary flow would aid in the prevention of dental caries [36]. Fluoride varnishes have also been used successfully to reduce caries lesions in permanent teeth [37] and can be used as a preventive measure during the first month after BS. The introduction of a nutritional therapist would also be beneficial to educate patients to establish healthy dietary habits are reducing the amounts of soft drinks, sugars, etc.
2. Patients should also be educated on the relationship between high levels of acid in the mouth and tooth wear, especially on patients presenting vomiting or regurgitation. Following an episode of vomiting, it is advisable to rinse the mouth with water or fluoride mouthwash to avoid the effects of gastric acid on the teeth. Moreover, teeth should not be brushed for at least an hour to allow the buffer capacity of the saliva to return to normal pH [38]. Remineralization techniques might be useful to prevent tooth wear from occurring [39] in addition to the use of mouthwashes and toothpaste with high concentrations of fluoride.
3. Finally, a comprehensive periodontal evaluation must be completed before BS. Although the risk of cardiovascular disease decreases after BS, periodontal disease continues to be a cardiovascular risk factor after surgery [40]. Periodontal status is negatively affected after BS; therefore, it is imperative to treat an active

periodontal disease before the procedure. Frequent periodontal evaluations must be performed after surgery to prevent further breakdown and motivate patients on the importance of oral hygiene.

Pitfalls and complications

We would like to highlight the importance of oral care and monitoring patients before and particularly after BS. The first 6 months after surgery seem to be the period when patients are at potential risk of additional periodontal breakdown, however, it tends to resolve at the 1-year follow-up. These patients are at higher risk of developing dental caries, dental wear, and periodontal complications. We suggest that bariatric surgeons should be aware of the oral complications after BS. A multidisciplinary approach is necessary to perform a correct diagnosis of the oral status before surgery and subsequent prevention measures to minimize the oral complications after the procedure.

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Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

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