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Review Article

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Stomatological and functional aspects linked to the stomatognathic system of patients submitted to bariatric surgery: an integrative review

Aspectos estomatológicos e funcionais vinculados ao sistema estomatognático de pacientes submetidos à cirurgia bariátrica: uma revisão integrativa

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Abstract

Background: Bariatric surgery is the most used procedure to treat obesity. Individuals who undergo this procedure may experience significant changes in the stomatognathic system. **Objective**: To analyze the possible implications of bariatric surgery for the stomatognathic system. **Materials and Methods**: Integrative literature review, carried out in the PubMed, SciELO and LILACS databases, using the keywords, extracted from the Health Sciences Descriptors (DeCS) ("*Cirurgia Bariátrica*", "*Saúde Bucal*", "*Odontologia*", "*Sistema Estomatognático*" e "*Cárie Dentária*") and Medical Subject Headings (MeSH) ("Bariatric Surgery", "Oral Health", "Dentistry", "Stomatognathic System" and "Dental Caries") and the Boolean operator "AND". Publications between the years 2009 to 2019, in Portuguese and English, with an observational study design, clinical trials and systematic reviews were included. Data were tabulated using Microsoft Excel 2016 for Windows and presented descriptively. **Results**: Twenty-three publications were eligible for review. Most studies were carried out by researchers from the Americas (73.9%), with all these studies carried out in Brazil (100%) and a cohort study design (48%). The number of participants ranged from 27 to 345. There were changes in salivary flow and composition, in periodontium, in masticatory kinematics and increased development of dental caries and erosion lesions, with an impact on the quality of life. **Conclusion**: Individuals undergoing bariatric surgery have implications for oral health regarding changes in salivary flow and composition, in periodontium, in masticatory kinematics and increased development of dental caries and erosion lesions, and on quality of life related to oral health.
Keywords: Bariatric Surgery; Oral Health; Dentistry; Stomatognathic System; Dental Caries.

Resumo

Introdução: A cirurgia bariátrica é o procedimento mais utilizado para tratar obesidade. Indivíduos que se submetem a esse procedimento podem apresentar alterações no sistema estomatognático significativas. **Objetivo**: Analisar as possíveis implicações da cirurgia bariátrica para o sistema estomatognático. **Materiais e Métodos**: Revisão integrativa da literatura, realizada nas bases de dados PubMed, SciELO e LILACS, utilizando as palavras-

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chave, extraídas do Descritores em Ciências da Saúde (DeCS) ("Cirurgia Bariátrica", "Saúde Bucal", "Odontologia", "Sistema Estomatognático" e "Cárie Dentária") e do Medical Subject Headings (MeSH) ("Bariatric Surgery", "Oral Health", "Dentistry", "Stomatognathic System" e "Dental Caries") e o operador booleano "AND". Foram incluídas as publicações entre os anos de 2009 a 2019, nos idiomas português e inglês, com delineamento de estudo observacional, ensaios clínicos e revisões sistemáticas. Os dados foram tabulados utilizando-se o Microsoft Excel 2016 para Windows e apresentados descritivamente. **Resultados**: Vinte e três publicações foram elegíveis para a revisão. A maioria dos estudos foram realizados por pesquisadores das Américas (73,9%), com a totalidade dessas pesquisas executadas no Brasil (100%) e desenho de estudo do tipo coorte (48%). O número de participantes variou de 27 a 345. Verificou-se alterações no fluxo e na composição salivar, no periodonto, na cinemática mastigatória e aumento no desenvolvimento de lesões de cárie e erosão dentárias, com impacto na qualidade de vida. **Conclusão**: Indivíduos submetidos à cirurgia bariátrica apresentam implicações na saúde bucal referentes a alterações no fluxo e na composição salivar, no periodonto, na cinemática mastigatória e aumento no desenvolvimento de lesões de cárie e erosão dentárias, e na qualidade de vida relacionada à saúde bucal.
Palavras-chave: Cirurgia Bariátrica; Saúde Bucal; Odontologia; Sistema Estomatognático; Cárie Dentária.

Introduction

Obesity is a chronic noncommunicable disease, characterized by the excessive accumulation of adipose tissue throughout the body[1], being a public health problem due to its high prevalence, difficult control and high recurrence rate[2]. Body mass index (BMI) is a simple method used to classify obesity in adults, defined as weight in kilograms divided by the square of height in meters (kg / m²)[3]. For adults, the World Health Organization (WHO) defines obesity as individuals with BMI equal to or greater than 30 kg / m²[3].

In 2016, more than 1.9 billion adults were overweight, of which over 650 million were obese[3]. In Brazil, 56.9% of adults are overweight and 20.8% are obese[4]. Obesity is a risk factor for other noncommunicable diseases (NCD), such as cardiovascular diseases, diabetes, musculoskeletal disorders and certain types of cancer[3,5]. Obesity is considered to have multifactorial etiology, involving genetic, hormonal and environmental factors [6], as well as physical inactivity and the current lifestyle of society[3].

According to the Ministry of Health, the longitudinal clinical treatment of obesity includes guidance and support for changing habits, dieting, psychological attention, prescription of physical activity and pharmacotherapy, among other actions[7]. However, individuals with BMI ≥50 kg / m², with BMI ≥40 kg / m², with or without comorbidities, and with BMI> 35 kg / m², with comorbidities, who do not respond to this protocol, are indicated for bariatric surgery[7].

Bariatric surgery is the effective long-term treatment method for obesity, as it implies rapid loss of excess weight[8] and helps in the resolution or improvement of other comorbidities, such as diabetes mellitus[9], hypertension[10] and apnea[11], thus improving the quality of life of these patients[8] and significantly reducing their relative risk of death[12].

However, despite its advantages, several post-surgical consequences are reported, including nutritional deficit[13], gastritis[14], nausea and vomiting[15], anemia[16] and vitamin and mineral deficiency[16]. In addition, repercussions on the stomatognathic system can also be observed. This system is composed of static structures, represented by bones, teeth, maxilla, mandible, cranial bones and temporomandibular joint, and neuromuscular dynamic structures, being responsible for suction, chewing, swallowing, breathing and speech functions[17]. Among the main changes observed in gastroplastized individuals,

periodontal changes, dental caries and dental erosion stand out[18,19]. Thus, obese patients undergoing bariatric surgery require dental follow-up to avoid increase in oral problems and improve their oral and general quality of life.

Therefore, this integrative review aims to analyze the possible implications of bariatric surgery for the stomatognathic system, providing health professionals with subsidies to assist in their decision making.

Materials and methods

This is an integrative literature review using the following keywords extracted from the Health Sciences Descriptors (DeCS) and the Medical Subject Headings (MeSH): “Bariatric Surgery”, “Oral Health", "Dentistry", "Stomatognathic System" and "Dental Caries" and the "AND" Boolean operator.

The search for publications was carried out in PubMed / MEDLINE (US National Library of Medicine), SciELO (Scientific Electronic Library Online) and LILACS (Latin American and Caribbean Literature in Health Sciences) databases until June 2019. Observational studies (cross-sectional, cohort and case-control), clinical trials, dissertations / theses and systematic reviews published in the period between 2009 and 2019 in Portuguese and English were included, excluding case reports and narrative and integrative literature reviews.

The selection of publications started with the reading of titles and abstracts, carried out independently by two trained researchers. Conflicts were discussed and the final decision was based on consensus. Information collected was: name (s) of author (s), year of publication, country where the study was carried out, study design, sample number and the most relevant conclusions for dentistry.

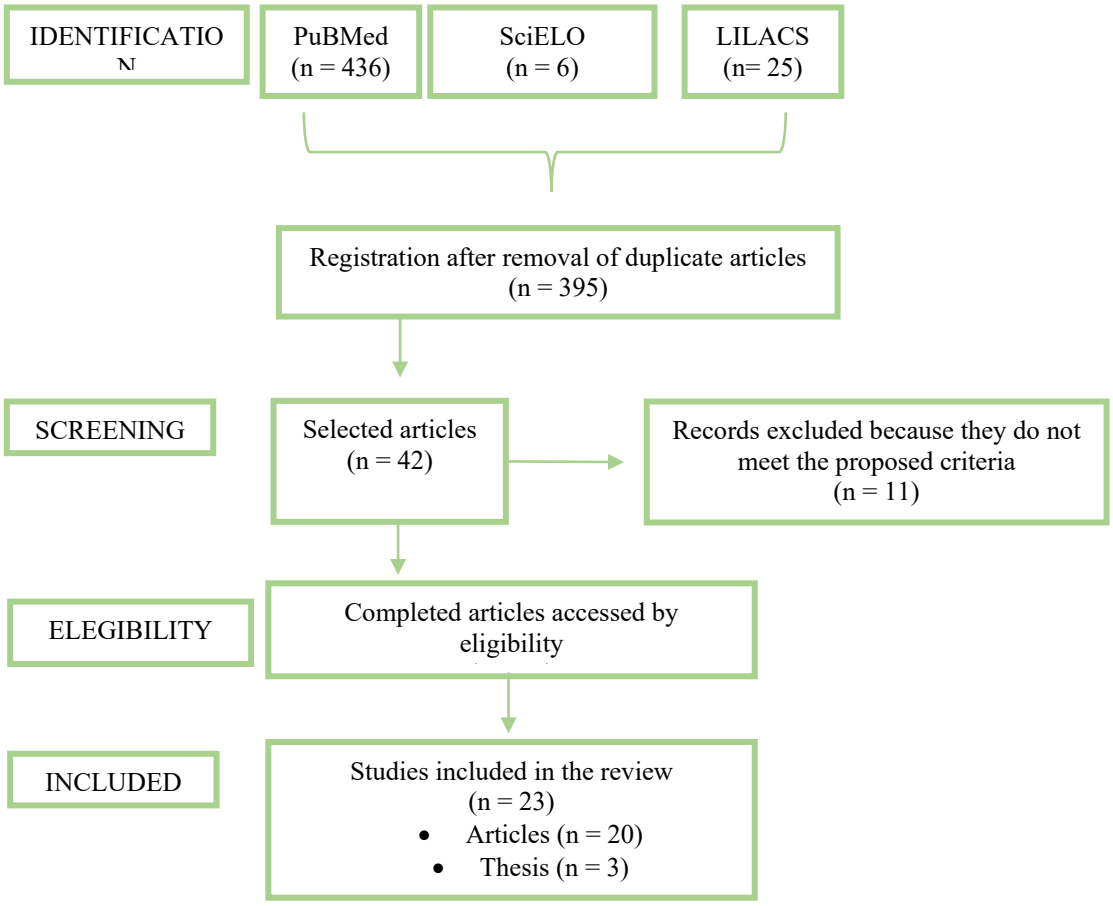
Data were tabulated using Microsoft Excel 2016 for Windows (Microsoft Press, Redmond, WA, USA) and descriptively presented.

Results

Overall, 467 publications were found, of which 436 in PubMed using "Bariatric Surgery and Oral Health", "Bariatric Surgery and Dentistry", "Bariatric Surgery and Stomatognathic System" and "Bariatric Surgery and Dental Caries" keywords,6 in SciELO and 25 in LILACS using "Bariatric Surgery and Oral Health", "Bariatric Surgery and Dentistry", "Bariatric Surgery and Stomatognathic System" and "Bariatric Surgery and Dental Caries" keywords for both databases.

After removing duplicates, 395 studies remained, of which 42 were selected and carefully examined. Of these, 31 were selected for further analysis and 11 were excluded because they did not meet the eligibility criteria. Thus, of the 31 publications that were read in full, 8 were excluded and, finally, 23 remained to be included and had their data analyzed, being 20 articles and 3 theses (Figure 1).

Figura 1. Flowchart of selection procedure for the articles included in the review.



Regarding geographic distribution, most studies were carried out by researchers from the Americas (73.9%), with the totality of these studies carried out in Brazil (100%), followed by Europe (26.1%). Regarding the methodological design, the most widely used was the cohort design (48%), followed by systematic review (20%). The number of participants ranged from 27[20] to 345[21], both with Brazilian individuals and for systematic reviews, the number of articles ranged from 6[22] to 10[23]. Thirteen studies (56.5%) evaluated the oral health of patients undergoing bariatric surgery, investigating halitosis, salivary flow, presence of periodontal disease, dental caries and tooth erosion. Four studies (17.4%) considered the impact of oral health condition on quality of life, three (13%), the microbiological characteristics of periodontal disease, two (8.7%), the oxidative damage of saliva and, one study (4.4%), the masticatory kinematics characteristics (Table 1).

Table 1. Distribution of articles on the implications of bariatric surgery for the stomatognathic system.

AUTHOR(S)	YEAR	COUNTRY	STUDY DESIGN	SAMPLE	CONCLUSIONS
Souza et al.[24]	2009	Brazil	Case-control	31 obese individuals (control group) and 31 individuals undergoing bariatric surgery (case group)	The complaint of halitosis among individuals undergoing bariatric surgery is not more frequent than among obese individuals waiting for this surgery. The results showed that there was no significant difference between breath self-assessment and the average concentrations of volatile sulfur compounds in case and control groups. Significant correlation between these two results was observed only for the case group and no correlation was found between breath self-assessment and impact on quality of life in case and control groups.
Gonçalves et al.[25]	2010	Brazil	Cross-sectional	30 patients undergoing bariatric surgery	In relation to the oral condition, frequent hyposalivation and low occurrence of gingival bleeding and dental caries were observed. The high DMFT was mainly associated with past history of the disease.
Marsicano et al.[12]	2011	Brazil	Cohort	Obese patients studied before the procedure: 54 / After 3 months: 24 / After 6 months: 16	After bariatric surgery, patients showed increase both in the occurrence of dental caries and periodontal pockets, and in the tooth wear severity, but these oral health changes did not influence quality of life.
Godlewski et al.[26]	2011	France	Cohort	46 women undergoing bariatric surgery divided into 3 groups according to the presence of dental elements	After bariatric surgery, all the obese patients, regardless of dental status modified their chewing kinematics. The number of chewing cycles and chewing frequency increased for all groups and for all foods. The effects of this chewing behaviour on bolus granulometry depended on dental status and type of food.
Moura-Grec[19]	2012	Brazil	Cohort	91 pre-surgery patients, 51 in the control group, 61 evaluated after 6 months of surgery and 50 evaluated after 12 months	Bariatric surgery had negative impact on oral health conditions, especially periodontal disease and tooth wear. Changes in the amount of periodontopathogenic bacteria were observed in patients evaluated during the three periods (preoperative, postoperative 6 and 12 months), with *P. gingivalis* showing significant association with the postoperative time.
Pataro et al.[21]	2012	Brazil	Cross-sectional	345 individuals were divided into three distinct groups: a preoperative group composed of 133 individuals and two postoperative groups composed of 72 and 140 individuals, respectively	Differences in periodontal condition were observed in individuals at different times of bariatric surgery, showing high prevalence of periodontitis both preoperatively and postoperatively.

Marsicano[27]	2012	Brazil	Clinical Trial	102 patients: G1 - experimental group with 52 patients undergoing Roux-en-Y gastric bypass surgery (RYGB) and G2 - control group with 50 severely obese patients selected for bariatric surgery	Bariatric patients showed prevalence of oral diseases similar to obese patients. However, higher prevalence of periodontal pockets was observed in bariatric patients.
Marsicano[28]	2013	Brazil	Cohort	90 patients, 70 obese and 20 with indication for cholecystectomy	12 months after bariatric surgery, the incidence of carious lesions increased significantly, and the incidence and severity of tooth wear also increased. Periodontal disease and saliva flow did not change significantly. The oral conditions evaluated did not have significant impact on quality of life.
Dupim Souza et al.[29]	2013	Brazil	Case-control	Candidates for bariatric surgery (control group): 31 / Individuals already submitted to Roux-en-Y gastric bypass surgery (case group): 31	No differences were found between the two groups in the halitosis frequency related to the white tongue index, plaque index and salivary flow rate. However, salivary flow was significantly reduced in the control group compared to the case group.
Moura-Grec et al.[30]	2014	Brazil	Cohort	59 individuals followed after 6 months of bariatric surgery and 51 non-obese volunteers (control group)	After surgery, improvement in general health was observed, but negative impact on oral health conditions was also observed, with the development of periodontal diseases and tooth wear.
Cardozo et al.[31]	2014	Brazil	Cohort	39 individuals evaluated one day before surgery and 6 months after the procedure	Regarding oral health, decrease in the feeling of dry mouth and increase in stimulated salivary flow was observed.
Hashizume et al.[20]	2015	Brazil	Cohort	27 patients with morbid obesity	No statistical differences were observed before or after bariatric surgery, for stimulated salivary flow, salivary pH, saliva buffering capacity and levels of *Lactobacillus spp*. and *C. albicans*. However, significant increase in the levels of streptococci was observed for the mutans group in the saliva of patients with

					morbid obesity 6 months after bariatric surgery.
Sales-Peres et al.[18]	2015	Brazil	Cohort	50 patients undergoing bariatric surgery	The severity of periodontal disease and the amount of *P. gingivalis* increased after gastric bypass surgery (GBS).
Knaś et al.[8]	2016	Poland	Case-control	40 morbidly obese patients who are candidates for bariatric surgery (case group) - assessed before and 6 months after the procedure / 40 healthy individuals (control group).	In morbid obesity, reduced unstimulated and stimulated salivary flow can be observed. Bariatric surgery restored only unstimulated salivary flow to normal values. Disturbances in oxidant/antioxidant homeostasis may be observed in unstimulated and stimulated whole saliva of obese patients before and after treatment.
Tinós[32]	2016	Brazil	Three studies were carried out, two cohorts (studies I and III) and one cross-sectional (study II)	In the three studies (EI, EII and EIII), patients were divided into two groups: experimental group (EG) and control group (CG). EI: 43 obese (CG) and 47 obese candidates for bariatric surgery (EG). EII: 44 non-obese (CG) and 50 obese candidates for bariatric surgery (EG). EIII: 43 obese candidates for bariatric surgery who remained in preparation for surgery during the segment (CG) and 46 obese candidates for bariatric surgery (EG)	After one year of performing bariatric surgery, compared to the preoperative period, no significant increase was observed in the salivary flow volume; however, worsening of the oral health condition with respect to initial dental caries lesions and gingival bleeding was observed. Bariatric surgery was not a protective factor for salivary flow volume or risk factor for initial dental caries lesions and gingival bleeding.
Sales-Peres et al.[33]	2017	Brazil	Cohort	110 obese adults undergoing bariatric surgery	Weight loss was associated with increased gingival bleeding, showing a peak 6 months after bariatric surgery. Periodontal pockets and loss of insertion remained unchanged during the first 12 months after surgery.
Fejfer et al.[34]	2017	Poland	Cohort	Individuals with morbid obesity analyzed before and	The morbid obesity is associated with oxidative damage to salivary proteins, lipids, and DNA, while bariatric treatment generally lowers the levels of

				after surgery: 47 / Healthy volunteers: 47	salivary oxidative damage. Six months after bariatric surgery a decreased oxidative modification of biomolecules in unstimulated and stimulated saliva could be observed, yet bariatric surgery related weight loss was not effective in restoring redox balance in the oral cavity.
Salgado-Peralvo et al.[35]	2018	Spain	Systematic Review	9 articles	Patients who have undergone bariatric surgery have a greater risk of dental caries.
Coelho e Cury[22]	2018	Brazil	Systematic Review	6 articles	The analysis of studies allowed concluding that individuals submitted to bariatric surgery presented worsening in periodontal conditions.
Karlsson et al.[36]	2018	Sweden	Case-control	Individuals undergoing bariatric surgery: 77 / Healthy obese: 45 / Non-obese: 71	Self-reported oral health problems (dental caries, difficult of chewing food, taste deteriorated, toothache, etc.) are more common in individuals that have undergone bariatric surgery than in obese patients and healthy people of normal weight. Individuals that have undergone procedure self-reported a higher or similar quality of life compared with obese patients; and a lower compared with healthy people of normal weight.
Fontanille et al.[23]	2018	France	Systematic Review and Meta-Analysis	10 articles	The deterioration of periodontal status may be observed in the first 6 months after surgery. Therefore, patient should be undergone systematic periodontal screening before procedure and receive periodontal follow-up after gastric bypass surgery, to avoid further deterioration of periodontium after procedure.
Souza et al.[37]	2018	Brazil	Systematic Review and Meta-Analysis	9 articles in the review, 5 articles in the meta-analysis	Quantitative analysis showed that the clinical level of insertion, the gingival index, the percentage of bleeding sites and the periodontal pocket depth probing were not different before and after bariatric surgery. However, the plaque index was lower after bariatric surgery.
Farias et al.[38]	2019	Brazil	Systematic Review and Meta-Analysis	8 articles	The results of included studies showed no significant change in the salivary flow rate for up to 24 months after bariatric surgery..

Discussion

As alternative for obesity treatment, bariatric surgery has shown significant results in relation to weight loss, leading to improvement in quality of life associated with the mental and physical aspects of individuals[39].

In recent years, the number of bariatric surgeries has increased and this procedure changes the anatomy and physiology of the organism and / or dietary habits of individuals[35]. However, they can have negative impact on oral health conditions due to increase in periodontal diseases, dental caries and erosion[30].

Of selected studies, most were developed by researchers from Brazil, possibly due to the growth in the search for this procedure in the country. According to the Brazilian Society of Bariatric and Metabolic Surgery, during the period from 2011 to 2018, the number of bariatric surgeries grew 84.7%, with approximately 424 thousand surgeries being performed in the country[40]. In 2019, Brazil was the third country that most performed Roux-en-Y gastric bypass surgery (76.6%), only behind Colombia (80.7%) and Canada (84.3%)[41]. In this surgery, part of the stomach is stapled, which reduces the space for food, and a deviation of the intestine, similar to the letter Y, which promotes the increase of hormones that provide satiety and reduce hunger[42].

The most frequent study design was cohort, corresponding to 12 surveys. This type of study enables estimating the incidence, the natural history of a condition and analyzing the risk factors that allow the calculation of the relative risk. By measuring events in the temporal sequence, they can distinguish causes from effects. Prospective cohorts are more accurate and, with good protocol, they can provide results as reliable as those of randomized clinical trials[43].

The complaint of halitosis, a condition that can be physiological or pathological with clinical causes of intraoral or extraoral origin, with over 75% of cases originating in the oral cavity[44,45], was the main theme of discussion of two selected articles[24,29]. From this perspective, it was observed that, in one of the studies, no significant difference was found in the breath self-assessment, measured using the visual analog scale, between obese individuals waiting for bariatric surgery and individuals who had already undergone the surgery[24]. However, the authors attributed this result to the exclusion of individuals with periodontal diseases and changes that could cause halitosis[24]. Additionally, the average concentration of volatile sulfur compounds was similar between case and control groups[24].

In the second study, which evaluated halitosis, carried out by Dupim Souza et al.[29], no difference in the occurrence of halitosis was observed between patients in the group of candidates for bariatric surgery and the group that had already undergone surgery. However, halitosis was related to other oral conditions such as white tongue index, plaque index and salivary flow rate in gastroplastized patients[29].

Another aspect linked to the stomatognathic system recurrent in studies included in this review is saliva, which plays a very important role in the oral cavity, such as lubrication, clearance of undesirable substances, digestion, neutralization of acids or bases, protection against demineralization and even as antimicrobial[20]. However, metabolic changes can influence the synthesis, composition and secretion of saliva[20]. Therefore, since saliva is a relevant component for maintaining healthy oral cavity, studies on salivary flow and composition in bariatric individuals are necessary.

Gonçalves et al.[25] concluded that hyposalivation was frequent in gastroplastized patients. This fact may be associated with the increase in dental caries rates, since the reduction in salivary flow is accompanied by the concomitant

increase in cariogenic microorganisms in the oral cavity, such as *Lactobacillus* and *Streptococcus mutans*[20]. On the other hand, another study reports that there is significant reduction in salivary flow in the group of individuals who are candidates for bariatric surgery compared to the group of individuals who have already undergone the surgical procedure[29]. In the study by Cardozo et al.[31], decrease in the sensation of dry mouth and increase in stimulated salivary flow were found among patients undergoing bariatric surgery.

In contrast to these results, Marsicano[28] observed absence of significant changes in relation to salivary flow 12 months after surgery, and Farias et al.[38] concluded, through the results of studies included in a systematic review and meta-analysis, that there was no significant change in the salivary flow rate for up to 24 months after bariatric surgery. In survey that evaluated salivary samples and microbial levels, the authors revealed that there were no statistically significant differences before or after bariatric surgery for stimulated salivary flow, salivary pH, saliva buffering capacity and levels of *Lactobacillus* spp. and *C. albicans* [20]. However, significant increase was observed in streptococci of the mutans group in the saliva of patients with morbid obesity six months after bariatric surgery[20].

For Tinós[32], one year after bariatric surgery, compared to the preoperative period, no significant increase was observed in the salivary flow volume, concluding in this study, also based on other results related to oral health, that both individuals, obese and bariatric, showed vulnerability to the study outcomes, requiring the participation of the Dentistry professional in the team of care for these patients.

In this review, negative changes in periodontal conditions such as the presence, as well as the worsening, of periodontal diseases, periodontal pocket and gingival bleeding, were observed[12,18,19,21-23,27,30,32,33]. However, Gonçalves et al.[25] found low occurrence of gingival bleeding in patients undergoing the surgical procedure; in the study by Marsicano[28], absence of significant changes related to periodontal disease was observed, and, finally, in the systematic review and meta-analysis by Souza et al.[37], the clinical level of insertion, the gingival index, the percentage of bleeding sites and the depth probing of the periodontal pocket were not different before and after bariatric surgery.

The divergence in results in relation to gingival bleeding may be related to changes (eating behavior, anatomical and physiological variations, technique used in surgery) associated with the surgical procedure, added to poor oral hygiene, which can cause biofilm accumulation mainly between tooth and gum[32]. Periodontal disease can also be related to nutritional deficiency secondary to surgery[30].

The diet pattern after bariatric surgery, which may include increased frequency of food and drink intake, is also a potential risk factor for the development of dental caries[46]. Among studies that addressed the occurrence of dental caries, five of them reported higher incidence of this disease in individuals undergoing bariatric surgery compared to a control group or to the same individual before the surgical procedure[12,28,32,35,36]. In contrast, Gonçalves et al.[25], in a cross-sectional study with gastroplastized patients, observed low occurrence of dental caries, as high DMFT was mainly associated with the period prior to surgery.

In addition to salivary flow, periodontal diseases and dental caries, another implication of bariatric surgery is dental erosion. In all studies that addressed this condition, individuals had higher tooth wear rate after surgery[12,19,28,30]. This index can be attributed to patients' non-adaptation to recommendations for changing eating habits, such as decreasing the amount of food ingested, fractionating food in several meals and increasing the

chewing time, leading to a situation of recurrent nausea and vomiting[47]. Therefore, one of the consequences of chronic vomiting is tooth erosion, especially on the palate face due to direct contact with the gastric juice[27].

Regarding oral health-related quality of life, in the study by Souza et al.[24], no correlation was found between breath self-assessment and impact on quality of life, in case groups, of individuals who have already undergone bariatric surgery, and control groups, of obese individuals with indication for bariatric surgery. This finding can be explained due to the absence in literature, at the time, of a specific validated instrument for this purpose, having been formulated a questionnaire based on the Oral Health Impact Profile (OHIP-14), which suggests that the questionnaire used did not present good psychometric properties[24].

In the cohort conducted by Marsicano et al.[12], the impact of oral health on quality of life decreased with time after bariatric surgery, probably as a result of the significant improvement in the general health of these patients. However, for Marsicano[28], after 12 months of bariatric surgery, the oral conditions evaluated did not have significant impact on quality of life. In a recent case-control research[36] carried out in Sweden, three different groups (non-obese individuals, healthy obese individuals and bariatric individuals) answered a questionnaire on oral health-related quality of life. Individuals who underwent the procedure reported higher or similar quality of life compared to healthy obese patients and lower compared to healthy people with normal weight. This may be associated with the age of older healthy obese people compared to healthy obese people, who had the highest average BMI, in addition to the fact that the gender distribution was higher for female patients, and the average age of non-obese people was considerably lower compared to the two obese groups[36].

In individuals with morbid obesity, there is reduction in the flow of stimulated and unstimulated saliva and the oxidative damage of salivary proteins, such as catalase and salivary peroxidase. Disturbances in homeostasis can be observed in both types of saliva and, only that of unstimulated saliva is restored after bariatric surgery[8]. In the study by Fejfer et al.[34], association of morbid obesity with oxidative damage of salivary proteins was also observed; however, even though there was a decrease in oxidative modification after weight loss resulting from surgery, the balance in the oral cavity was not regulated.

Chewing, one of the most important functions of the stomatognathic system, being involved in maintaining good motility in the digestive tract[48], was configured according to the analysis of one of the studies present in the current review, being susceptible to changes in patients undergoing bariatric surgery. In this sense, according to Godlewski et al.[26], all obese patients, after the surgical procedure, regardless of their dental condition, modified their masticatory kinematics. In this study, the number of chewing cycles and the chewing frequency increased in all groups and for all foods[26].

Finally, it is known that, when indicated and performed within ethical parameters, bariatric surgery brings many benefits to patients. Some selected studies have evaluated not only the implications of surgery for oral health, but also the systemic consequences and / or the degree of patient satisfaction[12,28,31,36], thus highlighting that the benefits to patient's health and quality of life provided by the surgery is greater than the possible damages.

In view of the growing current demand related to the performance of bariatric surgeries and considering the various negative oral repercussions that may affect patients undergoing this surgical procedure, dental monitoring before and after the procedure is essential

to prevent damage from occurring and progressing.

Conclusion

Individuals undergoing bariatric surgery have oral health implications regarding changes in salivary flow and composition, periodontium, masticatory kinematics and increased development of dental caries and erosion lesions, and oral health-related quality of life.

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