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The Deleterious Impacts of Bariatric Surgery on Oral Health: A Review Article

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Abstract *— Obesity is one of the most urgent public health problems today due to the epidemic growth of this pathology. Elevated values in body mass index are associated with increased morbidity and mortality. Among the treatments for weight reduction is bariatric surgery, an invasive procedure that presents varied adverse effects. Among the consequences of surgery is the decline in oral health. Bariatric patients may present dental erosion, caries, periodontal diseases and hypersensitivity that negatively affect the quality of these individuals. In this way, through a review of the literature, this article brought together the scientific publications related to oral health damages after the bariatric surgery of Y de Roux, in order to explain the importance of dental follow-up of these patients.*

Keywords *— **Obesity. Bariatric surgery. Oral health. Gastric bypass. Y de Roux.***

I. INTRODUCTION

Obesity has become a worldwide epidemic because of its widely distributed prevalence[1]. According to the World Health Organization (WHO), 2/3 of the world's population are overweight[2]. In Brazil, the high rate of obesity has raised great concern, since half of Brazilians are overweight and of these, 1/5 are classified as obese, placing the country in fifth position in the world ranking of obesity[3].

During the twentieth century, in an attempt to contain obesity, there was the intervention of the pharmaceutical industry and the introduction of medicalization was started to treat this pathology[4]. Several drugs have been and are still being used, but the limited long-term efficacy, the various adverse effects and the rebound effect caused by the interruption of medication have caused their use to be questioned[5].

In 1954, researchers Kremen, Linner and Nelson developed the technique of disabsorptive surgery in dogs, removing part of the small intestine of these animals to promote weight loss[6].This was not the first surgical intervention to reduce obesity, historical accounts describe that the first surgical attempt for weight control was performed in the tenth century by the Jewish physician Hasdai Ibn Shaprut[7], but it was only after Kremen and co-workers that this procedure won notoriety and the number of operations for obesity has grown over the years.

Currently there are different surgical procedures for the containment of obesity[8]. Among the techniques are biliopancreatic deviation with duodenal key; vertical gastrectomy; vertical banded gastroplasty and the Roux-en-Y technique or gastric bypass.

The Roux-en-Y surgery causes a decrease in stomach and intestinal size, being denominated restrictive, by reduction in the gastric volume, and disabsortiva, because it causes the reduction in the absorption of the nutrients [9].This technique is considered the gold standard methodological due to its efficiency in reducing and maintaining body weight in the long term[10].

According to the Brazilian Society of Bariatric and Metabolic Surgery (SBCBM), in 2017 Brazil performed 105,600 bariatric surgeries. But according to SBCBM estimates, five million Brazilians would be able to perform the procedure due to the high numbers of obesity in the country.

As bariatric surgery is an invasive and sometimes irreversible procedure, initially only indicated for patients between 18-60 years old, with class III obesity (BMI $\geq$ 40 kg / m^2) or with class II obesity (BMI $\geq$ 35 kg / m^2) with comorbidities.But due to the problems caused by overweight, currently, adolescents between 16-18 years old and elderly can be submitted to the procedure provided they fall into one of the categories 11. Extension of surgery also occurred for diabetic patients with BMI $\geq$ 30 kg/m^2[12].

Gastric bypass is not only effective for weight loss, the benefits of surgery also include improved quality of life, reduced mortality and remission of obesity-related

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comorbidities such as diabetes[13], hypertension and cardiovascular diseases[14], depression [15]and apnea[16].

Surgery is recognized as an effective treatment for severe obesity, but this procedure may present adverse effects resulting from surgical intervention such as mnemonic and behavioral changes, decreases in immune defense responses, bone decalcification, nutritional deficiencies and decrease in oral health[17,18].

Thus, this literature review investigated the repercussions of Roux-en-Y bariatric surgery in the oral cavity.

II. MATERIAL AND METHODS:

For the selection of articles used in this narrative literature review, the following keywords were used: (Oral Health and Bariatric Surgery); (Gastric by-pass or Roux-en-Y and Oral Impact); (Gastric by-pass or Roux-en-Y and Oral Health) in the MEDLINE / PubMed (NLM), Science Direct, Lilacs) PubMed, Lilacs and Science Direct databases. After electronic searching, full articles were reviewed and the most appropriate ones were included in this article.

BARIATRIC SURGERY AND ORAL HEALTH:

The oral cavity is an anatomical-physiological component of the gastrointestinal tract, and when part of this system undergoes some alteration, oral health may be potentially impaired[19].

After bariatric surgery one of the most frequent adverse manifestations is gastroesophageal reflux and vomiting, leading to changes in pH in the oral cavity[20].This regurgitation of gastric juice causes acidification of the mouth, leading to a decrease in pH at critical values for enamel and dentin, promoting the dissolution of hydroxyapatite crystals[21]. This loss of tooth structure may lead to exposure of the dentinal tubules causing hypersensitivity[22].

Patients with frequent reflux and vomiting may have dental erosion as well as lesions on the oral mucosa[23]. This loss of tooth structure due to significant pH reductions may result in loss of pulp vitality.

Reduced pH values also contribute to the development of dental caries. The oral cavity is largely colonized by cariogenic bacteria that produce organic acids through the metabolism of carbohydrates and sugars from food intake[24].Reduced pH values also contribute to the development of dental caries. The oral cavity is largely colonized by cariogenic bacteria that produce organic acids through the metabolism of carbohydrates and sugars from food intake[25]. The bone fragility caused by hypovitaminosis may be reflected in the increased mobility of the teeth, which may lead to tooth loss. In addition, Wojcik et al. Demonstrated that caries may be a reflection of vitamin D deficiency, since increases in the concentrations of this micronutrient in the diet reduce the incidence of caries[26].

The generation of acids helps in the degradation of the organic and inorganic matrices of the tooth. Saliva plays a key role in pH buffering in the oral cavity, but acid attacks from the stomach contents favor tooth demineralization and salivary packing becomes inefficient in the face of continuous regurgitation, resulting in the onset of caries[23].

Another important factor that is associated with the increase of dental caries in bariatric patients is the acquisition of new eating habits after the surgical procedure. Due to stomach reduction, it is necessary to reeducate food with reduction of ingested volume and increase in the frequency of intake (10-8 meals / day)[24], consequently, it is indispensable that brushing happens after feeding so that plaque formation does not occur and caries development is possible[27]. How bariatric surgery was developed to cause a reduction in intestinal absorption. This dis-absorptive intervention may affect the nutritional status of the patient. Studies reveal that after surgery may occur deficiencies of vitamins D, B vitamins and vitamins A[28,29,30].

Deficiencies of vitamins B2, B3, B6 and B12 usually manifest in the oral cavity through stomatitis, glossitis and oral ulcers, causing pain and discomfort to the patient[31].

Vitamin A (retinol) is known for its role in oral health and declines in systemic vitamin A concentrations are reflected in oral health. Vitamin A plays an important role in the maintenance of oral mucosa, salivary glands and teeth. In animal models, vitamin A reductions have been shown to cause degeneration of the salivary gland and a significant increase of cavities [32].

Saliva plays a crucial role in maintaining oral health due to functions in the immune response through the presence of antimicrobial components and proteins that act in innate and adaptive defense, as well as in buffering capacity[33]. Reports of hyposalivation have been observed in patients submitted to the Roux-en-Y procedure and reduction of salivary flow directly impairs the remineralization of teeth and decreases oral health[34].

Changes in periodontal tissues are also observed in patients undergoing bariatric surgery[35]. Due to the inflammatory nature of obesity resulting from the secretion of adipokines [tumor necrosis factor alpha (TNF-α) and interleukin 6 (IL-6)] by adipose tissue[36], initially it was believed that the surgical procedure could

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improve the periodontal condition of obese patients. But research investigating the periodontal condition after the Roux-en-Y procedure demonstrates that there is an increase in gingival bleeding and periodontal disease in these patients. It is believed that the reasons for this decline in periodontal health are partly due to changes in the microbiota of the oral cavity and nutritional changes after surgery[35].

III. DISCUSSION

Obesity in recent years has shown a worldwide growth, and due to the lack of efficient methodologies for the reduction of body weight, there was agreement on the use of more aggressive methodologies. In this context, bariatric surgery has proved to be a therapeutic option capable of causing a dramatic and sustainable loss of body weight[37].

Although the evolution in the surgical methodology reduced the risks involved during the procedure, adverse effects caused by the gatroplasty procedure are still observed. Thus, there is agreement that bariatric surgery is considered an effective model for reducing body fat, however, it should be the last option for weight loss.

The oral cavity is a component of the digestive tract and is also subject to the negative consequences of surgery, but often the adverse effects on the dentition are ignored. The authors are unanimous in reporting the significant decline in oral health after the gastrectomy procedure[18,23,38].

Among the oral pathologies commonly found in patients submitted to the Roux-en-Y bariatric surgery, the prevalence of periodontitis, caries, dental erosion and dental hypersensitivity is evident, demonstrating that despite Roux-en-Y surgery, the quality of life of patients is improved due to the reduction of body weight and obesity-related comorbidities, with decreased oral health[18]. This decline in the oral condition is observed mainly in the first six months after the procedure, period of greatest weight loss.

It is believed that many of these undesirable results may be consequences of changes in eating habits with an increase in the frequency of intake, frequent regurgitations, as well as reduction of oral hygiene. In addition, knowing that obesity is a pathology that causes a chronic inflammatory state due to the secretion of proinflammatory cytokines by adipose tissue and oxidative stress, the maintenance of fat cells in the first months after the surgical intervention together with the caloric restriction due to the post-surgical diet may reflect on the general condition of the patient, decreasing oral health conditions[39].

The decline in oral health has a negative effect on the patient's life[40].According to the WHO, oral health-related quality of life has significant implications in the individual's different domains (social, environmental, functional), impacting on self-esteem, personal satisfaction with oral health, ability to feed[41].

In this way, health professionals should be warned about the decline in oral status in bariatric patients so that the necessary care. However, there are no reports of the presence of dental surgeons in the pre-surgical follow-up of this group of patients and the need for the insertion of the dentist in the multidisciplinary team of bariatric surgery is undeniable in order to dignify and treat possible previous oral pathologies, as well as to prevent or attenuate the effects caused by bariatric surgery.

IV. FINAL CONSIDERATIONS

Obesity has become a public health problem responsible for several comorbidities that result in decreased quality of life, in addition to reducing the longevity of the individual, and therefore must be tackled. Thus, bariatric surgery is an effective method for reducing body weight, however, the scientific community should be aware of the adverse effects caused by surgical intervention, including oral health impairments.

There is no consensus about the deleterious effects of bariatric surgery on oral health, however the damage is evident. Thus, this review highlights the need for follow-up of patients submitted to surgical procedures, and the importance of the insertion of the dentist in the team of bariatric surgery professionals, in order to control the harmful effects on the oral cavity caused by surgery.

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REFERENCES

[1] Gadde KM, Martin CK, Berthoud HR, et al. Obesity: Pathophysiology and Management. *J Am Coll Cardiol* 2018; 71: 69–84.

[2] World Health Organisation. Global Database on Body Mass Index. *World Health Organization (WHO)*, http://apps.who.int/bmi/index.jsp%5Cnhttp://apps.who.int/bmi/index.jsp?introPage=intro_3.html (2016).

https://dx.doi.org/10.22161/ijaers.6765 *ISSN: 2349-6495(P) | 2456-1908(O)*

[3] Di Cesare M, Bentham J, Stevens GA, et al. Trends in adult body-mass index in 200 countries from 1975 to 2014: A pooled analysis of 1698 population-based measurement studies with 19.2 million participants. *Lancet* 2016; 387: 1377–1396.
[4] Haslam D. Weight management in obesity - Past and present. *Int J Clin Pract* 2016; 70: 206–217.
[5] Ortiz SE, Kawachi I, Boyce AM. The medicalization of obesity, bariatric surgery, and population health. *Health (Irvine Calif)* 2016; 1: 1–21.
[6] KREMEN AJ, LINNER JH, NELSON CH. An experimental evaluation of the nutritional importance of proximal and distal small intestine. *Ann Surg* 1954; 140: 439–48.
[7] Faria GR. A brief history of bariatric surgery. *Porto Biomed J* 2017; 2: 90–92.
[8] Moshiri M, Osman S, Robinson TJ, et al. Evolution of bariatric surgery: A historical perspective. *Am J Roentgenol* 2013; 201: 40–48.
[9] Zeve JL de M, Novais PO, Júnior N de O. Técnicas em cirurgia bariátrica: uma revisão da literatura. *Ciência & Saúde* 2012; 5: 132–140.
[10] Peterli R, Wölnerhanssen BK, Peters T, et al. Effect of Laparoscopic Sleeve Gastrectomy vs Laparoscopic Roux-en-Y Gastric Bypass on Weight Loss in Patients With Morbid Obesity. *Jama* 2018; 319: 255.
[11] Mancini MC. Bariatric surgery--an update for the endocrinologist. *Arq Bras Endocrinol Metabol* 2014; 58: 875–88.
[12] Dixon JB, le Roux CW, Rubino F, et al. Bariatric surgery for type 2 diabetes. *Lancet* 2012; 379: 2300–11.
[13] Buchwald H, Estok R, Fahrbach K, et al. Weight and Type 2 Diabetes after Bariatric Surgery: Systematic Review and Meta-analysis. *Am J Med* 2009; 122: 248–256.e5.
[14] Beamish AJ, Olbers T, Kelly AS, et al. Cardiovascular effects of bariatric surgery. *Nat Rev Cardiol* 2016; 13: 730–743.
[15] Jumbe S, Hamlet C, Meyrick J. Psychological Aspects of Bariatric Surgery as a Treatment for Obesity. *Curr Obes Rep* 2017; 6: 71–78.
[16] de Raaff CAL, de Vries N, van Wagensveld BA. Obstructive sleep apnea and bariatric surgical guidelines. *Curr Opin Anaesthesiol* 2017; 30: 1–6.
[17] Lager CJ, Esfandiari NH, Subauste AR, et al. Roux-En-Y Gastric Bypass Vs. Sleeve Gastrectomy: Balancing the Risks of Surgery with the Benefits of Weight Loss. *Obes Surg* 2017; 27: 154–161.
[18] Cardozo DD, Hilgert JB, Hashizume LN, et al. Impact of Bariatric Surgery on the Oral Health of Patients with Morbid Obesity. *Obes Surg* 2014; 24: 1812–1816.
[19] Marsicano JA, Grec PGD, Belarmino LB, et al. Interfaces between bariatric surgery and oral health. A longitudinal survey. *Acta Cir Bras* 2011; 26: 79–83.
[20] El-hadi M, Birch DW, Gill RS. The effect of bariatric surgery on gastroesophageal reflux disease. 2014; 57: 139–144.
[21] Suvan J, D´Aiuto F. Assessment and Management of Oral Health in Obesity. *Curr Obes Rep* 2013; 2: 142–149.
[22] Moura-Grec PG, Assis VH, Cannabrava VP, et al. Systemic consequences of bariatric surgery and its repercussions on oral health. *Arq Bras Cir Dig* 2012; 25: 173–177.
[23] Porcelli ICS, Roma CC, Nunes MC, et al. Effects of Bariatric Surgery on the Oral Health of Patients. *Int J Dent Oral Heal Cit Int J dent Oral Heal* 2016; 2: 1–6.
[24] Kianoush N, Adler CJ, Nguyen K-AT, et al. Bacterial profile of dentine caries and the impact of pH on bacterial population diversity. *PLoS One* 2014; 9: e92940.
[25] Rathee M, Tamrakar AK. Research and Reviews : Journal of Dental Sciences Oral Health and Vitamin B 12 : A Review . *RRJDS Res Rev J Dent Sci Oral* 2013; 2320–2323.
[26] Wójcik D, Krzewska A, Szalewski L, et al. Dental caries and vitamin D 3 in children with growth hormone deficiency A STROBE compliant study. *Medicine (Baltimore)* 2011; 97: 1–8.
[27] Klein MI, Hwang G, Santos PHS, et al. Streptococcus mutans- derived extracellular matrix in cariogenic oral biofilms. *Frontiers (Boulder)* 2015; 5: 1–8.
[28] Karmali S, Stoklossa CJ, Sharma A, et al. Bariatric surgery: A primer. *Can Fam Physician* 2010; 56: 873–879.
[29] Da SILVA PRB, de SOUZA MR, da SILVA EM, et al. Nutritional Status and Life Quality in Patients Undergoing Bariatric Surgery. *Arq Bras Cir Dig* 2014; 27: 35–38.
[30] Herron DM, Bloomberg R. Complications of bariatric surgery. *Minerva Chirurgica* 2006; 61: 125–139.
[31] Bal BS, Finelli FC, Shope TR, et al. Nutritional deficiencies after bariatric surgery. *Nat Rev Endocrinol* 2012; 8: 544–556.
[32] Rathee M, Bhoria M, Kundu R. Vitamin A and Oral

https://dx.doi.org/10.22161/ijaers.6765 *ISSN: 2349-6495(P) | 2456-1908(O)*

Health : A Review Vitamin A and Oral Health : A Review. *Med Sci* 2013; 3: 1–3.

[33] Marsicano JA, Sales-Peres A, Ceneviva R, et al. Evaluation of oral health status and salivary flow rate in obese patients after bariatric surgery. *Eur J Dent* 2012; 6: 191–197.

[34] De Moura-Grec PG, Yamashita JM, Marsicano JA, et al. Impact of bariatric surgery on oral health conditions: 6-months cohort study. *Int Dent J* 2014; 64: 144–149.

[35] Pataro AL, Costa FO, Cortelli SC, et al. Influence of Obesity and Bariatric Surgery on the Periodontal Condition. *J Periodontol* 2012; 83: 257–266.

[36] Suresh S, Mahendra J. Multifactorial relationship of obesity and periodontal disease. *J Clin Diagnostic Res*; 8. Epub ahead of print 2014. DOI: 10.7860/JCDR/2014/7071.4227.

[37] Karamanakos SN, Vagenas K, Kalfarentzos F, et al. Weight Loss, Appetite Suppression, and Changes in Fasting and Postprandial Ghrelin and Peptide-YY Levels After Roux-en-Y Gastric Bypass and Sleeve Gastrectomy. *Ann Surg* 2008; 247: 401–407.

[38] I JAM, Garcia P, Grec DM, et al. Interfaces between bariatric surgery and oral health . A longitudinal survey 1 Interface entre cirurgia bariátrica e saúde bucal . Estudo longitudinal. *Acta Cirúrgica Bras* 2011; 26: 79–83.

[39] Brandão IS, Soares DJ. *A OBESIDADE , SUAS CAUSAS E CONSEQUÊNCIAS PARA A SAÚDE O número de indivíduos adultos com excesso de peso corporal e obesidade tem aumentado de forma acentuada nos últimos anos (TIRAPEGUI , 2006). Segundo dados fornecidos pela Vigilância de Fatores de R*. Universidade da Integração Internacional da Lusofonia Afro-Brasileira, 2016.

[40] Bennadi D, Reddy CVK. Oral health related quality of life. *J Int Soc Prev Community Dent* 2013; 3: 1–6.

[41] WHO | Oral health, general health and quality of life. *WHO*, http://www.who.int/bulletin/volumes/83/9/editorial30905html/en/ (2011, accessed 16 July 2018).