Maxillofacial Bone Healing in a Patient post Gastric Bypass Surgery: A Case Report

Nicholas Mechas¹, Joseph P. Mulligan¹, Paul Deitrick¹, D'Arcy Duke², Allen Fred Fielding^{1*}

¹Oral and Maxillofacial Surgery, Temple University, 100 E Lehigh Ave, PM 2, Philadelphia, PA 19125

²Director Bariatric Surgery Conemaugh Memorial Medical Center, 1086 Franklin St, Johnstown, PA 15905

***Corresponding Author:** Allen Fred Fielding, DMD, MD, MBA, Professor, Oral and Maxillofacial Surgery, Temple University, 100 E Lehigh Ave, PM 2, Philadelphia, PA 19125, USA, Email: allenf@temple.edu.

Received Date: November 30, 2018 **Accepted Date:** March 18, 2019 **Published Date:** March 25, 2019

Citation: Nicholas Mechas, Joseph P. Mulligan, Paul Deitrick, D'Arcy Duke, Allen Fred Fielding (2019).

Maxillofacial Bone Healing in a Patient post Gastric Bypass Surgery: A Case Report.

POJ Dent Oral Care. 2(1):1-5. DOI: <https://doi.org/10.32648/2578-8817/2/1/003>

Abstract

Gastric bypass surgery with subsequent changes in both bone metabolism and bone density leading to increased fractures and mineral deficiencies are proven concepts. Whether the patient undergoes gastric bypass surgery during maxillofacial healing or has maxillofacial surgery within a year of prior gastric bypass surgery, the effect on bony healing of the maxillofacial region remains to be studied. We provide a case report of failed reconstruction due to significant bone loss and graft resorption in a patient who underwent gastric bypass surgery 4 months after a mandibular reconstruction procedure.

Abbreviations: OMFS: Oral and maxillofacial surgery, CTX: C-terminal telopeptide, CT: Computed tomography, GLP: glucagon-like peptide, MUSC: Medical University of South Carolina, MMF: Maxillomandibular fixation, OR: Operating Room, AICBG: Anterior iliac crest bone graft, PRP: Platelet rich plasma, TMJ: Temporomandibular joint

Background

2017 saw the largest number of gastric bypass or bariatric surgeries performed in the United States of any year [1]. Gastric bypass or bariatric surgery encompasses several types which include roux-en-Y gastric bypass, laparoscopic adjustable gastric banding, sleeve gastrectomy, and duodenal switch with biliopancreatic diversion. Out of the approximately 228,000 performed, 59.39% were sleeve gastrectomy, 17.8% were Roux-en-Y gastric bypass, 14.14% were revision surgeries and the remainder divided among other types [1]. With increasing rates of obesity across the U.S. and advances in gastric bypass success rates, this surgery is likely to become more prevalent in upcoming years [2]. This translates to seeing more patients in OMFS offices and patients undergoing oral and maxillofacial surgeries with history significant for gastric bypass surgery. It is therefore the surgeon's prerogative to be intimately knowledgeable on how this past surgical history can affect surgical outcomes and the timetables for which this can play a relevant role in the healing process. There is at the present time a dearth of information on

either bone healing or surgical precautions of the maxillofacial region in this patient population.

Although the process is yet to be entirely elucidated, gastric bypass surgery is known to have widespread effects on both calcium homeostasis and bone turnover [3]. Ensuing changes in bone mineral density has also been observed [4]. Gastric bypass is a malabsorption procedure and can cause secondary hyperparathyroidism if not given adequate supplements post operative. Sleeve gastrectomies do not cause malabsorption except for vitamin B-12 due to the resection of the greater curve of the stomach. Sleeve gastrectomies can also lead to overall malnutrition because of the calorie restriction; especially within the first 6 months immediately post operatively [5].

Mechanisms identified which contribute to alterations in bone metabolism after Roux-en-Y gastric bypass surgery includes: calcium and vitamin D malabsorption with secondary hyperparathyroidism, deficiency in other nutrients, and alterations in adipokines, gonadal steroids, and gut-derived hormones favoring bone loss [6]. Unlike other obesity-related co-morbid conditions, vitamin D deficiency and secondary hyperparathyroidism are not corrected after surgery, and can be exacerbated by the ensuing malabsorptive state or calorie restricted state [7]. A negative impact of bariatric surgery on bone metabolism may also be partially explained by a decrease in the mechanical loading and subsequent reduction in osteoblast

differentiation with post surgical weight loss. Concomitantly, resulting hormonal alterations produced by changes in adipose tissue and gut hormones [8] contribute in the negative feedback mechanism on bone mass. This includes polypeptide YY, an anorexigenic hormone secreted during feeding that increases after both Roux-en-Y and sleeve gastrectomy procedures and has catabolic effects on bone [9,10]. Also involved are incretins, including glucagon-like peptide-1 (GLP-1), GLP-2, and glucose-dependent insulinotropic peptide, which all increase after bariatric bypass, and may have direct skeletal effects [5, 11].

It is likewise known that bariatric surgery patients have increased rates of fractures after their surgery. Nakamura et al. found relative risk for any fracture was increased 2.3-fold and was elevated for a first fracture at the hip, spine, wrist, or humerus as well as first fracture at any other site [12]. Although no studies exists demonstrating increases in maxillofacial fractures after bariatric surgery, it can be presumed that these general decreases in bone mass do not spare the facial skeleton.

In terms of the post gastric bypass effects on bone metabolism and healing, this can be extrapolated from data looking at serum type 1 cross-linked C-terminal telopeptide (CTX), a product of type 1 collagen degradation and thus a marker of bone resorption. Yu et al, found that CTX levels in patients undergoing Roux-en-Y gastric bypass were not only elevated 10 days after surgery, but continued to be elevated at evaluation 1 year post operatively [13]. Other studies have similarly found that bone loss is greatest in the first year but then plateaus or even improves thereafter [14]. Although some bone metabolism alterations may persist beyond a year, the overall effects thereafter appear to be minimal [15].

Introduction

A question that remains unanswered is whether gastric bypass surgery can alter bony healing status post reconstruction or bone grafting. If a bone grafting procedure is performed or if reconstruction occurred prior to gastric bypass or within a year after gastric bypass, are surgical outcomes compromised or success rates diminished?

The following is a case report of failed reconstruction with significant bone loss and resorption in a patient who underwent sleeve gastrectomy gastric bypass surgery 4 months after a mandibular reconstruction procedure. The patient had tumor resection followed by delayed second stage reconstruction allogeneic cadaveric mandible crib packed with autogenous iliac crest bone graft and platelet rich plasma. This was chosen as the reconstructive option after patient refused free fibula flap but desired bony replacement after her ablative surgery which used a reconstruction plate and stock condyle to maintain soft tissue dimensions.

Case Presentation

A 44 y/o African American female, presented to the Temple OMFS clinic referred from her general dentist in December 2012 with chief complaint of progressive left lower jaw swelling. Panorex

at this time showed nearly the entire mandible posterior to tooth #18 resorbed by a pathological lesion (Figure-1).

Figure 1: Presenting Panorex at TUH

Patient reported past medical history of asthma, type 2 diabetes and morbid obesity. Patient reported past surgical history of C-sections in 2001 and 2009, hernia repair 2010, and cholecystectomy 2010, all with no complications. Patient reported mild allergy to morphine with adverse reaction of pruritus. She subsequently had biopsy of the left mandible performed January 2013, which resulted as ameloblastoma. After obtaining further history from the patient, she reported having previous biopsy in South Carolina several years back but then became pregnant, moved, and due to lack of pain did not follow up. This led OMFS to contact the MUSC OMFS program which was able to confirm S.R. was a patient of record of theirs, who was seen 05/28/08 for a left mandibular lesion (Figure-2),

Figure 2: Initial Panorex

failed follow up until 12/16/08 (Figure-3), and then had a biopsy which resulted on 01/06/09 for solid ameloblastoma, conventional type. The patient subsequently never returned for follow up.

Figure 3: Second Panorex, expanding left mandibular lesion

After the returned biopsy and treatment planning visits with the patient, insurance approval for hospitalization, tumor resection, and reconstruction was approved on 03/13/13. The patient had surgery 04/15/13 for resection of left mandibular ameloblastoma, reconstruction with titanium plate and myomucosal flap, and maxillomandibular fixation (MMF). The resection was performed proximal to the left lower canine (tooth #22) including the condyle, coronoid and a portion of the masseter with tumor perforation (clean margin confirmed by frozen intra-operative pathology). A 2.2 mm thickness reconstruction plate attached to a prosthetic condyle was seated in the glenoid fossa using Computed Tomography (CT) Guided Surgery (Figure-4).

Figure 4: Post op Panorex after first surgery

The patient underwent routine follow up and radiographic monitoring with a relatively uncomplicated post-operative course. The final pathology resulted as ameloblastoma follicular type. A small extraoral incision and drainage was performed on 04/23/13 of the left submandibular region with no further complaints by the patient or noted adverse events thereafter. The patient was in maxillomandibular fixation for approximately 6 weeks. Clinical exam and follow up visits revealed stability of the fixation over several months post operatively and plan was decided for final reconstruction.

After discussing options ranging from no further intervention to free fibula flap [16], the patient was adamant that she did not want free fibula flap as a reconstruction option as she did not desire neck dissection or removal of her fibula. The patient agreed to cadaveric mandible crib and anterior iliac crest bone graft packing as final reconstruction. This treatment has proven successful for several decades in multiple case reports. Freeze dried allogeneic bone for use in maxillofacial reconstruction was first described by Marx and Kline [17]. Further studies by Kline showed high success rate over 2 years using cadaveric cribs with autogenous packed bone [18]. Different case reports with follow up ranging from 4 to 20 years showed stability and success using cadaveric mandibular crib and autogenous packing to reconstruct hemi-mandibles including cases with the condyle [19,20,21].

The patient was taken to the OR on 08/26/13 for reconstruction left mandible using cadaveric mandible as a crib and condyle, anterior iliac crest bone graft (AICBG) with platelet rich plasma

(PRP), and maxillomandibular fixation. Post-operative panorex confirmed satisfactory placement of the graft with continuity between graft and native mandible (Figure-5). No infections, wound dehiscence or abnormal healing was observed over subsequent clinic follow up appointments.

Figure 5: Post op Panorex after bone graft reconstruction

After an uneventful post operative course, the patient returned for follow up on 12/17/13, just prior to her bariatric surgery. Imaging via panorex revealed no suspected abnormalities or significant graft resorption (Figure-6).

Figure 6: 4 month post op Panorex with stable bony reconstruction.

The patient had a sleeve gastrectomy performed at outside hospital the following week. The patient next presented for follow up on 02/11/14 at which time panorex demonstrated significant graft resorption (Figure-7). CT maxface was ordered and taken on 03/31/14 with the radiologist read noting "accelerated bone resorption secondary to metabolic derangement or graft failure."

Figure 7: Accelerated bony resorption on Panorex taken 2 months after bariatric surgery

The next follow up on 05/06/14 revealed imaging with continued graft resorption and planning for reconstruction plate and temporomandibular joint (TMJ) prosthesis ensued. The patient underwent final reconstruction on 06/16/14 with reconstruction plate and prosthetic condyle without complication (Figure-8).

Figure 8: Panorex after final reconstruction

Stability of the reconstruction over the next year with the patient returning to normal diet followed. The patient was informed of the recommendation for reconstruction plate with prosthetic condyle to be temporary and not as a final restoration or for typically greater than 2 years. The patient expressed understanding but was content with the result, current level of function, lack of pain, and refused any further surgeries. Likewise to our reconstruction, alloplastic replacement of mandibular condyle for reconstruction after disarticulation for pathology with metallic mandibular condyle against the native condylar disc or a soft tissue interface, as performed by Marx and Cillo was shown to provide long term stability with minimal complications. Their paper provides evidence for this treatment with 132 cases and 3.4 to 18.6 years follow ups proving this treatment as a viable restorative option. In this study, no middle cranial fossa erosions occurred and only 4 plates needed removal (3.0%) [22].

Conclusion

Although the precise reason for the rapid bony resorption remains unknown, the clinical history reveals no infection after the graft placement and no intraoral communication or wound dehiscence. The patient remained in MMF until her bariatric surgery and thus motion and occlusive trauma can be ruled out as causes of failure. Further, her diet after bariatric surgery remained limited for many months likely eliminating this as another source for the rapid resorption.

As elucidated above, the effects of bariatric surgery on bone and calcium homeostasis can be quite pronounced. There has yet to be any studies in the head and neck literature on gastric bypass or bariatric surgery and its effects on bone grafting or reconstruction healing. It is surmised that the patient's bariatric surgery played an integral role in her mandibular reconstruction bone graft failure and resorption. It is hoped that this case report can spur further research on the relationship between bariatric surgery and maxillofacial bone healing. Further analysis on outcomes of bone grafting or reconstructive procedures in bariatric surgery patients could provide guidelines to increase success or delineate timeframes to best avoid failure.

Declarations

Grants

No grants, patent licensing arrangements, consultancies, stock or other equity ownership, donations, advisory board memberships, or payments for conducting or publicizing the study exist. No financial support was received.

Conflicts of Interest

No known or observed conflicts of interest exist to report.

References:

1. American Society for Metabolic and Bariatric Surgery. Estimate of Bariatric Surgery Numbers, 2011-2017. [cited 2018 Nov 10]; Available from: <https://asmbs.org/resources/estimate-of-bariatric-surgery-numbers>.
2. CDC Newsroom. Centers for Disease Control and Prevention. New CDC Data Shows US Adults Still Struggling with Obesity. [cited 2018 Nov 10]; Available from: www.cdc.gov/media/releases/2017/a0831-obesity-data-maps.html.
3. Hage MP, El-Hajj Fuleihan G. Bone and mineral metabolism in patients undergoing roux-en-Y gastric bypass. *Osteoporos Int.* 2014;25(2):423-39.
4. Luger M, Kruschitz R, Winzer E, Schindler K, Grabovac I, Kainberger F, et al. Changes in Bone Mineral Density Following Weight Loss Induced by One-Anastomosis Gastric Bypass in Patients with Vitamin D Supplementation. *Obes Surg.* 2018;28(11):3454-3465.
5. Xanthakos SA. Nutritional Deficiencies in Obesity and After Bariatric Surgery. *Pediatr Clin North Am.* 2009;56(5):1105-21.
6. Ivaska KK, Huovinen V, Soinio M, Hannukainen JC, Saunavaara V, Salminen P, et al. Changes in Bone Metabolism after Bariatric Surgery by Gastric Bypass or Sleeve Gastrectomy. *Bone.* 2017;95:47-54.
7. Lupoli R, Lembo E, Saldalamacchia G, Avola CK, Angrisani L, Capaldo B. Bariatric Surgery and Long-Term Nutritional Issues. *World J Diabetes.* 2017;8(11):464-474.
8. Pournaras DJ, Osborne A, Hawkins SC, Mahon D, Gbatei MA, Bloom SR, et al. The gut hormone response following Roux-en-Y gastric bypass: cross-sectional and prospective study. *Obes Surg.* 2010;20(1):56-60.
9. Wong IP, Driessler F, Khor EC, Shi YC, Hörner B, Nguyen AD, et al. Peptide YY regulates bone remodeling in mice: a link between gut and skeletal biology. *PLoS One.* 2012;7(7):e40038.
10. Valderas JP, Irribarra V, Boza C, de la Cruz R, Liberona Y, Acosta AM, et al. Medical and surgical treatments for obesity have opposite effects on peptide YY and appetite: a prospective study controlled for weight loss. *J Clin Endocrinol Metab.* 2010;95(3):1069-75.

11. Xie D, Cheng H, Hamrick M, Zhong Q, Ding KH, Correa D, et al. Glucose-dependent insulintropic polypeptide receptor knockout mice have altered bone turnover. *Bone*. 2005;37(6):759-69.
12. Nakamura KM, Haglind EG, Clowes JA, Achenbach SJ, Atkinson EJ, Melton LJ, et al. Fracture Risk Following Bariatric Surgery: a Population-Based Study. *Osteoporos Int*. 2014;25(1):151-8.
13. Yu EW, Wewalka M, Ding SA, Simonson DC, Foster K, Holst JJ, et al. Effects of Gastric Bypass and Gastric Banding on Bone Remodeling in Obese Patients With Type 2 Diabetes. *J Clin Endocrinol Metab*. 2016;101(2):714-22.
14. Johnson JM, Maher JW, Samuel I, Heitshusen D, Doherty C, Downs RW. Effects of gastric bypass procedures on bone mineral density, calcium, parathyroid hormone, and vitamin D. *J Gastrointest Surg*. 2005;9(8):1106-10.
15. Vilarrasa N, San José P, García I, Gómez-Vaquero C, Miras PM, de Gordejuela AG, et al. Evaluation of bone mineral density loss in morbidly obese women after gastric bypass: 3-year follow-up. *Obes Surg*. 2011;21(4):465-472.
16. Goh BT, Lee S, Tideman H, Stoelinga PJ. Mandibular Reconstruction in Adults: a Review. *Int J Oral Maxillofac Surg*. 2008;37(7):597-605.
17. Marx RE, Kline SN, Johnson RP, Malinin TI, Matthews JG, Gambill V. The use of freeze dried allogeneic bone in oral and maxillofacial surgery. *J Oral Surg*. 1981;39(4):264-74.
18. Kline SN, Rimer SR. Reconstruction of osseous defects with freeze-dried allogeneic and autogenous bone. Clinical and histologic assessment. *Am J Surg*. 1983;146(4):471-3.
19. Lowlicht RA, Delacure MD, Sasaki CT. Allogeneic (Homo-graft) Reconstruction of the Mandible. *Laryngoscope*. 1990;100(8):837-43.
20. Rochanawutanon S, Suddhasthira T, Pairuchvej V, Vajjaradul Y. Long Term Follow-up of Reconstruction with Allogeneic Mandibular Bone Crib Packed with Autogenous Particulate Cancellous Bone Marrow. *Cell Tissue Bank*. 2002;3(3):183-97.
21. Verweij JP, Bouwman RH, Dicker GJFM, Groot RH, Merkesteyn JPR. Twenty-year follow-up of reconstruction with allogeneic hemimandible and autogenous particulate bone and cancellous marrow. *Eur J Plast Surg*. 2014;37(11):623-626.
22. Marx RE, Cillo JE Jr, Broumand V, Ulloa JJ. Outcome analysis of mandibular condylar replacements in tumor and trauma reconstruction: a prospective analysis of 131 cases with long-term follow-up. *J Oral Maxillofac Surg*. 2008;66(12):2515-23.