Case Report

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Dentistry Section

Mandibular Reconstruction with Iliac Crest Graft Associated with L-PRF and Hyperbaric Oxygen Therapy: A Case Report

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ABSTRACT

Maxillofacial reconstructions with free grafts have become a routine reality for plastic surgeons and maxillofacial surgeons in the last decade. This condition usually occurs after radical treatment of benign or malignant pathologies of the stomatognathic complex, through en bloc resections with a safety margin to reduce the chances of recurrence of the pathology. One of the great challenges faced by surgical teams is no longer just in relation to the technique used for planning, but the predictability and maintenance of the graft performed in the face of systemic changes that can compromise the success of the graft, such as diabetes mellitus. Several aspects have been explored in recent years, such as the use of ozone, synthetic membranes, formation of Leukocyte and Platelet Rich Fibrin (L-PRF) and hyperbaric therapy in the quest to maximize the chances of graft success, reducing the chances of infection and bone resorption mainly through osteoinductive and osteogenic stimuli, which are not characteristics present in a metabolic dysfunction such as diabetes. Another important data for these types of surgery is the bone quality offered by the donor bed, because in maxillofacial reconstructions, a balance in the amount of corticalized bone and medullary bone is important, which leads us to characteristics such as the best donor bed for these surgical reconstructions in the iliac crest region. Here the authors present a case of 64-year old male hypertensive patient with history of (h/o) diabetes mellitus, managed by a mandibular reconstruction surgery with iliac crest graft associated with L-PRF and hyperbaric oxygen therapy after extensive resection of a benign mandibular tumour in a patient with diabetes mellitus.

Keywords: Ilium, Jaw, Leukocyte and platelet rich fibrin, Oxygenation

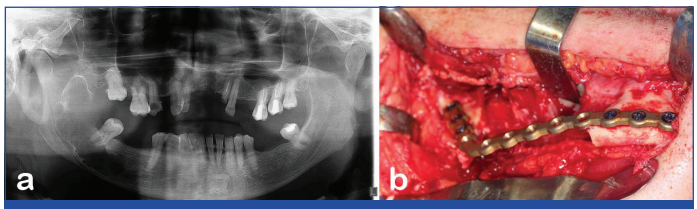
CASE REPORT

A 64-year-old male hypertensive patient with diabetes mellitus, compensated for both co-morbidities, underwent extensive resection surgery, the defect extension was from the region of the right mandibular ramus to the region of the right mandibular body near the mandibular symphysis, with an approximate size of 8 cm in length, due to a mandibular ameloblastoma, causing a large mandibular defect supported by a 2.4 mm reconstruction plate [Table/Fig-1a,b]. The patient was followed up for one year after the resection, with no evidence of tumour recurrence. As the surgical resection was performed one year ago, there is an increase in the risk of fatigue of the osteosynthesis material. Thus, bone reconstruction of the defect was planned. The surgical approach adopted for this case was chosen considering the patient's age, co-morbidities that the patient had and the extent of the bone defect generated by the resection surgery, which was 7.5 cm in this case. The use of free graft from the iliac crest was chosen, associated with adjuvant trans surgical and immediate postsurgical treatments with the use of L-PRF and hyperbaric oxygen therapy, respectively.

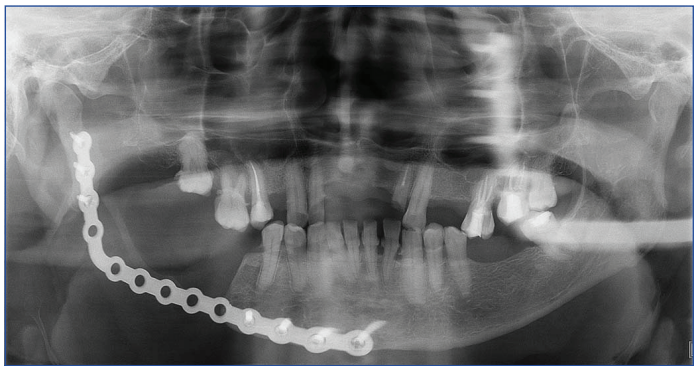
A preoperative control panoramic radiograph was performed, and no evidence of injury was observed [Table/Fig-2]. On clinical examination, the recipient bed showed no changes and showed good healing after the first surgical resection approach [Table/Fig-3]. No previous history of infection or exposure of osteosynthesis material. Patient underwent surgery together with the orthopaedic team that removed the iliac crest graft in the proportions of length, height and width, respectively 8 cm, 4 cm and 5.5 cm [Table/Fig-4].

The iliac crest graft was modelled to fit the mandibular defect using 702 surgical drills, maxicut and reciprocating saw with intense irrigation with 0.9% ice-cold saline. After fixing the graft to the plate with 8 mm bicortically locked screws, 30 mL of blood were collected and placed in 6 mL glass tubes and subjected to centrifugation at 2500 rounds per minute (rpm) for 12 min to make the L-PRF [Table/Fig-5,6].

The membrane formed was placed over the graft so that it covered almost the entire superior, buccal and lingual extension of the graft.



[Table/Fig-1]: (a) Initial X-ray of the ameloblastoma (b) Transoperatory image after resection of the tumor.

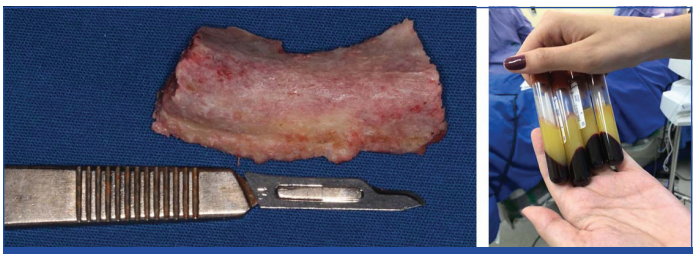


[Table/Fig-2]: Panoramic radiograph showing mandibular bone discontinuity after 12 months of tumour resection.

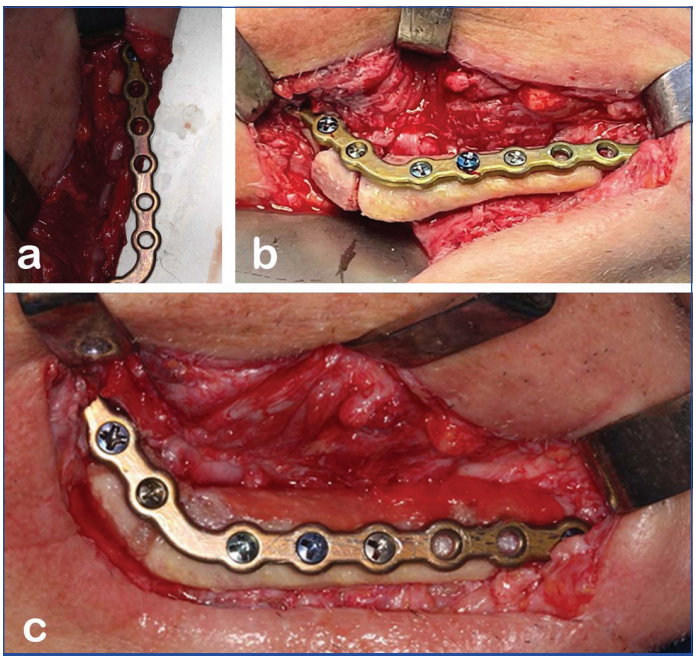
The planes were carefully sutured with 5-0 monocryl thread and the skin was sutured with 5-0 nylon thread. An X-ray taken immediately, showed adequate placement and volume of the autogenous graft [Table/Fig-7].

After 24 hours of the graft surgical procedure performed, the patient underwent uninterrupted sessions of hyperbaric oxygen therapy with 1.5 isobaric phases and duration of 90 minutes each session at speed 006 to 012 KJF/cm^2/minute for 30 days.

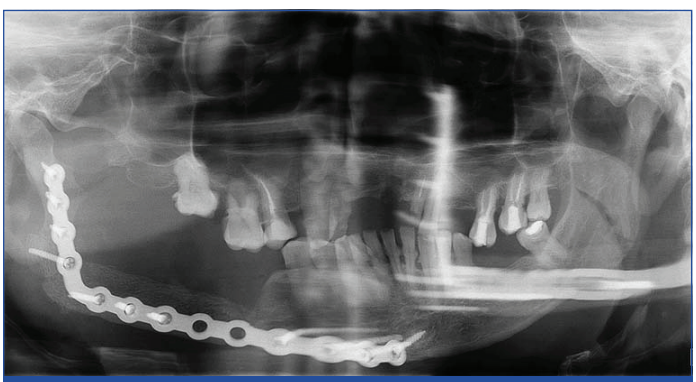
[Table/Fig-3]: Extraoral preoperative image of the patient.



[Table/Fig-4]: Iliac crest graft removed for mandibular reconstruction.
[Table/Fig-5]: Leukocyte and Platelet Rich Fibrin (L-PRF) membrane made with autologous blood to be used in the iliac crest. (Images from left to right)

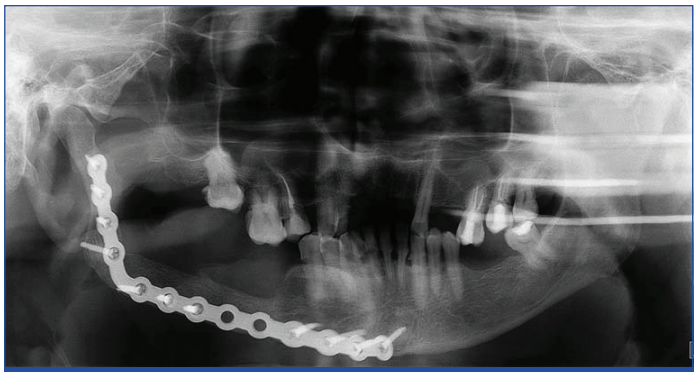


[Table/Fig-6]: Images from transoperatory reconstruction surgery. a) Exposition of the reconstructive plate and bone segments; b) Graft positioned and fixed on the titanium plate; c) L-PRF membrane in position.



[Table/Fig-7]: X-ray immediately after mandibular reconstruction.

After performing the hyperbaric therapy, the patient was followed up as an outpatient for another eighteen months, showing surgical success with a 12-month panoramic radiograph showing low graft resorption and adequate anatomical contour [Table/Fig-8].



[Table/Fig-8]: 12-month postoperative control radiograph, showing adequate maintenance of the bone graft.

DISCUSSION

The mandible is a bone that forms the skeletal structure of the lower third of the face, receiving insertions from the muscles of mastication and plays an important role in speech, mastication and aesthetics [1,2]. The objective of mandibular reconstruction is mainly to restore continuity, bone contour and masticatory functional restoration. Bone grafts are frequently used in oral and maxillofacial reconstructive surgery. The choice of donor site largely depends on the amount of bone needed. When relatively large defects need to be repaired, iliac crest grafts are often used [1,3].

The surgical approach of mandibular bone reconstruction has been gaining more and more space in the routine of surgeons in general, and together with this greater demand, there have been new therapeutic acquisitions that help and maximize the success of the procedure as reported in the case. Harvested bone is primarily cancellous bone and is an excellent substrate for implantation due to its substantial height and thickness. Compared to other donor sites such as the tibia, fibula and skullcap, the iliac crest may offer a unique advantage over other donor sites in terms of bone quality and quantity [3,4].

In order to accelerate the physiological healing phenomenon, surgical additives have been studied, such as L-PRF, an autologous biomaterial used for grafts, which incorporates leukocytes, platelets, cytokines into a matrix of fibrin. leukocytes and growth factors, collected from a simple blood sample, when associated with bone grafts accelerates the bone regeneration process [5].

Another adjuvant therapy that has been explored alone or in combination is Hyperbaric Oxygen (HBO) therapy in which 100% oxygen is provided to a patient with above-normal atmospheric pressure at sea level, leading to a subsequent increase in oxygen tension, promote tissue regeneration through multiple mechanisms, including changes in vascular reactivity, angiogenesis, free radical production, cytokine synthesis, and modulation of the immune response. HBO therapy has already been successfully used to improve bone healing because it also stimulates angiogenesis and osteogenesis [6,7].

The iliac bone can be contoured to fit most segmental mandibular defects. Opening osteotomies performed in the iliac bone allow the reliable reconstruction of mandibular defects [8]. Considering such characteristics, the choice of iliac crest graft proved to be adequate and satisfactory in the operated case. Regarding the adjuvant treatments that allow an increase in the predictability of the reconstructive surgery presented in this article, it was based on the use of L-PRF and hyperbaric oxygen therapy.

Growth factors combined with fibrin matrix have been studied to accelerate the repair of bone tissue and allow the proliferation of

fibroblasts, favouring tissue vascularization, collagen formation, mitosis of mesenchymal stem cells and endothelial cells, as well as osteoblasts, playing key roles in the rate and extent of bone neoformation [5].

The literature has shown that the fibrin matrix is an excellent support for mesenchymal stem cells transplanted with the objective of regenerating bone defects, since bone marrow mesenchymal stem cells contribute to the regeneration of all types of bone cells and many other types of tissue [5,9]. Hyperbaric oxygenation as a result of a state of hyperoxygenation in all tissues of the body that stimulates collagen synthesis and accelerates the process of angiogenesis and osteogenesis [7]. While hyperbaric oxygenation therapy leads to graft incorporation by increasing vascularization and decreasing resorption potential, it also stimulates leukocyte activity and bactericidal and bacteriostatic effects [10].

The data shown in the literature regarding L-PRF and hyperbaric oxygen therapy show synergistic effect on bone regeneration and applicability in large grafts, being adopted as adjuvants to the surgical procedure, improving surgical success rates, as we can relate to the operated case in which both therapeutic resources were used [11].

CONCLUSION(S)

The condition of rehabilitating patients with extensive bone defects will always be a challenge for the surgical team, however, with the various combinations of adjuvant techniques to be adopted in the trans-surgical and immediate postoperative period, this challenge has become more predictable and prone to success. In this case, the concomitant action of adjuvant therapies and applied with bone reconstructions in the oral maxillofacial surgery area minimised imitations such as a high rate of free graft resorption and combination of therapies led to successful graft uptake. It is also essential to mention that nowadays the success of free grafts is also closely linked to the adequate indication and conditions of the recipient. Oxygen therapy associated with L-PRF has shown unique results with regard to two of the main adversities seen in free grafts, which are the volumetric maintenance of the graft and the integration with the stumps of the recipient bed, when they are available.

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