Correction of Bone Deficiency Caused by Residual Scissor With Heterological and Fibrin Rich In Platelets and Leucocytes (L-Prf)

Nathara Morais Ferreira¹, Diego Luís Rocha¹, Rodrigo Soares de Andrade²*, Adriana Boeri Freire Tamberini¹,3, Alessandro A Costa Pereira⁴, Ruy Cesar Camargo Abdo Filho¹,3, Leandro Carnevalli Franco de Carvalho¹

¹ Dentistry Department, Dental School, University of José Rosário Vellano, Minas Gerais, Brazil
² Department of Oral Diagnosis, Dental School, University of Campinas, Piracicaba, São Paulo, Brazil
³ Center for Rehabilitation of Craniofacial Anomalies, Dental School, University of José Rosário Vellano
⁴ Department of Oral Pathology, Dental School, Federal University of Alfenas, Alfenas, Minas Gerais, Brazil

*Correspondence author: Rodrigo Soares de Andrade, Oral Pathology, FOP-UNICAMP, Av. Limeira, 901 - Areião, Piracicaba - SP, 13414-018 Piracicaba – São Paulo – Brazil, Tel : + 55-19-999665488; E-mail: rodrigosoares002@hotmail.com

Abstract

The residual cyst is an inflammatory odontogenic lesion caused by insufficient or insufficient curettage. Radiographically presents a radiolucent image, circumscribed by radiopaque halo located in the region of a tooth not previously removed. The enucleation of the lesion is the most indicated treatment and, for the correction of the bone defect caused by the removal of the cyst, the technique with a heterologous bone graft of bovine origin can be indicated. In order to improve bone regeneration, Platelet and Leukocyte Rich Fibrin (L-PRF) was used because it is a biomaterial rich in growth factors that aid in tissue repair. In the present study, this biomaterial was associated with the heterologous graft, favoring the induction of regeneration and remodeling of the bone tissue. The objective of this study was to report a case of bone defect correction, after the enucleation of a residual cyst, by the use of heterologous graft and fibrin rich in platelets and leukocytes, demonstrating clinically and scientifically its efficacy.

Keywords: Residual cyst; Heterologous graft; Fibrin; Platelets; Leukocytes

Introduction

Pulp tissue can be necrotic due to several factors, such as dental trauma or caries disease. The epithelial remains of the periodontal ligament when they are stimulated by the necrosis of the pulp tissue can give rise to the radicular cyst. When the root cyst remains after the loss of the affected tooth it is called the residual cyst[1].

The residual cyst is one that remains intraosseous even after the extraction of a tooth or a residual root associated with a periapical lesion. It usually has no symptoms, affects more people of the male gender (53.4%) and has a higher incidence in the posterior maxilla region[2].

The residual cyst is part of the inflammatory ontogenic cysts group and is considered a destructive bone lesion affecting the jaws. It has benign biological characteristics, slow growth and in certain cases, as long as it is not diagnosed and treated in time, can get considerable size[3].

There is a large number of cystic lesions in the mandible and maxilla that present a series of similar clinical and radiographic features. In view of this, the diagnosis of odontogenic cysts should be made through a meticulous

Published Date: October 24, 2018


Copy Rights: © 2018 de Andrade, R.S. All rights are reserved of this open access article distributed under the terms of Creative Commons Attribution 4.0 International License.
evaluation of the clinical, radiographic and histopathological aspects found. This lesion presents clinical and histological findings similar to those of a root cyst. Radiographically it is seen as a circular or oval radiolucent image, of variable size, present in sites that have undergone previous dental extractions.[4]

Usually the treatment of choice for the residual cyst is surgical enucleation and, frequently, bone neoformation is observed in the region. When this bone neoformation does not occur, other artifacts are used for the recovery of bone linearity, such as the use of bone grafts[5].

Although autologous bone graft (from the patient itself) is considered “Golden Standard” for the correction of bone defects due to its biocompatibility and osteogenic properties, this type of graft presents disadvantages such as the creation of additional surgical bed, pain and quantity limitation of material. Therefore, heterologous bone grafts (material obtained from different species) seems to be an appropriate alternative to replace the autogenous graft in the treatment of bone defects. This biomaterial facilitates the deposition of new bone-forming cells and the formation of new bone matrix through osteoconduction[6].

In order to improve bone regeneration, Choukron et al. 2006[7], developed the platelet concentrate called Platelet and Leukocyte Rich Fibrin (L-PRF), which can be used simultaneously to the bone graft.

Fibrin-rich plasma is a derivative of platelet-rich plasma developed to accelerate the repair of bone and soft tissues. It consists of a material rich in autologous platelets, growth factors with an immunological and platelet concentrate. The clinical use of L-PRF has been widely researched since it is a material that promotes osteoconductive action, stimulating the autologous cells of the patient as a response to regeneration[8].

This paper aims to report a case of correction of bone defect, after enucleation of a residual cyst, by the use of a heterologous graft associated with the use of fibrin rich in platelets and leukocytes.

Case Report

A 43-year-old male patient, smoker, with no systemic alterations, edentulous, sought the Unifenas Dentistry Clinic, Alfenas-MG, to make upper and lower total dentures. As a protocol of the University, a routine panoramic radiograph was performed and a circumscribed radiolucent image of cystic aspect was observed in the left maxilla region, where the hypotheses of a residual cyst and odontogenic keratocyst were raised (Figure 1).

The patient was referred to the Surgery Clinic of the Dentistry Course - UNIFENAS to remove the lesion and subsequently confirmed the diagnostic hypothesis by histopathological examination.

The enucleation of the lesion followed by a heterologous graft associated with platelet and leukocyte-rich fibrin (L-PRF), obtained through a patient’s own blood sample, was proposed as a treatment for correction of the bone defect resulting from the lesion. originates a material rich in autologous platelets, growth inducing factors and that present an immunological and platelet concentrate, favoring the osteoconduction and intensifying the regenerative response of cells. After the surgery, a radiographic follow-up was performed by means of panoramic radiographs to follow the local response aiming at the correction of the bone defect.

The cyst enucleation surgery was performed on March 16, 2018. At the first moment the patient’s blood was collected and four samples of 10 mL of peripheral venous blood were collected, following all the biosafety rules established by the Institution and by the (Centrifuge Monserrat Routine Laboratory 12 x 15ml PRP E PRF), for 8 minutes at about 1800 rpm to obtain the fibrin-rich plasma at the top of the whole and the precipitate of red blood cells at the bottom.

The access of the bone defect was performed by a linear incision through the edentulous border for better visualization (Figure 2). The presence of a purulent collection of whitish-yellow color was observed in the interior.

Macroscopic examination revealed a soft tissue fragment with firm consistency, irregular surface, dark brown color, with dimensions of 16.0 x 17.0 x 5.0 mm.

By microscopic examination, a fragment of fibrous, dense, capsular connective tissue with little cellularity and with a discrete mononuclear inflammatory infiltrate was observed, with a small area covered with non-keratinized stratified squamous epithelium, as well as inactive odontogenic epithelial remains. apical root cyst (Figure 3), resulting in the association of clinical and histopathological diagnosis with the final diagnosis of residual cyst.

Figure 1: Well circumscribed cystic image located in left hemi-maxilla.
Figure 3: Fragment of fibrous connective tissue, dense, capsular, not very cellular and with a discrete mononuclear inflammatory infiltrate, with a small area covered with non-keratinized stratified squamous epithelium, in addition to inactive odontogenic epithelium, with a histopathological diagnosis as an apical root cyst.

In the second part of the surgery, the graft was started for correction of the bone defect. Four tubes with the cell concentrate were used. One at a time, the rich fibrins platelets and leukocytes formed in the tubes were removed separating them from the red part. The fibrin was compressed, separating the white blood cells, forming a membrane with a higher concentration of fibrin.

The graft used was the Lumina-Bone® brand, which is a product obtained from the natural raw material of bovine bone structure, where in the surgical act it was crushed and mixed together with the leukocyte-rich plasma that was separated from the fibrin-rich membrane and platelets, in addition, two of the four membranes were cut into small pieces and combined next to the mixture. It was taken to the defect site, which was completely filled by the graft, stabilizing it. In the opening of the defect the two remaining membranes were placed in order to create a barrier preventing the invasion of connective tissue. The surgery was completed with suture at continuous points (Figure 4) and the patient received the postoperative instructions and medication, being amoxicillin 500mg every 8 hours for 7 days.

Figure 4: A - Fibrinous membrane embedded in platelet-rich plasma and leukocytes. B-Injection of heterologous graft crushed at the site of the maxillary bone defect after enucleation surgery. C - Insertion of fibrinous membrane embedded in platelet-rich plasma and leukocytes stabilizing the previously placed bone graft. D - Closure of the surgical shop with continuous sutures.

The patient remained in observation for 5 months, with total resolution of the lesion and osteoconduction considered as success (Figure 5).

Figure 5: Panoramic radiography after 5 months of preserva- tion, evidencing total resolution of the lesion, confirming the success of the established treatment.

Discussion

The radicular cyst is inserted within the group of odontogenic cysts of inflammatory origin, being considered the most common pathological lesion to affect the jaws. The most commonly used form of treatment for the root cyst is surgical enucleation. However, when the enucleation of this cyst is done erroneously or the alveolar curettage of this lesion associated with the extraction of a tooth is not performed, there is scope for a possible development of the residual radicular cyst[2].

In the clinical case reported here, the patient presented a lesion in the left maxillary region, which was enucleated, being the most appropriate treatment for this type of lesion, according to Sridevi K et al. (2014)[9].

A heterologous graft associated with fibrin rich in platelets and leukocytes was used for subsequent rehabilitation of the patient to facilitate osteoconduction and healing. The use of procedures for bone gain and subsequent rehabilitation with dental implants through bone graft is widely used[10].

Historically, the first bone graft was performed in 1880 by a Scottish surgeon who successfully reconstructed the infected humerus of a four-year-old boy with a graft obtained from the tibia of another boy with rickets[11].

More recently, fresh frozen allogeneic bone grafting has been successful for 20 years in orthopedic surgeries for reconstructive treatment of limbs after resection of tumors; for filling of cavities in the treatment of bone cysts; for fracture reduction and a variety of other conditions. During this period, the use of the heterologous graft has expanded from the field of orthopedics to dentistry and has been used for reconstruction of sites affected by ablation of mandibular tumors and correction of mandibular contours for implant installation[12].

Chaushu et al. (2009)[13], evaluated the success rate of dental implants placed simultaneously with lifting of the floor of the maxillary sinus with heterologous block graft. They concluded that the heterologous graft has potential as a graft material in procedures for this purpose and that dental implants installed in
heterologous bone should be considered as an alternative viable alternative to the autogenous bone.

For Nissan et al. (2009)[14], besides the comfort to the patient in not forming a new surgical shop, is shown with guaranteed effectiveness for such a posterior result. However, doubts remain about the biological behavior of heterologous material in the short, medium and long term after its implantation.

Winslow et al. (2006)[15] reported that lysosomal acid resistant phosphatase (TRAP) positive cells appear from the fifth day after the graft procedure which is a precursor of osteopontin (OPG). OPG acts as a ligand for receptor nuclear factor-kβ activator (RANKL), since it blocks the RANK / RANKL interaction, inhibiting the terminal stage of osteoclastic differentiation and, thus, resulting in decreased bone resorption. The OPG is statistically higher in the autogenous group when compared to the values of the heterologous group. Also in this study, the analysis of the radiographic density did not show statistical differences between the heterologous and autogenous groups, although in the latter there was a trend of higher Hounsfield values (quantitative scale describing radiodensity).

Bone formation is driven by cells surviving the graft and by the ability of the bone matrix to induce differentiation of osteoprogenitor cells in the recipient area. Although the graft and bed have individual contributions to the process, it is the sum of these interactions that determines the success and failure of the graft[16,17].

Blood supply and angiogenesis play a key role in the formation of new bones and in the supply for the viability of the graft. In this study, a fibrin rich in platelets and leukocytes was added to the heterologous graft, increasing the conditions of the clot formation medium and enriching the biological barrier with defensive cells through the insertion of leukocytes. In fact, a blood clot contains a large amount of growth factors (GFs) in their naturally occurring and biologically determined relationship and are successful in healing acute wounds[18].

These GFs include vascular endothelial growth factor (VEGF), platelet-derived growth factor (PDGF), epidermal growth factor (EGF), insulin-like growth factor-I (IGF-1), basic growth factor (bFGF), growth factor-b1 (TGF-b1) and transforming growth factor α (TGF-α)[19,20].

These molecules have the ability to interact with cells, such as endothelial cells from osteoblasts and stem cells in subcutaneous tissues. They can activate events of intracellular signaling mediating cell proliferation, migration, survival and production of extracellular matrix proteins after binding to their cellular receptors[21].

Thus, the association of platelet-rich plasma and leukocytes to the heterologous graft, in addition to a greater stability at the site of the bone defect, is an advantageous biological association, resulting in successful treatment[15,17,22,23].

Conclusion

The use of a heterologous graft in post-extraction cavities, bone defects or avulsions is recommended in order to maintain adequate bone volume at that site.

The membrane formed by plasma rich in platelets and leukocytes induces blood clot formation favoring healing, neovascularization, tissue regeneration and when associated with the heterologous graft favors the early rehabilitation of the patient.

Conflicts of Interest: This work does not have any conflict of interest, disclosure or financial support information, including donations. All authors have contributed significantly to the development of all the stages of this manuscript.

References


