Case Report

Journal of Dental and Maxillofacial Surgery

Closure of an Oroantral Communication Using Leucocyte-Platelet Rich Fibrin: A Novel Technique Using Regenerative Medicine

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Received: January 07, 2019; Accepted: January 20, 2019; Published: January 26, 2019

Abstract

Oroantral communication (OAC) is a common complication following extraction of maxillary posterior teeth because of the close anatomic proximity of the roots to the maxillary sinus. The most frequent methods described in the literature to close an oroantral communication involve buccal or palatal rotational advancement flap surgery or use of the buccal fat pad. These surgical procedures require advanced surgical skill and are associated with donor site morbidity, such as avascular flap necrosis that can lead to soft tissue graft failure to close the OAC, infection and extreme postoperative patient discomfort that affects patient quality of life. This paper describes a novel technique using leucocyte platelet-rich fibrin matrix obtained from the patient's own venous blood that leads to predictable soft tissue regeneration and closure of the OAC. This regenerative medicine procedure is clinician friendly, less traumatic compared to traditional methods of OAC closure with minimal postoperative recovery for the patient.

Keywords: Regenerative medicine, Leucocyte-platelet rich fibrin, Oroantral communication (OAC), Maxillary sinus

Introduction

Oroantral communication (OAC) is an iatrogenic complication of the hard and soft tissues of the maxilla due to extraction of the maxillary posterior teeth (premolars and molars) [1-4]. Although the incidence is relatively low (5%) [4,5], such iatrogenic complication occur because of the proximity of the roots of the posterior teeth to the sinus floor and the thinness of the sinus floor [1,2,5]. However, this complication can also occur from implant surgery, enucleation of cyst and tumors from the posterior maxilla, orthognathic surgery, osteomyelitis, trauma, and pathologic entities [1-4].

Small oroantral communications that are 1 to 2 mm in diameter have the potential to heal spontaneously

due to formation of a blood clot and secondary healing if no infection is present [1-3,6,7]. However, oroantral communications greater than 3 mm in diameter may not heal spontaneously and develop into an oroantral fistula (OAF) [2,3,8-12]. With larger sized OACs greater than 3 mm in diameter spontaneous closure persist and surgical closure of the OAC is indicated and numerous techniques have been developed [1-15]. The most frequently reported technique in the literature involves suturing the buccal and palatal gingiva directly over the OAC to obtain primary closure. Attempts at primary closure directly over the OAC have resulted in a relatively large number of failures due to insufficient soft tissue [7-9]. Therefore, mucosal closure using a buccal mucoperiosteal flap or a palatal rotational flap should be considered, especially for larger OACs [9-11]. Use of the buccal fat pad harvested for closure of

OACs is also another treatment option for the surgeon, especially when use of a buccal or palatal flap has failed [12-15]. The purpose of this publication is to describe a novel technique using regenerative medicine to close an oroantral communication with a leucocyte platelet-rich fibrin matrix clot obtained from autologous platelet concentrate of the patient.

Regenerative medicine has emerged as a novel strategy utilizing bioactive modifiers such as platelet-rich plasma (PRP) and leucocyte platelet-rich fibrin (L-PRF) in the management of oral and maxillofacial soft and hard tissue wounds [16]. Leucocyte platelet rich fibrin (L-PRF) is a second-generation autologous platelet concentrate prepared without the use of any exogenous components such as bovine thrombin and anticoagulant required in preparation of platelet-rich plasma (PRP) [17]. Introduced by Choukroun et al, L-PRF contains 7 times more growth factors than PRP and are released at a slower rate throughout the wound healing process [18-20]. Within the platelets are fibrin, fibronectin and vitronectin that are secreted and act as adhesion molecules for cell migration. Growth factors that enhance the production of fibroblasts, osteoblasts, the extracellular matrix, stem cell differentiation and the inflammatory response are the following: platelet derived growth factor bb (PDGF-bb), transforming growth factor-b1 (TGF-b1), insulin-like growth factor-1 (IGF-1), vascular endothelial growth factor (VEGF), fibroblast growth factor (FGF), epidermal growth factor (EGF) and bone morphogenetic protein (BMP). Leukocyte cytokines discovered in the matrix include interleukins-1b, 4 and 6 (IL-1b, 4 and 6) and tumor necrosis factor-alpha (TNF-a). All the growth factors and stem cells contained within the L-PRF matrix have been shown to stimulate soft and hard tissue wound healing [16-22].

L-PRF Technique

All patients that presented to the office for extraction of maxillary posterior teeth were informed of the risk of oroantral communication and the method described below to close the OAC. Once the diagnosis of OAC was made, to produce two L-PRF matrix clots (Figure 1a and Figure 1b) blood was collected from the upper extremity of the patient using conventional phlebotomy technique into two 9- ml blood collection tubes without anticoagulant. The blood samples are placed into the Intraspın centrifuge (BioHorizons Intraspın, Birmingham, AL) and centrifuged for 12 minutes at 3,700 rpm. About 4.5 to 5 ml of L-PRF is obtained per 9 ml tube. To repair the OAC, gingival full-thickness crestal, anterior and posterior vertical releasing incisions on the buccal surface of the maxilla are made

with a #15 scalpel and raised to expose the buccal and palatal cortices of the posterior maxilla with a #9 periosteal elevator (Figure 2a). The tooth extraction site is debrided and prepared to receive one of the L-PRF matrix clots that would be placed directly into the OAC extraction site. The second L-PRF matrix clot is placed directly over the extraction site (Figure 2b). The buccal and palatal ends of the L-PRF matrix clot are adapted to the maxilla for passive, tension-free closure. The soft tissue flaps are reapproximated and closed using resorbable sutures (Figure 3a and Figure 3b). Postoperative care consists of augmentin 750 mg twice per day for seven days and rinsing with chlorhexidine gluconate 0.12% twice per day. Seven days after surgery the OAC is repaired as granulation tissue is observed in the extraction site (Figure 3c). At 4 weeks post-closure of the OAC, what is consistently observed is complete closure of the OAC due to regeneration of the gingival soft tissues (Figure 3d).

Discussion

Wound healing is a complex process mediated by different signaling molecules and growth factors at the point of care [16]. Growth factors in autologous platelets play a critical role in the facilitation of wound healing [22-25]. The effectiveness in enhanced wound healing is due to their ability to continually release various growth factors throughout the course of wound healing at various times [16,18,21-25]. Use of the patient's own autologous platelet concentrate that contains many of the growth factors involved in tissue wound healing is an innovative method to facilitate the human body to regenerate tissue.

Studies by Dohan et al showed that the observed clinical effects of wound healing were due to the release of growth factors and cytokines during L-PRF production during the centrifugation process as platelets were degranulated [26]. L-PRF has been shown to stimulate wound healing at the site of tissue injury by the recruitment of cells, such as osteoblasts, endothelial cells, chondrocytes and fibroblasts [22-25]. These specialized cells are involved in wound healing and angiogenesis. As the fibrin matrix is slow to dissolve, it has been demonstrated that by the seventh day of wound healing, L-PRF releases the largest amount of PDGF-AB that is involved in angiogenesis and neocollagenesis. By day 14, enormous quantities of TGF-beta 1 are expressed [19]. Transforming growth factor beta-1 has been shown to facilitate the growth of epithelial cells and endothelial cells. L-PRF also contain substantial amounts of VEGF that enhances epithelial healing, tissue vascularization and soft tissue regeneration [18,27].

In the published medical and dental literature, there is a paucity of reports of using autologous platelet concentrates in the repair of OACs. In a series of 20 patients, Gulsen et al used six PRF matrix clots to close each OAC that was greater than 3 mm in diameter [27]. Compared to the technique described by Gulsen et al where oroantral communications involving molar teeth are always greater than 3 mm, our technique of closing an OAC requires only two PRF matrix clots to regenerate soft tissue and successfully close the OAC in the posterior maxilla.

Figure 1a: Two L-PRF matrix clots removed from the blood collection tube.

Figure 1b: Clinical photograph of L-PRF matrix excised from the platelet poor fraction of the PRF clot and ready to be placed into the point of care.

Figure 2a: Clinical photograph of large oroantral communication after extraction of left maxillary molar tooth.

Figure 2b: Clinical photograph of L-PRF matrix placed over the extraction site.

Use of this novel technique is user friendly for the clinician confronted with the complication of OAC of the posterior maxilla. It does not require advanced surgical skill and experience with harvesting and rotating soft tissue flaps in the oral cavity as with other reported techniques. As regenerative medicine is now at the forefront of medicine and dentistry, there are many food and drug administration (FDA) approved centrifuges for fabricating a PRF matrix that has many other applications in not only regenerative medicine, but aesthetic medicine as well. Based on the manufacturer of the L-PRF centrifuge, a standard

protocol is followed for preparation of the L-PRF matrix clot that contains the growth factors, leucocytes and platelets. The armamentarium usually consists of a centrifuge, blood collection kits with a butterfly needle and 9-ml phlebotomy collection tubes that do not contain anticoagulant.

Figure 3a: Clinical photograph of different patient from figure 2 that reveals large oroantral communication after extraction of left maxillary molar tooth.

Figure 3c: Seven days post-surgery. Closure of the OAC is observed due to regeneration of gingival tissues from growth factors contained in the L-PRF matrix.

Figure 3d: 4-weeks post-OAC closure. Note complete regeneration of gingival tissues.

Figure 3b: L-PRF matrix placed over the tooth extraction site and gingival tissues closed with resorbable suture. Note that primary soft tissue closure is not needed when using a PRF matrix.

Additional advantages of this technique are that the centrifuge is inexpensive and requires minimal training for the clinician and their support staff. The procedure can be completed under local anesthesia, or conscious sedation in the office. For the patient, there is minimal postoperative

pain and bleeding compared to other surgical procedures used to close an OAC.

Conclusion

The goal of closing an oroantral communications is separation of the oral cavity from the maxillary sinus and to prevent infection of the maxillary sinus. Regenerative medicine that uses the patient's own autologous growth factors in the L-PRF matrix is a novel alternative strategy that should be considered when the surgeon is confronted with having to close an OAC instead of harvesting a soft tissue rotational flap from the cheek or palate of the maxilla.

Conflict of Interest

The author claims to have no financial interest that is commercially related to the products mentioned in this manuscript.

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