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Review

L-PRF as an Alternative for Treating Oroantral Communications: An Integrative Review

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Abstract: Oroantral communication is defined as a direct access between the sinus cavity and the oral cavity. This condition is often accidentally caused during the dental extraction of a tooth whose roots are closely associated with the floor of the maxillary sinus, in addition to oral pathologies and even traumas. The technique of using the L-PRF membrane associated with flaps is widely used for extensive communications and has several advantages. The present study aims to analyze the efficacy of L-PRF in the treatment of existing oroantral communications in the most current literature. An integrative literature review was conducted to list and analyze the efficacy of L-PRF in tissue healing when obtaining the closure of oroantral communications. Scientific articles from 2014 to 2023, published in full in Portuguese and English, were selected and excluded were literature reviews and systematic reviews, articles in languages other than Portuguese and English, repeated articles in the databases, and articles that deviated from the theme proposed in the guiding question chosen. The data search was conducted in Google Scholar, LILACS, and PubMed, through the combination, using the Boolean operator "AND," of the descriptors in English: "Oroantral Communication," "L-PRF," "Maxillary Sinus." A total of 205 articles were found, but only 9 satisfactorily met the listed criteria. After a careful analysis, it was observed that the authors suggest that the use of the L-PRF membrane insertion technique for tissue healing involved in oroantral communication associated with sutures or flaps for its closure is feasible, effective, and widely spread in modern Dentistry.

Keywords: Oroantral Fistula; Platelet-Rich Fibrin; Maxillary Sinus.

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1. Introduction

The maxillary sinuses are anatomical structures bilaterally present in the maxillary bones and are known as the largest paranasal sinuses. They contain air and communicate with the nasal fossa through an opening called the ostium [1]. Oroantral communication is currently defined as the direct access between the oral cavity and the maxillary sinus and is usually caused during the extraction of upper molars due to their roots being in close contact with the floor of the maxillary sinus. When this access is lined by epithelial tissue, the communication is then called a fistula [2]. The diagnosis of this complication must be made through clinical and radiographic procedures. Initially, attention should be paid to the patient's complaints about the escape of food and liquids from the oral cavity to the maxillary sinus and, consequently, to the nasal cavity, as well as epistaxis, exacerbated pain within and around the affected sinus region, and changes in voice resonance [3].

To confirm the diagnosis, it should be suggested to the patient to undergo imaging exams - Panoramic Radiography, Waters' View, or Computed Tomography (CT), the latter being considered the gold standard imaging study for further examination. It is worth mentioning that the Valsalva Maneuver, formerly widely used to confirm

this type of diagnosis, is no longer recommended today, as it can rupture the sinus membrane if it has not been ruptured previously [4, 5]. There is no established consensus regarding the treatment of oroantral communication. There are surgical and non-surgical techniques, as well as adjuvant treatments, and it is necessary to consider multiple factors for treatment indication, such as the size of the communication, its location, the time of diagnosis, the amount and condition of tissue available for repair, the potential placement of dental implants in the future, and whether there is an infection present or not [6, 7].

Closing these communications as soon as possible is of utmost importance to prevent food or salivary contamination, which can cause a bacterial infection, impair healing, and lead to maxillary sinusitis. The use of flaps for local closure and sealing of bone openings with platelet concentrates to improve tissue healing is currently one of the most used methods by oral and maxillofacial surgeons to resolve this condition [5, 8]. At present, in various areas of Dentistry, the use of platelet aggregates to improve the healing of oral tissues is relevant, due to the presence of important cells that act in the inflammatory process and cause effective healing, including accelerating this process [9].

Leukocyte- and Platelet-Rich Fibrin (L-PRF) is extracted from the patient's own blood minutes before the dental procedure through a simple technique, without biochemical manipulation and without the use of anticoagulants. Used for various purposes in Dentistry, such as accelerating the tissue repair process and reducing postoperative discomfort, the L-PRF membrane is obtained from a preoperative centrifugation process. It should also be noted that it is considered the concentrate most similar to the natural clot due to its autogenous procurement [10, 11]. In this context, the aim of this integrative review was to analyze the efficacy of L-PRF in the treatment of existing oroantral communications in the most current literature.

2. Methodology

An integrative literature review was conducted aiming to list and analyze the efficacy of L-PRF in tissue healing while attempting to achieve closure of oroantral communications. For this purpose, the following guiding question was used: "Is L-PRF effective in closing oroantral communications?". The search for articles was carried out in the databases Google Scholar, Latin American and Caribbean Literature on Health Sciences (LILACS), and U.S. National Institutes of Health's National Library of Medicine (PubMed), using the Boolean operator "AND" to combine the descriptors in English: "Oroantral Communication", "L-PRF", "Maxillary Sinus".

Scientific articles published in full, in Portuguese and English, from 2014 to 2023 were included. Excluded were literature reviews and systematic reviews, articles in languages other than Portuguese and English, duplicate articles in the databases, and articles that deviated from the theme proposed in the chosen guiding question. Data collection was carried out by a single researcher in April 2023. After selecting the articles in the databases, eligibility criteria were applied, separated by phases. First phase: title analysis; Second phase: reading of abstracts; Third phase: full reading; Fourth phase: final selection of articles.

The information from the selected articles was organized into a flowchart and tables, and the conclusions found were organized into blocks/topics of information, for a better understanding of the collected data. This study adhered to the ethical aspects of research, being faithful to the authorship of the ideas, concepts, and definitions present in the works that were part of this review. As this was an integrative review article, there was no need to submit this study to the Research Ethics Committee.

3. Results

A total of 205 articles were found, with 194 in the Google Scholar database, 9 in PubMed, and 2 in LILACS. Taking into account the inclusion and exclusion criteria, 9

articles were selected. The flowchart shows the phases of the data search, the combination of descriptors, the number of works found, and those selected for the study (Figure 1). The combination of descriptors "Oroantral Communication" AND "L-PRF" AND "Maxillary Sinus", in both Portuguese and English, in the Google Scholar database, yielded the most results for composing this review (94%) (Table 1).

Figure 1: Flowchart for Article Selection.

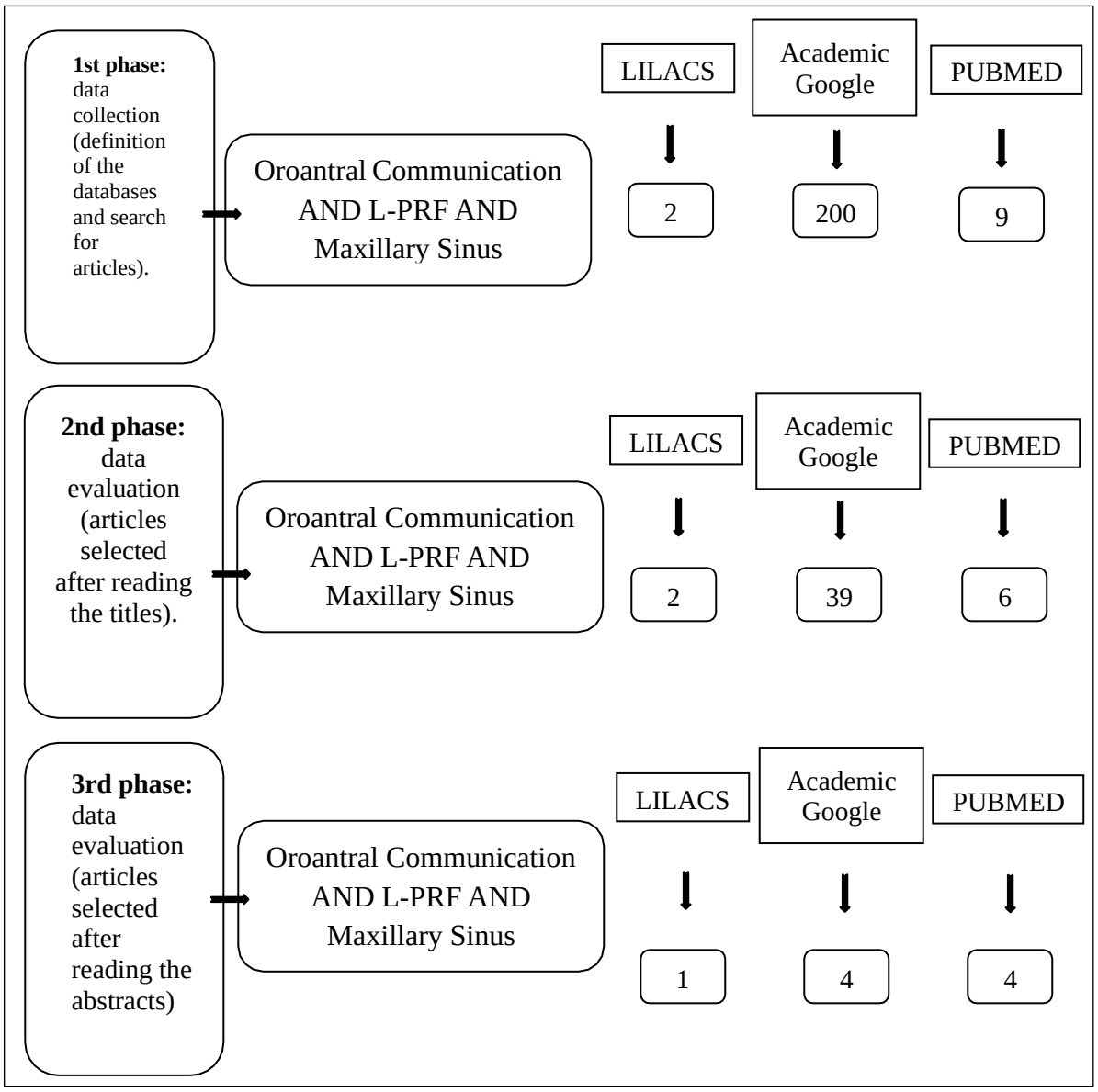

Table 1: Flowchart for Article Selection.

Reference	Objective	Methodology	Main Results
[12]	Evaluate the efficacy of L-PRF in closing oroantral communications.	Study conducted on two patients, a 29-year-old male and a 44-year-old female, who complained of discomfort in the area of tooth 16, passage of air and food from the oral cavity to the nasal cavity, and changes in vocal resonance.	The use of L-PRF for closing oroantral communications was promising due to its osteoconductive and/or osteoinductive properties, facilitating bone regeneration and achieving satisfactory closure of the communications.

[13]	Evaluate the efficacy of L-PRF in tissue regeneration of oroantral communications.	Study conducted on 21 patients with oroantral communications larger than 3mm between February 2013 and December 2016. None of the patients had systemic diseases or symptoms of sinusitis; they were not smokers or alcoholics.	L-PRF proved to be an adequate pathway for immediate treatment of this condition, being used for tissue wound healing without generating side effects.
[14]	Demonstrate the repair of a large sinus membrane perforation with L-PRF that occurred during a maxillary sinus floor elevation.	Male patient, 70 years old, normosystemic, presented with missing teeth 16, 17, and 18. He had a pneumatized right maxillary sinus, a condition that prevented rehabilitation of the area through implants. Thus, a maxillary sinus lift procedure was proposed for the patient.	L-PRF was considered effective in repairing sinus membrane perforations and did not present any postoperative complications.
[15]	Report the treatment of a patient with chronic sinusitis arising from an oroantral communication.	Female patient, 54 years old, healthy, complained of pain in the maxillary sinus region for 3 years. Tomographic examination showed a hyperdense area in the region of the left maxillary sinus and its floor in close relation to the roots of the upper molars.	The use of L-PRF membrane aided and optimized the healing of soft tissues, promoted complete closure of the communication, and also had an antimicrobial action, which prevented the proliferation of pathogenic microorganisms in the sinus cavity.
[16]	Report the treatment of a patient with an oroantral fistula using L-PRF membranes associated with collagen membranes.	Study conducted in a male patient, 32 years old, non-smoker, normosystemic, who presented with passage of food from the oral cavity to the nasal cavity. Imaging tests confirmed the diagnosis of oroantral communication, occurring for more than 3 months.	The L-PRF membrane induced proliferation of fibroblastic cells in the area, causing hyperplasia of the gingival tissue, making its use advantageous and effective in closing oroantral communications.
[17]	Evaluate the treatment of oroantral communications with platelet-rich fibrin (PRF).	Study conducted on 21 patients (12 women and 9 men) who required treatment to close oroantral communications with a diameter of 3 to 5mm, occurring shortly after the extraction of upper molars.	The use of the membrane is effective in treating oroantral communications with a diameter of 5 mm or less, due to complete epithelialization in the defect area, presenting low risk of complications.
[18]	Report the treatment of an oroantral communication associating L-PRF with the vestibular flap technique.	Female, melanoderma, smoker, complained of halitosis and oral cavity secretion for three years, starting after the extraction of an upper molar. Imaging showed a 7 mm bone defect, communicating the oral cavity with the right maxillary sinus.	The use of L-PRF was adequate in its treatment, where there was satisfactory tissue repair and significant bone neoformation.
[19]	Describe the use of L-PRF for managing an oroantral communication.	Female patient, 61 years old, complained of pain in the region of tooth 16 and a history of its extraction about 8 months ago. Imaging examination showed loss of the local vestibular bone plate, indicating communication between the oral cavity and the right maxillary sinus.	The use of the L-PRF membrane was adequate for obstructing the communication, due to its easy and quick preparation, high biocompatibility, low cost for procurement, and no risk of infection.
[20]	Report the use of L-PRF in the treatment of oroantral communications with a 90-day postoperative follow-up.	Female, 68 years old, melanoderma, non-smoker and normosystemic, complained of pain in the right hemiface, presenting edema and hyperemia.	The use of L-PRF resulted in bone regeneration and healing without postoperative complications, reducing operative time; besides being low cost and considered safe for use, as it is auto

4. Discussion

Oroantral communication can be defined as a pathway between the oral cavity and the maxillary sinus. This condition is often caused accidentally during dental extractions of teeth whose roots are closely related to the floor of the maxillary sinus, as well as other causes such as oral pathologies, systemic diseases, or traumas that may be associated with this condition [16]. The ideal treatment depends on several factors, including the size of the communication. Small communications, 2mm or less, are more easily closed, often by the patient's own healing condition, requiring only sutures to retain the clot in the socket. Moderate to large communications, from 2mm to 7mm or more, generally require membranes to facilitate healing and flaps to close the communication satisfactorily [21].

There are various techniques for correcting this condition, and choosing the ideal one is quite controversial; however, many authors affirm that it is necessary to wait for the sinus infection to be eliminated before attempting any closure. Authors state that closing the communication within 48 hours has high success rates (90 to 95%), whereas this rate drops to 67% when closure occurs later [2]. L-PRF, a platelet aggregate widely used in Dentistry today in search of better tissue repairs, has properties that accelerate physiological healing, and when associated with bone grafts, also accelerates the bone regeneration process [22]. It is a second-generation platelet concentrate (autologous fibrin matrix) and was first described by Choukron and colleagues in the year 2000 [17, 20]. Dohan and colleagues described the protocol for preparing platelet-rich fibrin by collecting 20 mL of venous blood and centrifuging it at 3,000 rpm for 10 minutes, successfully using this technique in their study [26].

It was recently discovered that PRF suppresses osteoclastogenesis, promoting the secretion of osteoprotegerin, a protein synthesized by osteoblasts, thereby reducing the action of osteoclasts and preventing bone resorption in the area where it is inserted [23]. Therefore, also due to its osteoconductive and/or osteoinductive properties, it successfully closes oroantral communications [12]. Assad and colleagues, in a study conducted in 2017, used PRF in closing oroantral communications and showed that it has natural fibrin structures that protect growth factors against proteolysis. Therefore, because these growth factors remain active for a relatively longer period, they are effective in stimulating tissue regeneration. Additionally, it was shown that PRF plays an important role in revascularization of the environment by also inducing angiogenesis, making it use a viable and promising alternative for achieving satisfactory closure of oroantral communications, a reality achieved in the two patients chosen for the study [12].

Bilginaylar, in his 2017 study, used L-PRF in search of tissue regeneration in oroantral communications larger than 3mm and demonstrated that wound healing is a biological condition that occurs with the collaboration of different types of cells. Since PRF is a natural matrix containing various essential cells in the healing process, it induces angiogenesis and, consequently, tissue repair. For this reason, it can be used to improve and accelerate tissue regeneration in cases of oroantral communications [13].

Pinto and colleagues concluded in their 2018 study that using L-PRF to repair a large perforation in a sinus membrane was deemed adequate for repairing this type of condition due to its capacity to promote the constant release of cells, such as platelet-derived growth factor, transforming growth factor (TGF), and vascular endothelial growth factor, resulting in satisfactory tissue repair [14]. Based on these characteristics, a recent in vivo study evaluated the advantage of this aggregate in repairing perforations in the sinus membrane in rabbit maxillary sinuses and showed that L-PRF positively contributed to the proliferative phase of growth factors, resulting in satisfactory healing of the sinus membrane [24].

Mourão, in his 2018 study, used L-PRF as an adjunct in the treatment of a sinus infection, concluded that the implantation of L-PRF inside the maxillary sinus, after

debridement, accelerated the healing of the sinus membrane, in addition to exhibiting antimicrobial action, which prevented the spread of pathogenic microorganisms in the cavity of the maxillary sinus. Thus, its use to treat the condition of the patient chosen for the study optimized the healing of tissues, causing the complete closure of the communication satisfactorily and definitively [15].

It has been demonstrated that the use of PRF has been exponentially increasing over the years in Dentistry, primarily in search of better results in the process of soft tissue healing [25-27]. The platelet aggregate was juxtaposed to a collagen membrane in closing the oroantral communication, and the authors affirmed that the barrier achieved by the membrane, together with the bioactive molecules present in the blood derivative used, created a favorable condition for cell differentiation and local tissue repair. It was observed that there was hyperplasia of the gingival tissue after 6 weeks of the surgical procedure, demonstrating the capacity of PRF to induce the proliferation of fibroblastic cells in the region where it is inserted, making its use advantageous when seeking faster and more effective tissue healing [16].

Demetoglu, in his 2018 study, used L-PRF to achieve the closure of oroantral communications with 3 to 5 mm after extractions, achieving clinical success in the 21 patients treated and highlighted that, among the numerous advantages of using L-PRF for closing oroantral communications, the fact that there is no need to create a flap, whether buccal or palatal, to close the existing defect stands out, as L-PRF successfully fulfilled this function; thus, avoiding possible future complications from the flap technique, such as the reduction of the patient's vestibular depth, temporarily making prosthetic rehabilitation unfeasible. It was reported that PRF stimulated angiogenesis and induced the proliferation of fibroblasts and osteoblasts, accelerating the recovery of soft tissues. It was also shown that PRF is compatible with tissues and does not contain alloplastic material, therefore it does not cause a foreign body immune reaction in the patient. Easy to use and low cost, its properties accelerated tissue recovery and prevented the loss of vestibular sulcus depth, making its use advantageous in seeking satisfactory closure with low risk of complications of oroantral communications with a diameter of 3 to 5mm [17, 28].

Brazilian authors, in 2020, used L-PRF associated with a buccal flap to perform the surgical closure of an oroantral communication and demonstrated that this technique caused bone regeneration and adequate healing, without postoperative complications. Thus, they concluded that platelet aggregates are viable options for healing tissues more quickly and that the expected benefits of their use reside in the potential to induce the differentiation of local repairing cells, associated with the action of a physical barrier, capable of promoting a favorable environment for specialized tissue neoformation [18].

Freitas and colleagues, in 2021, used L-PRF to treat an oroantral communication and reported that this technique was chosen due to its ability to accelerate local tissue repair and to promote a more comfortable postoperative period for the patient. Thus, L-PRF becomes an appropriate option for treating these conditions, as it is associated with a more comfortable postoperative period, reduces the morbidity of the procedure, and accelerates tissue regeneration; however, the fact that it involves a cost in obtaining L-PRF membranes should be considered and disclosed to the patient [19]. In a study conducted in 2022, L-PRF was used to treat an oroantral communication and it was concluded that the technique resulted in adequate bone healing and regeneration, without postoperative complications. Thus, its use was considered useful and satisfactory due to its induction of tissue neoformation and angiogenesis, in addition to significantly reducing the operative time, having a low cost for manufacture, and being considered quite safe for use, as it is autologous [20].

4. Conclusion

It is suggested, therefore, that the use of L-PRF is effective in closing oroantral communications, in terms of better tissue healing conditions, due to its properties of tissue neoformation, stimulating angiogenesis, and inducing the proliferation of fi-

broblasts and osteoblasts. It is compatible with tissues and does not contain alloplastic material in its structure, thus avoiding a negative immunological reaction in the host, significantly reducing operative time, and having a low cost of manufacture.

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