Vol. 12, No. 6, November-December 2023

# REVOLUTIONIZING ORAL SURGERY: UNVEILING THE UNIQUE POTENTIAL OF PRF PRODUCTS IN PRECISION HEALING. A NARRATIVE REVIEW

**Ada Stefanescu[1], Irina-Georgeta Sufaru[2]*, Maria-Alexandra Martu[2], Victor Costan[3], Kamel Earar[4]**

[1]PhD students, "Dunarea de jos" University - Galati, Romania,
2 Grigore T. Popa" University of Medicine and Pharmacy, Iasi, Faculty of Dental Medicine, Department of Periodontology, Iasi, Romania
[3]Grigore T. Popa" University of Medicine and Pharmacy, Faculty of Dental Medicine, Department of Surgery, Iasi, Romania
[4]"Dunarea de jos" University, Faculty of Dental Medicine - Galati, Romania,

**Corresponding authors:* Sufaru Irina. e-mail: irina_ursarescu @yahoo.com
*+ All authors have the same scientifical contribution and equal rights*

## Abstract

Periodontology has adapted over the years to demands for better healing, a more comfortable solution, treatment of marginal tissue recessions, and better aesthetics. This has become one of the main goals of this discipline. Platelet-enriched fibrin (PRF) is an autologous platelet concentrate similar to a scar matrix that guides the various cellular elements and releases growth factors and cytokines near the injury. It is an autogenous alternative to conjunctive grafting in treating gingival recession that would allow optimal healing quickly. This review presents the different types of PRF, the protocols for obtaining them, and the practical features of their surgical applications. The use of PRF in oral surgery signifies not just a trend but a fundamental shift towards patient-centered, evidence-based, and minimally invasive practices that redefine the boundaries of what is achievable in modern oral healthcare.

**Keywords**: PRF, PRF protocol, surgical therapy, management of complications

## 1. Introduction

Today, the world's population has a more significant number of people with chronic diseases. These systemic diseases are often closely related to periodontology through their two-way connection.

Added to these are the risks due to the therapy itself. Indeed, we can face hemorrhages, allergies, and infections that can increase the patient's stress. The more impaired the general condition, the more difficult this anxiety will be to manage.

In addition, the healing time can be substantial depending on the intervention, which would prolong the time to achieve the treatment plan results. Clinicians are constantly looking for a solution to improve and reduce this delay to favor the success of treatments.

With technological advancements and the modernization of dentistry, patient demands have increased over time. Health awareness of every individual has increased. Added to this is a need for comfort and aesthetics of the therapeutic solution.

To meet these imperatives, periodontics has adapted to this demand for better healing, a more comfortable solution, treatment of marginal tissue recessions, and better aesthetics over the years. This has become one of the main goals of this discipline.

Platelet-enriched fibrin (PRF) is an autologous platelet concentrate similar to a scar matrix that guides the various cellular elements and releases growth factors and cytokines near the injury. It is an autogenous alternative to the conjunctive graft in treating gingival recession that would allow optimal healing quickly.

PRF can be presented in different forms, each with indications for its application. Depending on the shape of the PRF obtained from the sample, a type of

PRF such as membrane, plug, or Sticky bone can be received [1].

## 2. The different types of PRF

Each clinical intervention may require a specific structure for its utility. Thus, depending on the act, whether it is an extraction, a filling, or, for example, a protection, the PRF will be shaped in a certain way before being inserted into the oral cavity. Each PRF, whether A-PRF, S-PRF, or i-PRF, makes it possible to obtain specifically a clot, a membrane, or others that will have their indications [2].

• A-PRF makes it possible to obtain clot, membrane, or plug

• S-PRF makes it possible to obtain sticky bone or large membrane

• i-PRF makes it possible to obtain a liquid form

The benefits of Sticky bone are:

• Granule immobility: mobility is the primary factor in graft oxidation

• Spaces filled with fibrin: angiogenesis is accelerated

• Reduction of the space between the granules: osteoconduction is facilitated

## 3. Indications of different types of FRP

We will discuss here the other indications of A-PRF, S-PRF, and i-PRF with the result of different PRF structures that can be obtained.

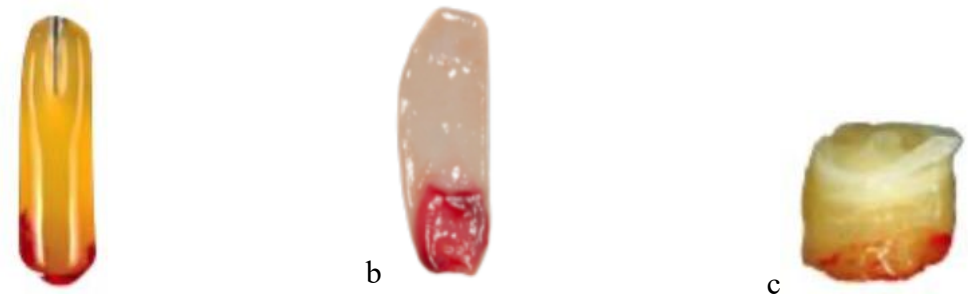
### *3.1 A-PRF*

With A-PRF, three different structures can result clot, membrane, and plug [3] (Figure 1).

The clot is indicated for sinus filling with PRF alone and a simultaneous implant. It can also be used in clinical cases where periodontal pockets smaller than 6 mm are present. And finally, it can be used as a filler for cystic lesions.

The membrane, on the other hand, makes it possible to cover a site. It can also protect Schneider's membrane, a membranous lining of the maxillary sinus cavity. The membrane can be used as a connective tissue substitute. Finally, it can be used in the field of implantology as a cloak for the healing screw [4].

We can also use a plug to achieve a post-extraction filling of the socket.



a b c

Figure 1. Different A-PRF products: a) clot; b) membrane; c) plug

### *3.2 S-PRF*

Thanks to S-PRF, we can get Sticky bone or a large membrane (Figure 2).

Figure 2. Different S-PRF products: a) Sticky bone; b) membrane;

Sticky bone is indicated in fillings of the alveolar socket, as is the plug. It can also be used in guided bone regeneration (GBR). Finally, its last indication is the treatment of periodontal pockets that are more significant than 6 mm [5].

To speed up coagulation, adding the exudate from the PRF box to the reservoir is recommended.

A large membrane may be indicated to cover a large site. To accelerate coagulation, the exudate from the PRF box can also be added to the reservoir [6].

***3.3 i-PRF***

i-PRF is a liquid form indicated in preoperative flaps by injection (Figure 3). It can be used for papillae, temporomandibular joint, and endodontics. It can also be used in aesthetics and orthopedic surgery in facial aesthetics, alopecia, cartilage regeneration, and joint pain [7].

Figure 3. i-PRF injection syringe

**4. Success and failure rates**

Several factors can be the source of success and failure of a PRF intervention. Conditions that are appropriate or not will be detailed below. In addition, the different success and failure rates for each type of PRF will be specified: A-PRF, L-PRF, i-PRF, and PRF+.

*4.1 Antibiotic therapy*

First of all, antibiotic therapy is mandatory for the success of the treatment. Indeed, patients who do not receive antibiotics have a failure rate of 5.6%, as opposed to those whose failure rate is 1.8%. The best protocol would be administration in a single dose of 3g of Amoxicillin 1 hour before the intervention [8].

*4.2. PRF and oxidative stress*

Oxidative stress is the cellular aggression of molecules that obtain oxygen from the body's cells. Free radicals are the best known. These are also called reactive oxygen species (ROS) and modify cellular DNA. Oxidative stress is an accumulation of oxidants in tissues, knowing that oxidation is a physiological phenomenon. It is thus responsible for the premature aging of our cells and can be combined with specific diseases such as cancer [9]. This is why we commonly see foods or other antioxidant substances that help fight these free radicals properly.

In addition, several factors favor this production of free radicals. This is the case of a polluted environment, smoking, an unbalanced diet, exposure to the sun, stress, or even too intense physical exertion. Excessive production of antioxidants is also observed during periods of considerable anxiety, diabetes, obesity, cancer, and chronic inflammation. The insufficient production of antioxidants can be caused by diabetes, smoking, or hypertension [10].

Whether it is gum or bone, they can become ischemic from excessive soft tissue stress from tension or bone stress from pressure. In smokers, for example, smoke destroys antioxidants in oral tissues (bones and gums), skin, and lungs [11].

In a situation with high LDL levels, they cause oxidation of osteoblasts with slowed bone metabolism and replacement of bone with adipose tissue (<1.40 g/L). Bone is a viscoelastic and anisotropic material; its properties vary depending on the direction in which it is considered. According to Wolff's law, it forms and resorbs according to the mechanical stresses exerted on it. Bone remodeling occurs in the presence of low or excess stress, leading to the resorption and causing inhibition of osteoblast function. This increases the number and activity of osteoclasts, inducing osteoclastogenesis.

A high rate of failures and complications occurs when excessive or insufficient antioxidant production occurs. Healing failures can occur during oxidative stress, preventing the tissue from healing. Therefore, a therapeutic choice is resorted to: the use of PRF to counteract this phenomenon.

Oxidative stress associated with PRF accomplishes three actions:

• Stimulates angiogenesis
• It has an anti-inflammatory effect
• Inhibits osteoclastogenesis

Therefore, PRF is a powerful antioxidant. It should be noted that its period of activity is 7 to 15 days.

**5. Preparation of PRF**

To obtain a PRF product, the practitioner must go through several steps. First, a blood sample must be taken from the patient to have the material to use. Then, there are the centrifugation steps and the actions to obtain a PRF in the form of a membrane, plug, liquid, etc.

Therefore, PRF preparation is divided into two sub-steps: the blood sampling protocol, which also deals with blood exposure accidents, then the centrifuge protocol and settings for obtaining different types of PRF (A -PRF, S-PRF, i-PRF, and i-PRF+) [12].

*5.1 Protocol for blood collection*

The sample is taken at the elbow level, with two central veins: the internal basilic and external cephalic veins. We should choose the cephalic vein first because it is more voluminous and runs less. If the veins are not visible, look for a vein inside the theoretical "M." Carefully palpate the entire area.

Everything must be prepared: tourniquet, alcohol, venlite, dressing, samples, and tubes. The device is plugged in, the cover is open, and the settings are made.

• The dressing is prepared and applied to the hand to fasten it when the time comes.

• Tighten the tourniquet above the elbow. It must be left on for the duration of the test.

• Apply alcohol to the area and dab. The heat thus created will increase the volume of the veins.

• Palpate the entire area to find the best vein. We need a 2 cm straight segment.

• Place the guide: with the help of a marker, make two or three points delimiting a segment of two centimeters.

• Prepare the needle with the fingers positioned on the rough side. The skin is pulled 10 cm from the sampling point and punctured.

• Puncture the skin with the bevel up and a 15° penetration angle with the skin.

• Venous reflux occurs; sticking the dressing on the wings is necessary.

• The tube is connected.

• At the end of the test, the tourniquet is removed to avoid an accidental splash of blood.

• The needle is then removed as quickly as possible.

• The puncture site is pressed for hemostasis.

• The patient bends the arm for about 1 minute.

In complex cases, if we have a small segment less than 2cm, the needle is inserted a little forward to have the bevel inside the vein.

If there is no reflux, the skin is pulled to separate the bevel from the vein wall. It may be necessary to search for several different axes.

Following this blood draw, and before going into the details of the protocol for obtaining PRF correctly, it would be wise to dwell a bit on blood exposure accidents (BEAs). Indeed, these can happen to any healthcare professional who handles blood, so it is essential to know the protocol well [13].

First, first aid must be given without delay. If the exposure is percutaneous, immediately clean with

water, followed by antisepsis for at least 5 minutes. Chlorinated derivatives such as Dakin or Amukine, 70° alcohol, or Betadine can be used for this. If projection has occurred on the mucous membrane, an immediate saline flush for 5 minutes should be performed.

After that, the nearest emergency department should be called.

The second step, which takes place within an hour, is the risk assessment by the emergency physician at the hospital. It will assess the depth of the wound and the type of exposure that occurred, for example, by a needle, projection, or other, and finally define the serological and clinical status of the patient. At this point, two directives can be taken: the patient can be determined to take antiretroviral prophylaxis or not. If necessary, treatment should begin within 4 hours of exposure [13].

Afterwards, a declaration of the work accident to the Directorate of Public Health (DSP) must be made within 24 hours. Patient anonymity will be respected.

Finally, there will be a serological and clinical follow-up of the person exposed to the blood [13].

*5.2 The protocol for obtaining the PRF*

This part will show the steps regarding A-PRF+, S-PRF, and i-PRF. It should be noted that the first PRF or L-PRF appeared in 2001, counting 2700rpm and doing it in 12 minutes.

*5.2.1 A-PRF protocol*

The A-PRF+ steps that occur in the red tubules and make it possible to obtain clots, membranes, and plugs are:

• Collection of blood in rapid flow tubes.

• Place the tubes in a balanced manner in the centrifuge using the colors inside the machine.

• The A-PRF+ program is launched at 1300rpm and 14min.

• When the cycle is finished, the tubes are removed from the machine, the caps are removed, and the tubes are placed in the tube holder.

• If the clots are not completely solid, wait 5 minutes.

• Do not leave tubes in the centrifuge or clots in the tubes.

• Remove the clot from the tube and remove the red component with a peeling motion [14].

It is thus possible to use the curd as it is. If a membrane is desired, the curd should be placed in the FRP box and the crusher placed on top. If a plug is selected, the clot must be placed in the dedicated cylinder and compressed using the plunger.

*5.2.2 S-PRF protocol*

The steps of S-PRF, which take place in green tubes to obtain sticky bone and large membranes, are [15]:

• Draw blood from a green tube and a red fast-flow tube.

• Place the tubes evenly in the centrifuge using the colors in the machine.

• Run all tubes simultaneously with the A-PRF+ program at 1300rpm for 14 minutes.

• When the run is complete, remove the tubes from the centrifuge by placing them on the tube holder and then remove the caps.

• Using a 2 ml syringe, withdraw the liquid from the green tube directly

• Apply the liquid on the biomaterial or alone.

S-PRF coagulates in 20-30 minutes. Exudate from the PRF box or, alternatively, a PRF clot can be added to the mixture to accelerate coagulation. Thus, coagulation will take place in 2-3 minutes.

To get more liquid, it will be necessary to use the green tubes.

Some steps must be followed if we want to graft and then maintain the graft. It will be necessary to mix one or two membranes cut into small pieces with the biomaterial, then gently hydrate the resulting mixture with the exudate, the liquid at the base of the PRF box. After that,

the graft will be applied to the recipient site, and the mixture will be fixed with liquid S-PRF. The only drawback of this result is that it has to be grafted a second time with an S-PRF for liquid at the time of grafting if an A-PRF for membranes was already taken at the beginning of the intervention. A second alternative is to use both tubes, A-PRF and S-PRF when performing the graft [5].

*5.2.3 i-PRF protocols*

For i-PRF, use the green tubes to obtain a liquid for 10-15 minutes. The setting will be 700rpm (60g) and 3min for women and 700rpm (200g) and 4min for men.

Meanwhile, i-PRF+, used in aesthetics and orthopedics and generated in purple tubes, allows a liquid to be obtained for 20 minutes. Therefore, it is injectable and is used anatomically up to an area that follows the papilla. It replaces cortisone in treating pain and osteoarthritis of the temporomandibular joint. The settings will also be different here depending on the gender of the patient. For women, this will be set at 700rpm (60g) and 5min, while for men, it will be selected at 700rpm (200g) and 6min [14].

**6. Peculiarities of using PRF in surgery**

In periodontology, sutures play an essential role because they can point the tension and pressure of the surrounding tissues.

Whether during the treatment session or after the treatment in the dental office, my pain management is fundamental. The latter will be adapted according to each patient, either through analgesia, anesthesia, sedation, or according to the patient's allergies.

To complete this part, we will deal with the medication that must be provided to improve the quality of work of the doctor and the patient. Hemorrhagic situations may occur, which may cause difficulties in visibility or placement of the A-PRF membrane, for example. Preventive medicine can be prescribed or intervened when they appear to counteract them. The same is true for vagal discomfort, with some patients being more prone to it. This can be caused by the intense stress of drawing blood to perform PRF. Therefore, it is essential to know how to handle these situations. It is also necessary to know what to do when a patient has hypersialorrhea or an excessive gag reflex, as these increase the risk of treatment failure. Abundant saliva prevents, among other things, isolation of the field, and the gag reflex makes it challenging to access instruments or any other medical component, such as A-PRF membranes or plugs, when applied to the posterior area of the oral cavity.

*6.1 Stress and pressure*

Pressure on a tissue causes a reduction in the growth process of new blood vessels from existing vessels. The latter is a normal physiological process called angiogenesis. Therefore, it causes ischemia, defined as local anemia with a stoppage or insufficiency of blood circulation in the tissue. Lack of angiogenesis is the primary cause of all healing failures [16].

*6.1.1 Voltage*

A stress is defined as a state of a flexible or elastic substance under tension. In physics, it is a force that dissociates an element's component parts.

It is recommended that after PRF application, the surgical site is closed without tension [17]. However, it is essential to emphasize that vestibular tension will always be present through, among other things, smiling, talking, chewing, and coughing. In periodontology, if tension occurs, ischemia will affect the periosteum, which will cause some bone resorption.

To counteract the tension, several alternatives are possible that can be used alone or not. First, to reduce the tension of the flap as much as possible, the doctor can make a micro-incision in the periosteum. Indeed, adequate relaxation of the flap is

necessary to achieve tension-free closure for bone augmentation. The only way to achieve this result is to incise the vestibular periosteum.

However, a difficulty to consider is the presence of the mental nerve, which may be close to the site. The fibrous segment of the incised periosteum is similar to a rigid collagen membrane. Its consistency is due to the cohesion of collagen fibers caused by elastin and proteoglycans 5. It is, therefore, necessary to dissociate the fibers by breaking the elastin bridges with the help of related instruments.

The Soft Brushing Technique [18] does not traumatize the periosteum, increasing the elasticity of the flap without incising it. Non-cutting tools are used to do this, such as the STUP Process used for PRF. Different sizes are available to meet the needs of other boxes (Figure 4). The distension generated will be considerable, and without affecting the vascular system, to apply a flap closure for each case.

At the level of the mandible, lingually, the fibers of the mylohyoid muscle are dissociated from the lingual flap by brushing the internal face of this flap. The result will be a 20 mm flap release. This technique can be applied without difficulty because the risk of cutting the muscle fibers by the instrument is impossible. Only gentle brushing will allow the muscle fibers of the mylohyoid muscle of the lingual flap to be separated. Regarding the vestibular area, brushing will disturb the structural organization of the collagen in an apical-coronal movement [18].

Figure 4. PRF Process Soft Brushing kit. It consists of an extra-large (XL), a medium (M), a regular (R), a right angle (AD) and a left angle (AG) brush.

Another solution to reduce tension is the apical suture in the mattress. It is a very deep U-shaped suture in the vestibule. When we raise the flap, it first becomes mobile, and second, the blood supply is interrupted. We need to repair the back of the flap to eliminate its mobility. Two actions must be performed: flap release to reduce tension and vestibular flap fixation to eliminate mobility. Unfortunately, when a classic suture is made, it cannot be repaired in this second part. Fixation can be done with a special suture: the apical mattress technique. Thus, the latter effectively preserves bone tissue and soft tissues, which will have an increased thickness [19].

The advantages of this apical technique are numerous. First, it cooperates to suppress vestibular flap tension and mobility by reducing soft tissue ischemia, promoting healing, increasing soft tissue thickness, and significantly decreasing the risk of dehiscence. Also, the cortical bone and the bone graft are revascularized in a shorter time. Finally, this technique prevents the resorption of the already present bone and bone graft [19]. Monoglycolic absorbable monofilament will be used.

To control the tension, manipulation at the end of the surgical act, pulling the lips and cheeks, is essential. If the tension persists, for example, if the flap remains mobile, it is necessary to make an incision in the vestibule.

*6.1.2 Pressure*

Pressure is defined as a force acting on a surface. A unit of area measures this force.

In the field of surgery, the pressure is conditioned by the flap. When the vestibule is short, or the bone tissue is increased, the pressure will cause ischemia

of the periosteum. However, it is necessary to know that a situation of excessive pressure can be observed when compression is made through a post or a screw, for example.

To solve this pressure problem, several solutions are available [20]:

• A screw is used to make a "tent peg."

• An apical suture is performed as seen previously to resolve the tension problem

• A titanium plate is used

• One or more cortical bone plates are used.

*6.1.3. The sutures*

Reattachment of the periosteum requires several weeks after flap elevation. Therefore, the sutures must be able to stay in place for at least 3 to 4 weeks. To do this, it is recommended to use a monofilament thread. For convenience, an absorbable monofilament can be used. Indeed, in the case of nonabsorbable monofilaments, the monofilament wire will adapt to the flap after a month and will be difficult to remove. The monoglycolic thread has a stable structure that prevents bacterial plaque formation, unlike braided threads that trigger secondary inflammation due to plaque formation [21].

In conclusion, the advantages of Glycolon Monoglyc are numerous. Its elasticity is noteworthy while obtaining stable knots without removing the threads. It prevents the attachment of bacterial plaque and, in addition, allows enough time for reattachment of the periosteum and a significant reduction in the risk of suture dislodgement.

*6.2 Pain Management*

According to the International Association for the Study of Pain [22], “pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in these terms.” There are three types of pain: acute, chronic, and caregiving pain. Anyone suffering from pain of any kind should be able to have the opportunity for proper diagnosis and appropriate treatment.

*6.2.1. Analgesia*

Analgesia refers to the abolition of pain sensitivity, whether spontaneous or due to treatment. All pain comes from a process of the body's defense against aggression (trauma, infection, etc.), which can manifest itself in different ways (pain, swelling, heat, redness, etc.) and is called inflammation. To reduce the latter, we will use cortisone, the most effective molecule [23]. Indeed, it is a steroid hormone with anti-allergic and anti-inflammatory action secreted in the cortex of the adrenal glands.

Steroids have a biological half-life of about three days. The indicated dose is 1 mg/kg of Prednisolone (Solupred) or 0.20 mg/kg of Dexamethasone (Celesten/Betenesol). A single dose is enough to reduce inflammation most of the time. If necessary, a second dose can be added after three days. Combine the use of cortisone with an analgesic such as ibuprofen or paracetamol.

*6.2.2. Anesthesia*

To increase the effectiveness of anesthesia, tissue pH can be increased [24]. Isotonic sodium bicarbonate 1.4% can be used in 5-10 ml in the anesthesia area. Care should always be taken to inject this solution after the anesthetic has been injected.

*6.2.3 Allergic reactions*

An allergy is defined as a change in an organism's reactions to a pathogen when this organism has previously been affected by the same agent. It is a hostile reaction.

During an allergy episode, macrophages release histamine after exposure to the allergen. These are the causes of allergic symptoms. The release of histamine can be blocked to counteract the allergic reaction before it occurs. To do this, we use antihistamines (eg Hydroxyszine): Atarax® [25]. The correct dose is one 25

mg tablet per day for three days before surgery, at bedtime.

***6.4 Sedation***

A sedative acts as a moderator by calming the individual down. In conscious sedation, the central nervous system is more or less sedated with drugs. The latter makes it possible to achieve a more or less substantial result, from calming to deep sleep. What differs from general anesthesia is that the level of consciousness is reduced but still present; the patient can still swallow and breathe independently. Sedatives are used in anxious or phobic patients. In advance, a relationship of trust will be established between the doctor and the patient during the pre-procedure meeting. Everything must be explained step by step. Different conscious sedation techniques are available.

First, the breathing technique with nitrous oxide (MEOPA®, Kalinox®), a gas that considerably reduces stress and sensitivity, was used [26]. On the contrary, the patient experiences a feeling of well-being. In everyday parlance among non-health professionals, it is also called laughing gas.

In more challenging situations, intravenous conscious sedation may be necessary. Thus, the patient will be completely relaxed and asleep during treatment. The use of intravenous sedation can only be done by an anesthesiologist for optimal safety. However, this technique is still different from general anesthesia.

The last conscious sedation technique to be mentioned and the most used in our field is the administration of oral tablets. It can be used in combination with nitrous peroxide inhalation sedation if needed. Antihistamines (eg, hydroxyzine) Atarax® are used. The average dose is 1 mg/kg for an adult, starting 2 hours before the intervention. If the stress is essential, the same dose is prescribed for the night before the intervention, before bed [25].

***6.5 Hemorrhage and prevention of venous bleeding***

Hemorrhage is defined as significant, continuous loss of blood. This flow can be external or internal. Hemorrhage is the result of a ruptured blood vessel inside the body. It can be arterial (during heavy bleeding and challenging to stop), venous (quickly stopped), or capillary.

Either in hemorrhaging situations or to prevent venous bleeding, treatment with one bottle of Exacyl and two ampoules of Dicynone is indicated. The method of administration will be intravenous because oral treatment will not be effective [27].

Exacyl, an injectable solution, is hemostatic in VIDAL and the ATC classification as hemorrhagic. Its excipients are concentrated hydrochloric acid and water for injections [28].

Dicynone is part of the hemostatic family. It is a vascular protector and antihemorrhagic. The injectable solution is indicated during small subcutaneous hemorrhages that show up as red or purple spots, unusual bleeding, and, in our case, microhemorrhages during specific surgical procedures. The use of this drug should be taken with caution because it contains sulfites that can cause allergic reactions in particularly susceptible people [29].

***6.6 Vagal discomfort***

Vagal discomfort corresponds to a significant and sudden drop in blood pressure due to excessive stimulation of the vagus nerve. It is associated with a slowing heart rate caused by an imbalance between the sympathetic and parasympathetic nervous systems. The brain then has poor perfusion because the blood flow is too low, which causes a loss of consciousness for a short time due to lack of oxygen. Usually, this incident is not severe [30].

Symptoms of vagal discomfort are muscle weakness, excessive sweating, loss of consciousness, then headaches, and digestive disorders. The patient may feel vagal discomfort with indicators that precede it, such as palpitations, visual

disturbances (for example, blurred vision), dizziness, tinnitus, and tremors.

Vagal discomfort can be caused in various situations, such as high emotions, intense pain, excessive fatigue, excessive physical exertion, orthostatic hypotension, and a warm environment. Certain medications can also be the cause. This is the case, for example, of hypotensives, vasodilators, diuretics, and hypnotics [31].

In vagal discomfort, the patient should lie down and raise the legs to promote blood return to the heart. Then, if the latter's condition does not improve after five minutes, it is necessary to call 112 to contact the emergency services. Finally, if necessary, an injection of 0.25 mg of Atropine intramuscularly or intravenously will be made [30].

### *6.7 Hypersialorrhea and excessive gag reflex*

Hypersialorrhea is defined as an excessive secretion of saliva. It can reach 4 to 5 liters per day without considering swallowed saliva. Saliva comprises water, mucus, enzymes (ptialin), and electrolytes (sodium, chlorine, and potassium). Hypersialorrhea can be of three different types: primary, secondary, and emotional. The primary corresponds to the hypersecretion of the salivary glands, the secondary is due to the alteration of neuromuscular control, and the dynamic is caused by anxiety or stress [32]. Hypersialorrhea is found in many dental problems such as mouth ulcers, caries, and gingivitis, but also when the general condition is affected, for example, when patients have diabetes, cancer, or digestive disorders [33].

Therefore, it is essential to know the source of hypersialorrhea because some patients may be affected due to stress and emotion caused by the dental session preceding the PRF to the blood test or due to a general illness. The practitioner must be able to manage the situation as it may alter the comfort or outcome of the act.

The same goes for the gag reflex. It is caused by stimulation of the posterior wall of the pharynx on either side of the uvula towards the posterior surface of the larynx. It is a normal phenomenon by which the human body protects the throat and airways from foreign bodies to avoid possible suffocation [34]. Some patients may have a more muscular gag reflex, which can cause additional anxiety. The dental act will then take place less easily in these patients.

To remedy hypersialorrhea or the gag reflex, the doctor may use atropine sulfate 0.25 mg intramuscularly, intravenously, subcutaneously, or even on the floor of the mouth. Another technique for patients with an excessive gag reflex is also to use an anesthetic spray or spray the oral cavity with a local anesthetic.

The evidence supports the notion that PRF is not just a biomaterial but a therapeutic ally that accelerates the healing process and promotes tissue regeneration. Its ability to harness the body's growth factors and cytokines offers a biocompatible and natural approach to augmenting surgical outcomes.

Moreover, the simplicity of PRF preparation and its cost-effectiveness make it an accessible and viable option for a wide spectrum of patients and surgical scenarios. As a result, its integration into routine oral surgery protocols could significantly elevate the standard of care, particularly in procedures involving bone grafting, periodontal surgeries, and implantology.

The promising results observed in various studies and clinical applications highlight the potential for PRF to minimize postoperative complications, reduce healing times, and improve overall patient satisfaction. These advantages impact the immediate postoperative period and contribute to the long-term success and stability of oral surgical interventions.

## 7. Conclusions

In conclusion, platelet-rich fibrin (PRF) application in oral surgery represents a transformative paradigm, ushering in a new era of enhanced clinical outcomes and patient care. The multifaceted benefits of PRF, ranging from its regenerative potential to its immunomodulatory properties, underscore its versatility in various oral surgical procedures.

As research in PRF continues to evolve, collaboration between oral surgeons, researchers, and industry partners becomes paramount to optimize protocols, standardize techniques, and explore new frontiers in regenerative oral medicine. The use of PRF in oral surgery signifies not just a trend but a fundamental shift towards patient-centered, evidence-based, and minimally invasive practices that redefine the boundaries of what is achievable in modern oral healthcare.

**References**

1. Aizawa H, Tsujino T, Watanabe T, Isobe K, Kitamura Y, Sato A, Yamaguchi S, Okudera H, Okuda K, Kawase T. Quantitative Near-Infrared Imaging of Platelets in Platelet-Rich Fibrin (PRF) Matrices: Comparative Analysis of Bio-PRF, Leukocyte-Rich PRF, Advanced-PRF and Concentrated Growth Factors. Int J Mol Sci. 2020 Jun 22;21(12):4426.
2. Pereira VBS, Lago CAP, Almeida RAC, Barbirato DDS, Vasconcelos BCDE. Biological and Cellular Properties of Advanced Platelet-Rich Fibrin (A-PRF) Compared to Other Platelet Concentrates: Systematic Review and Meta-Analysis. Int J Mol Sci. 2023 Dec 29;25(1):482.
3. Pitzurra L, Jansen IDC, de Vries TJ, Hoogenkamp MA, Loos BG. Effects of L-PRF and A-PRF+ on periodontal fibroblasts in in vitro wound healing experiments. J Periodontal Res. 2020 Apr;55(2):287-295.
4. Clark D, Rajendran Y, Paydar S, Ho S, Cox D, Ryder M, Dollard J, Kao RT. Advanced platelet-rich fibrin and freeze-dried bone allograft for ridge preservation: A randomized controlled clinical trial. J Periodontol. 2018 Apr;89(4):379-387.
5. Gheno E, Alves GG, Ghiretti R, Mello-Machado RC, Signore A, Lourenço ES, Leite PEC, Mourão CFAB, Sohn DS, Calasans-Maia MD. "Sticky Bone" Preparation Device: A Pilot Study on the Release of Cytokines and Growth Factors. Materials (Basel). 2022 Feb 16;15(4):1474.
6. Mohan SP, Jaishangar N, Devy S, Narayanan A, Cherian D, Madhavan SS. Platelet-Rich Plasma and Platelet-Rich Fibrin in Periodontal Regeneration: A Review. J Pharm Bioallied Sci. 2019 May;11(Suppl 2):S126-S130.
7. Farshidfar N, Amiri MA, Jafarpour D, Hamedani S, Niknezhad SV, Tayebi L. The feasibility of injectable PRF (I-PRF) for bone tissue engineering and its application in oral and maxillofacial reconstruction: From bench to chairside. Biomater Adv. 2022 Mar;134:112557.
8. Miron RJ, Gruber R, Farshidfar N, Sculean A, Zhang Y. Ten years of injectable platelet-rich fibrin. Periodontol 2000. 2023 Nov 30.
9. Jaganjac M, Milkovic L, Zarkovic N, Zarkovic K. Oxidative stress and regeneration. Free Radic Biol Med. 2022 Mar;181:154-165.
10. Cieślar-Pobuda A, Yue J, Lee HC, Skonieczna M, Wei YH. ROS and Oxidative Stress in Stem Cells. Oxid Med Cell Longev. 2017;2017:5047168.
11. Sczepanik FSC, Grossi ML, Casati M, Goldberg M, Glogauer M, Fine N, Tenenbaum HC. Periodontitis is an inflammatory disease of oxidative stress: We should treat it that way. Periodontol 2000. 2020 Oct;84(1):45-68.
12. Al-Badran A, Bierbaum S, Wolf-Brandstetter C. Does the Choice of Preparation Protocol for Platelet-Rich Fibrin Have Consequences for Healing and Alveolar Ridge Preservation After Tooth Extraction? A Meta-Analysis. J Oral Maxillofac Surg. 2023 May;81(5):602-621.
13. Center for Disease Control. Occupational Exposure to Blood. 2023 https://www.cdc.gov/oralhealth/infectioncontrol/faqs/occupational-exposure.html
14. Pavlovic V, Ciric M, Jovanovic V, Trandafilovic M, Stojanovic P. Platelet-rich fibrin: Basics of biological actions and protocol modifications. Open Med (Wars). 2021 Mar 22;16(1):446-454.

15. Soni R, Priya A, Yadav H, Mishra N, Kumar L. Bone augmentation with sticky bone and platelet-rich fibrin by ridge-split technique and nasal floor engagement for immediate loading of dental implant after extracting impacted canine. Natl J Maxillofac Surg. 2019 Jan-Jun;10(1):98-101.
16. Pastar I, Marjanovic J, Stone RC, Chen V, Burgess JL, Mervis JS, Tomic-Canic M. Epigenetic regulation of cellular functions in wound healing. Exp Dermatol. 2021 Aug;30(8):1073-1089.
17. Kyriazidis I, Ali SR, Maklad M, Curtin E. Wound Closure Under Tension: It Takes Brains, Not Brawn. Aesthet Surg J. 2019 Jan 17;39(2):NP11-NP12.
18. Ronda M, Stacchi C. A Novel Approach for the Coronal Advancement of the Buccal Flap. Int J Periodontics Restorative Dent. 2015 Nov-Dec;35(6):795-801.
19. Lee WH, Kuchler U, Cha JK, Stavropoulos A, Lee JS. Distance of insertion points in a mattress suture from the wound margin for ideal primary closure in alveolar mucosa: an *in vitro* experimental study. J Periodontal Implant Sci. 2021 Jun;51(3):189-198.
20. Marouf A, Mortada H, Khedr B, Halawani L, Zino Alarki SMK, Alghamdi H. Effectiveness and safety of immediate application of negative pressure wound therapy in head and neck free flap reconstruction: a systematic review. Br J Oral Maxillofac Surg. 2022 Oct;60(8):1005-1011.
21. Li Y, Meng Q, Chen S, Ling P, Kuss MA, Duan B, Wu S. Advances, challenges, and prospects for surgical suture materials. Acta Biomater. 2023 Sep 15;168:78-112.
22. IASP, 2020. https://www.iasp-pain.org/publications/iasp-news/iasp-announces-revised-definition-of-pain/
23. Ogle OE. New Approaches to Pain Management. Dent Clin North Am. 2020 Apr;64(2):315-324.
24. Saraghi M. Intraoperative Fluids and Fluid Management for Ambulatory Dental Sedation and General Anesthesia. Anesth Prog. 2015 Winter;62(4):168-76; quiz 177.
25. Shakouri AA, Bahna SL. Hypersensitivity to antihistamines. Allergy Asthma Proc. 2013 Nov-Dec;34(6):488-96.
26. Mohan R, Asir VD, Shanmugapriyan, Ebenezr V, Dakir A, Balakrishnan, Jacob J. Nitrousoxide as a conscious sedative in minor oral surgical procedure. J Pharm Bioallied Sci. 2015 Apr;7(Suppl 1):S248-50.
27. Aoun N, Noujeim Z, El Toum S. von Willebrand disease revealed after dental post-extractional bleeding: a case report. J Int Oral Health. 2016; 8(4): 512-517.
28. Has, 2021. https://www.has-sante.fr/jcms/p_3289356/en/exacyl-0-5-g/5-ml-i-v-acide-tranexamique-prevention-et-traitement-des-hemorragies
29. Vidal, 2012. https://www.vidal.fr/medicaments/gammes/dicynone-2810.html
30. Hutse I, Coppens M, Herbelet S, Seyssens L, Marks L. Syncope in Dental Practices: A Systematic Review on Aetiology and Management. J Evid Based Dent Pract. 2021 Sep;21(3):101581.
31. Longo S, Legramante JM, Rizza S, Federici M. Vasovagal syncope: An overview of pathophysiological mechanisms. Eur J Intern Med. 2023 Jun;112:6-14.
32. Hockstein NG, Samadi DS, Gendron K, Handler SD. Sialorrhea: a management challenge. Am Fam Physician. 2004 Jun 1;69(11):2628-34.
33. Lakraj AA, Moghimi N, Jabbari B. Sialorrhea: anatomy, pathophysiology and treatment with emphasis on the role of botulinum toxins. Toxins (Basel). 2013 May 21;5(5):1010-31.
1. 34.Mehdizadeh M, Mohammadbeigi A, Sharifinejad A. An Overview about New Methods in Management of Gag Reflex during Dental Treatment: A Systematic Review. J Dent (Shiraz). 2023 Dec 1;24(4):372-381.