RESEARCH PAPER

Application of i-PRF in dentistry

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ABSTRACT

Injectable platelet-rich fibrin (i-PRF) is a novel platelet concentrate that has been employed in dentistry with the objective of promoting tissue regeneration and healing. In contrast to platelet-rich plasma (PRP), i-PRF is more straightforward to handle, more cost-effective, and free from anticoagulants, which reduces biochemical alterations. The i-PRF procedure was developed in 2014 by adjusting the centrifugation forces. The resulting product remains in a liquid state for approximately 15 minutes, gradually transforming into a growth factor-rich clot that releases continuously over 10-14 days. It has demonstrated efficacy in a range of dental applications. In periodontology, i-PRF is an effective treatment for periodontitis, enhancing gingival thickness and reducing inflammation, plaque, and recession. Furthermore, it enhances the outcomes of periodontal regenerative surgery and lichen planus treatment. In oral surgery, i-PRF has been shown to facilitate bone regeneration, fistula resolution, and sinus augmentation. Orthodontic studies have indicated that i-PRF accelerates tooth movement and bone remodeling. However, osteomicroperforation remains more effective for some treatments. A limited number of endodontic studies have indicated that i-PRF may support revascularisation and periapical healing. In conclusion, i-PRF's regenerative capabilities, anti-inflammatory and antimicrobial properties offer significant potential in dentistry, and further exploration and application is therefore warranted.

Keywords: dentistry, oral surgery, platelet concentrates, platelet rich fibrin

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INTRODUCTION;

PRF is an autologous fibrin-based (membrane, matrix or scaffold), living biomaterial, derived from human blood, also referred to as anoptimized blood clot. In essence, PRF is a natural (autologous) composite biomaterial, consisting of fibrin, platelets, growth factors and various cell

types including leukocytes and stem cells.[1-4]

The blood concentrate which is obtained after centrifugation has 3 distinct layers: a red blood cell (RBC) base at the bottom, a PRF clot in the middle, and an acellular plasma (platelet-poor plasma [PPP]) supernatant layer at the top.[1-6]

For over three decades, platelet concentrates have been employed in dentistry as regenerative agents that release growth factors in concentrations exceeding thoseobserved in normal physiological conditions, thereby promoting tissue regeneration from autologous sources [1]. Various types of platelet-rich concentrates, including platelet-rich plasma (PRP) and platelet-rich fibrin (PRF), have been explored in numerous in vitro and in vivo studies for tissue regeneration [2-6]. However, PRF offers certain benefits over PRP, such as easier handling, lower costs, and the absence of anticoagulants or bovine thrombin, which minimizes biochemical alterations and associated risks [2, 3]. In 2014, injectable platelet-rich fibrin (I-PRF) was introduced, developed by modifying centrifugation forces. By using lower centrifugation speeds and non-glass tubes, a flowable form of PRF, known as I-PRF, is obtained [4-7]. I-PRF, a new platelet concentrate rich in leukocytes, can stimulate the regeneration of both soft and hard tissues.[2-5]

Its liquid state, which lasts approximately 15 minutes post-application, provides dental practitioners with an alternative, practical form of PRF [5-9]. Upon application, the liquid fibrinogen in I-PRF gradually forms a PRF clot rich in growth factors, which are released continuously over 10–14 days [6]. Moreover, I-PRF has demonstrated significant anti-inflammatory and antimicrobial properties, which may accelerate tissue regeneration [1-7].

The aim of this review was to present the new possibilities offered by the use of i-PRF in the field of dentistry.

Composition of PRF;

Three Dimensional Structural Design and Cell Composition of PRF The slow fibrin polymerization manner of PRF and cicatricial capacity forms a physiologic structural design which foster wound healing.39 Equilateral junctions (Connected trimolecular) allows the organization of a flexible and ine fibrin network to hold up cytokines enmeshment and cellularmigration. This 3-dimensional structure gives great elasticity to the fibrin matrix which is seen in elastic, flexible and strong PRF membrane .[7-14]

In comparison platelet rich plasma shows abrupt fibrin polymerizationdepending on the amount of surgical additives (calcium chloride and thrombin) and bilateral junctions (Condensed tetramolecular) are created with strong thrombin concentrations and allow the thickening of fibrin polymers leading to the development of a inflexible network, critical to cellular migration and cytokine enmeshment40. The biochemical study of the PRF composition shows that this biomaterial is formed by assembly of

glycanic chains, cytokines, and structural glycoproteins (fibronectin) enmeshed within a slowly polymerized fibrin network . [1-12]

PRF has a dense fibrin network with leukocytes, cytokines, growth factors such as Platelet derived growth factor (PDGF), Transforming growth factor (TGF _1), Vascular endothelial growth factor (VEGF) and glycoproteins such as thrombospondin-1. Leukocytes that are more in number in PRF scaffold have a fundamental role in growth factor release, anti-infectious activities, immune regulation, and matrix remodeling during wound healing.[1-5]

The L-PRF contains the vast number of the platelets and half the count of leukocytes present in the initial blood collection. Platelets are by and large activated and perform as a cement to sustain the strongly polymerized fibrin matrix. The platelets GF are entrapped within the fibrin network.

With this structural design, L-PRF is the resource of growth factors which are released slowly in more than 7 days in vitro.[1-9] In the migration and adhesion of the platelets, Vitronectin and Fibronectin both are main proteins that take part in a very important function. Initially there is slow liberation of the fibronectin over a period of 1 week, i.e. the free fibronectin from the exudates and afterward is replaced by the fibronectin from the PRF membrane further, during the first four hours vitronectin is

released from the PRF membrane, followed by almost a insignificant release over the next week.[12-19]

Role of Fibrin Matrix

1. Natural guide of angiogenesis.

2. Natural support to immunity.

3.Guides the coverage of injured tissues, affecting the metabolism of

epithelial cells and fibroblasts.38

Cell composition of PRF Platelet Cytokines

1.Transforming growth factor- _ (TGF_-1)

2. Platelet derived growth factor (PDGFs)

3. Insulin like growth factor (IGF)

Leucocyte and Cytokines

Inflammatory Cytokines 40

1. Interleukin-1_ (IL-1_)

2. Interleukin-6 (IL-6)

3. Tumour necrosis factor -_ (TNF- _)

Healing Cytokines 40

1. Interleukin-4 (IL-4)

2. VEGF

TGF_-1.

1.TGF_-1 is the chiefly produced isoform of TGF-_. It represents the most powerful fibrosis agent among all cytokines .

2. It stimulates fibroblast chemotaxis as well as the production of collagen and fibronectin by fibroblast.

3. It inhibits collagen degradation by decreasing proteases and increasing protease inhibitors, all of which favour fibrogenesis.

4. Further, TGF-_ brings about chemotaxis and mitogenesis of osteoblast precursors while also stimulating osteoblast deposition.

5. It inhibits osteoclast development and bone resorption, thus favor boneformation over resorption.

PDGFs

1. PDGF the first growth factor present in a wound and it starts connective tissue healing, including bone repair and regeneration.

2. PDGFs are crucial regulators for the migration, proliferation and survival of mesenchymatous cell lineages .

3. PDGF activities are mitogenesis (increase number of healing cells), angiogenesis (endothelial mitoses into functioning capillaries), and macrophage activation (debridement of the wound site and a secondary phase source of growth factors for continued repair and bone regeneration).

4. Every single platelet has 1,200 molecules of PDGF in it. Therefore, a greater concentration of platelets as seen in PRF can be expected to have a profound effect on wound healing enhancement and bone regeneration .

IGF

1. IGFs I and II are positive regulators of most cell types for proliferation and differentiation, including tumor cells. They have major role in apoptosis regulation. IL-1_ 1. IL-1_ remains the prevalent isoform and is a key mediator of inflammation control. Its main activity is the stimulation of T helper lymphocytes. In combination with TNF-_, IL-1 leads to osteolysis, i.e. it activates osteoclasts and inhibits osteoblasts.

1.IL-6 was initially originally recognized as a B cell differentiation factorwhich induced the maturation of B cells into antibody producing cells. Within the B lymphocyte populations, IL-6

,significantly stimulates the secretion of antibodies by 120–400 times.

2. In addition, IL-6 is an essential accessory factor for T cell activation and proliferation. IL-6 induced not only proliferation but also induce differentiation of cytotoxic T cells in the presence of IL-2 from murine and human thymocytes and splenic T cells .

3. IL-6 has positive effect on hematopoiesis and was described by Ikebuchi et al in 1987. IL-6 and IL-3 act in a synergistic way to increase hematopoietic stem cell proliferation in vitro where IL-6 activates cells at the G0 stage to enter into the G1 phase .

4. IL-6 functions as a hepatocyte stimulating factor and induces expression of various acute phase genes.

TNF-_ 1

TNF derives its name from the ability to stimulate tumor necrosis and regression (Ikram et al. 2004). TNF_ is one of the initial cytokines seen during the inflammatory response to bacterial endotoxin. TNF-_ stimulates the remodeling capacities of fibroblasts and activates monocytes. It also

promotes phagocytosis, neutrophil cytotoxicity and modulates the expression of key mediators such as IL-1 and IL-6 .

IL-4

IL-4 induces differentiation of naive helper T cells into .TH2 cells (Goldsby et al. 2003). IL-4 also leads to proliferation and differentiation of the activated B cells. During inflammatory phenomena, it supports healing by moderating inflammation ,

Moreover, IL4 is a potent inducer of Interleukin1 receptor antagonist (ILRa), which contributes to its anti-inflammatory actions by neutralizing the biological effects of IL1 .

VEGF

VEGF is considered as a master regulatory molecule for angiogenesis related processes. Factors like IGFI and IL1_ regulate angiogenesis byupregulating the expression of VEGF .

It plays a straight job in the control of endothelial cell behaviors, such as proliferation, migration, specialization or just survival .

PRF PREPARATION TECHNIQUE;

Choukroun et al. 2001 proposed a protocol to prepare PRF in Nice, France 47.He has given a very simple protocol and easy to use. To prepare requirements are:

1. Table with fixed centrifugation machine,

2. Glass Test tubes with a capacity of 10-mL

3. Blood collection armamentarium.

PRF formation advantages are:

1. It requires a spinning process at once.

2. No need for additive bovine thrombin.

Protocol for Preparation;

Collection of blood is carried out in 10 ml of test tubes. Then centrifugation process is undertaken for 10 minutes at 3000 rpm 48. Many authors reportedits preparation with the same protocol but for 12 min at 2700 rpm .Following procedures for preparation of PRF is given below:

1. Collected of patients owns blood from anticuboidal vein of the patient.

2. Placement of test tube for centrifugation to allow spin immediately for the protocol period,

3. Formation of various layers of the blood sample get settles.

Activation of platelets occurs because of an absence of anticoagulants. There is a formation of blood clots due to contact with the test tube.

Initially, blood coagulates at the upper layer in the test tube until thrombin

converts it into a fibrin meshwork .

Facets of preparation of PRF

1. Ideal centrifugation parameters for PRF preparation

2. Ideal centrifuge machine for the preparation of PRF

3. Blood collection tubes for preparation of PRF and Liquid PRF

4. Time of initiation of centrifugation

5. Preparation of PRF and Liquid PRF

Ideal centrifugation parameters for PRF preparation;

A-PRF + protocol, that is (200 g for 8 min), has been found to produce a fibrin clot with the highest platelet and WBC count and highest overall cumulative growth factor yield. C-PRF (700 g for 8 min) is the most optimum protocol for preparation of liquid PRF. Ghanaati et al.49 in 2014 performed a histopathological analysis of PRF clot produced using the traditional L-PRF protocol and found that most of the cells were accumulated at junction of the clot and the RBC layer or in the RBC layer.

Fujioka-Kobayashi et al. showed that low-speed protocols of APRF and A-PRF + release much higher cumulative quantity of growth factors like (EGF, VEGF, TGF-b1, PDGF-AB etc.) over a period of 10

days. Miron et al. evaluated the distribution of platelets and WBC when PRF was prepared using different protocols. They found a much more even distribution of platelets and WBCs with A-PRF and A-PRF+ protocol.[19-25]

Fujioka-Kobayashi et al. also studied the growth of human gingival fibroblast when cultured with different PRFs. A-PRF+ Protocol showed the highest cumulative growth factor release and the highest Levels of human fibroblast cellular migration, proliferation and the highest collagen type I

production at days 3 and 7.

Miron et al showed that a liquid PRF could be produced by reducing the centrifugation time and speeds (60 g for 3 min). Authors named it I-PRF or injectable PRF. This new form of PRF was very versatile as it could now be injected before forming the clot. However, because of the smaller

centrifugation time and speed in, only two- to three-fold increase in platelets and 1.5-fold increase in leukocyte concentration could be achievedin I-PRF.[25-32]

Comparatively PRP could achieve a fivefold amplification of platelet concentration. A liquid formulation of PRF with much higher platelet concentration was required. Ghanaati et al 49 and Fujioka-Kobayashi et al.50had previously shown that using the original L-PRF protocol, that is 700 g

for 12 min, nearly all the WBCs and platelets were concentrated at the buffy coat layer, whereas almost no platelets in the layers above that.[21-34]

This could be used as a method to concentrate platelets in the form of liquid PRF. Miron et al.53 showed that a nearly 10-fold increase in platelet concentration could be achieved if liquid PRF was prepared using the original L-PRF protocol. This was later termed Concentrated PRF or CPRF.

This method requires spinning the blood at 700 g for 8 min and 0.3– 0.5 mL layer just above and including the buffy coat is taken.

Later, the same authors studied and compared I-PRF and C-PRF on growth factor release and collagen production by cultured gingival fibroblasts.

They found almost two- to threefold higher increase in growth factor released during 10 day period and a further fourfold increase in gingival fibroblast migration and collagen type I synthesis in the C-PRF arm when compared with the original I-PRF.[4]

It is recommended to use C-PRF protocol for when using liquid PRF for various indications. On comparing I-PRF to PRP, I-PRF was found to have a higher long-term release of growth factors. Although PRP showed a significantly higher cellular proliferation, I-PRF showed higher cell

migration and collagen 1 expression at day 3 and 7 when compared toPRP.51

Preparation protocol of i –prf

1. In line with Mourao et al. Collect 9 ml of unpreservatived autologous blood in a test tube. After that, it was centrifuged for 2 minutes at 3300 rpm, forming the orange-colored fluid into the tube known as I-PRF 60.

2. In line with Miron RJ et al. Without using any additional anticoagulants, collect autologous blood in disposable tubes. After that, it was centrifuged at 700 rpm for 3 minutes. Plastic tubes' hydrophobic surface prevents the coagulation process from being efficiently activated. Thus, all of the blood's clotting components and platelets necessary for the creation of platelet concentrate arrive in the tube's top zone during the first two to four minutes of centrifugation. Together, these seperated platelets and plasma together are located at the upper layer in light yellow color used in injectable form .

3. In accordance with Al-Maawi et al. According to the low-speed centrifugation idea, the test tube containing the collected blood was immediately maintained in the centrifuge at 600 rpm, 44 g for 8 minutes. After centrifugation, i-PRF was created, consisting of various blood components in the bottom zone and yellow-orange coloured components in the top zone .

4. Castro et al. 2019, Cortellini et al. 2018, updated the injectable PRF original technique. Test tubes with collected blood inside were spun in a centrifuge for 2,700 rpm for 3 minutes and 408 grams .63

5. According to Miron et al. 2019, the i-PRF was prepared using a horizontal centrifugation process at 200g for 8 min. Leukocyte and platelet concentrations are increased as a result, reaching 10.92 109 cells/L (178% original values) [6]. Injectable Platelet-Rich Fibrin (i-PRF) has revolutionized the field of implant dentistry by offering numerousadvantages in terms of bone regeneration, implant success rates, healing speed, reduced inflammation, and preservation of soft tissue. Its regenerative properties make it an invaluable adjunct to conventional dental implant procedures, enhancing patient outcomes and satisfaction. As research and technological advancements continue, i-PRF is expected to play an increasingly significant role in the future of implant dentistry, providing even better treatment options for patients seeking dental implant solutions. I-PRF is an autologous blood concentrate derived from the patient's own blood, rich in platelets, leukocytes, growth factors, and fibrin matrix. This biological material offers numerous benefits in implantdentistry, including its ability to accelerate wound healing, enhance soft tissue regeneration, and stimulate bone formation.[12-18]

PREPARATION OF PRF MEMBRANES;

Each fibrin clot concentrates most platelets (97%) and more than half of the leukocytes from a 9 ml blood harvest .The PRF clot is removed from the tube with a sterile tweezer. The fibrin clot is

separated from the red blood cell fragment, approximately 2 mm below the dividing line, using a scissor .The section of the blood clot attached to the fibrin clot contains the stem cells.

The PRF clots are placed in the Box grid (Process, France) or Xpression™Kit (Intra-Lock, Boca Raton, Florida) and covered with the lid.[1-12]

The PRF membranes are ready for use after 2 minutes. It provides a threedimensional matrix of platelets, leukocytes, and growth factors. A PRF membrane remains usable many hours after preparation, as long as the PRF is prepared correctly and conserved in physiologic conditions. Moreover, the use of the PRF Box, a user-friendly and inexpensive tool, allows for standardized preparation of homogeneous PRF membranes with a higher growth factor content, avoids the dehydration or death of the leukocytes living in the PRF clot, and also prevents the shrinkage of the fibrin matrix architecture . The concept of "the optimal PRF scaffold or composites," tailored for specific clinical applications, is still in a process of virtual development.[11-17]

Further clinical trials are required to validate this concept, and whatcentrifugal force and time is required to get the optimum PRF composite biomaterial for specific clinical applications. At this stage in time there isnot a single RCT or CCT to compare the effectiveness of any of the abovementioned PRF (A-PRF or L-PRF) protocols. Furthermore, in vitro studies that claim superiority or inferiority of a specific PRF preparation have not been validated by independent clinical trials. Therefore, based on these facts, no preference or distinction is made between any of the abovementioned PRF preparation protocols (A-PRF or L-PRF) in this review.[12-18]

TYPES OF PRF;

LEUCOCYTE-PLATELET RICH FIBRIN (L-PRF)

L-PRF resembles second-generation platelet concentrate. LPRF constituents of growth factors, platelets, leukocytes, and lymphocytes combine to form polymerized fibrin gel. The formed gel has achieved stability, resilience, strong, adhesiveness, and malleable. The obtained clot can be made into various shapes to adapt to anatomical defects. It can be applied as a bone graft or combines with other biomaterials also forms a membrane by compressing it .[3-4]

INJECTABLE PRF (I-PRF)

The production of this injectable formulation of PRF was with the goal of delivering to clinicians a simple to use platelet concentrates in liquid form which can be either employed alone or combined easily with many biomaterials. Taking advantage of slower and shorter centrifugation speeds,

an intense presence of regenerative cells with elevated concentrations of growth factors can be seen when compared to other formulations of PRF.

The i-PRF is designed by: 10 ml of whole blood accumulated in plain vacuum tubes with no use of anticoagulant was quickly centrifuged at 700 rpm for 3 min. The 1 ml top most upper plasma layer was then collected by needle and designated as i-PRF. Addition of i-PRF to particulate bone will

activate the polymerization in 15 min to develop red colored sticky bone.

PROPERTIES OF i –PRF;

1. i-PRF has been observed higher release of growth factor at the end of ten days such as Platelet-derived growth factor (PDGF) like PDGF-AA, PDGF-AB, Epidermal growth factor (EGF) and Insulin-like growth factor-1 (IGF-1) as compared to PRP

2. PRP and i-PRF demonstrated similar tissue compat-ibility

3. i-PRF demonstrated higher cellular migration.

4. Also, in cell culture, i-PRF induced significantly m-RNA expression of transforming growth factor (TGF-β) and collagen-1 at 7 days. This preliminary data hints that i-PRF may have comparative or slightly superior biologic properties as compared to that of PRP.

5. i-PRF is fibronectin which is an extracellular glyco-protein with a high molecular weight (approximately 440 kDa). Application of fibronectin to root surfaces improves cellular proliferation from the periodontal ligament towards the supracrestal parts.

6. The higher antimicrobial activity with I-PRF in case of Pg could be purely due to the higher concentration of platelets and other blood cells such as leukocytes in I-PRF as compared to the other platelet concentrates. This can be explained by Ghanaati et al. [39] concept of ' low-speed ' for blood centrifugation. He observed that low centrifugation speed contains a higher amount of cells with leukocytes before the fibrin clot develop-ment.

7. i-PRF has the bonding characteristics with the bone graft which permits proper adaptation of the defect area.

USES OF i –PRF;

i-PRF is being studied for its regenerative potential and re-lease of growth factors along with Anti- Bacterial activity against Porphyromonas gingivalis (Pg) and Aggregatibacter actinomycetemcomitans.[40,41] i-PRF using microneedle can be effective for increasing gingival thickness [42] which elu-cidates through neoangiogenesis, neocollagenesis and better wound-healing. The application of i-PRF may be improved the success of periodontal therapy in individuals with thin gingival phenotypes, gingival recession defect,[43] infrabony defects and furcation defect. The possibility of bonding of i-PRF with bone grafts provides an alternative to PRP as a platelet aggregate for bone regeneration. This enhances the bone quality and used effectively in grafting Dental Im-plants.[44] The use of i-PRF in local drug delivery is an easy and convenient way due to its liquid or polymerized form and also applied as root surface bio-modification on root coverage.[41-44]

ADVANTAGES;

1. It is in injectable form.

2. Can be used alone or in a combined form with various biomaterials.

3. The capacity of a high amount of regenerative cells with the release of more growth factors.

4. Formed a small fibrin clot with that worked as a dy-namic gel.

5. Additive role in releasing growth factors for about 10 days.

6. It decreases the probability of adverse reaction

REVIEW AND DISCUSSION;

ORAL SURGERY;

The utilisation of i-PRF in the context of oral surgery has been demonstrated to facilitate enhanced tissue repair and bone regeneration. In a case report by Giudice et

al., i-PRF injections resulted in the complete healing of oro-cutaneous fistulas within 50 days, demonstrating its capability to release growth factors and chemotactic

agents that are crucial for tissue repair processes [17].

Melek and Taalab's clinical trial investigated the utilization of i-PRF in conjunction with guided bone regeneration, demonstrating that i-PRF's elevated growth factor content facilitates more favourable bone formation at graft sites. This combination not only improves the predictability of bone regeneration but also helps to maintain the structural integrity of the alveolar ridge, which is crucial for successful implant placement [18,37-44].

In a further study, Dayashankara Rao demonstrated that the combination of i-PRF and autologous iliac crest bone resulted in a significantly enhanced rate of bone formation in alveolar clefts compared to the use of bone grafts alone. This combination also facilitated a reduction in the rate of bone resorption, thereby enhancing periodontal health in the vicinity of the grafted site. This is of particular benefit to patients with cleft lip and palate conditions [19]. Moreover, Gülşen and Dereci demonstrated that i-PRF-soaked collagen plugs used in sinus floor augmentation resulted in, substantial new bone formation. The continuous

release of growth factors from i-PRF improved the osteogenic environment, thereby facilitating enhanced bone integration at the site of implantation [20]. Furthermore, in vitro studies have demonstrated that i-PRF enhances osteoblast activity when combined with allogenic bone substitutes, indicating the potential for a beneficial impact on bone regeneration in clinical settings [6,37-44].

ENDODONTICS;

The number of studies investigating the use of i-PRF in endodontics is limited. Ibrahim et al. demonstrated that i-PRF revascularisation represents a successful regenerative treatment for mature permanent incisors with closed apices [32]. Similar positive outcomes were documented by Mansour and El Sawy, who observed the healing of periapical lesions with the use of i-PRF [33]. Furthermore, Agrawal et al. documented complete periapical healing and pain resolution when combining i-PRF with mineral trioxide aggregate [34-41].

It is proposed that liquid PRF may offer enhanced regenerative potential for human dental pulp cells in comparison to traditional PRP, facilitating odontoblastic differentiation and reparative dentin formation while reducing inflammation [35-42].

ORTHODONTICS;

The effects of i-PRF on orthodontic tooth movement have been examined in several randomised trials [21–23]. The accelerated bone remodelling facilitated by i-PRF allows for a more expeditious tooth movement within the dental arch [24]. Nevertheless, the use of i-PRF alone is not a guaranteed method of preventing root resorption or bone fenestrations [22]. The studies conducted by Alaa and colleagues and Ammar and colleagues demonstrated that i-PRF significantly outperformed PRP in accelerating orthodontic tooth movement, with i-PRF showing more sustained effects [25, 26]. Its application during orthodontic treatment is well tolerated, with minimal discomfort that typically subsides within 24 hours [27]. Furthermore, the retraction of the canines was observed to occur at a rate 1.8 times faster when i-PRF was used, accompanied by an increase in alkaline phosphatase levels shortly after the commencement of treatment [28-39]. Nevertheless, research conducted by Kushal and Niranjane has indicated that osteomicroperforation may be a more effective technique than i-PRF for accelerating orthodontic tooth movement [29,37-46]. Furthermore, animal studies have indicated that i-PRF facilitates cementum and bone formation, increasing the number of cementoblasts, cementoclasts, and new bone in expanded palatal.[37-446]

PERIODONTOLOGY;

In a systematic review, Niemczyk et al. demonstrated that i-PRF is an efficacious intradermal treatment for periodontitis, exhibiting considerable bactericidal effects against Porphyromonas gingivalis [36]. Fur-tures [30, 31,37].thermore, the utilisation of i-PRF in patients with thin periodontal phenotypes has been associated with augmented gingival thickness, indicating a prospective non-surgical approach for gingival tissue enhancement[8–10]. Similar conclusions were reached by Żurek et al. in their systematic review on this topic [11]. Pullishery et al. reported that i-PRF, whether used alone or in conjunction with other agents, has a beneficial effect on the reduction of plaque, the alleviation of inflammation, and the stability of gingival tissue, which may contribute to a reduction in gingival recession [12,13]. In a meta-analysis conducted by Kalburgi et al., it was demonstrated that i-PRF has the potential to enhance the outcomes of periodontal regenerative surgery Mahajan et al. observed that the combination of i-PRF and free gingival grafts (FGG) for gingival recession resulted in superior root coverage compared to FGG alone [14,37-46].

Similarly, the meta-analysis conducted by Gupta et al. demonstrated that i-PRF is an effective treatment for lichen planus, reducing pain and lesion size and significantly improving patient satisfaction [15]. In a split-mouth study, Saglam et al. demonstrated that i-PRF is as effective as injectable corticosteroids for the treatment of erosive lichen planus [16,37-46].

Conclusion;

PRF is the new generation of platelet concentrates and has potential applications in medicine and dentistry too. It can be used alone or in combination with grafts or other biomaterials. Although The mechanisms how growth factors work is not clearly understood yet, PRF shows to have beneficial outcomes and satisfactory clinical results giving new perspectives of treatment in dentistry field. Injectable platelet-rich fibrin has demonstrated considerable potential in a range of dental applications, largely due to its regenerative and anti-inflammatory properties. Niemczyk et al. emphasised its efficacy in the treatment of periodontitis and its bactericidal activity against Porphyromonas gingivalis. i-PRF has been demonstrated to thicken thin gingival phenotypes, potentially offering a non-surgical approach to gingival tissue augmentation. The findings of studies conducted by Pullishery et al. and Kalburgi et al. indicate that i-PRF has the potential to reduce plaque, gingival inflammation and attachment loss, while also enhancing the outcomes of periodontal regenerative surgery. The combination of i-PRF and free gingival grafts demonstrated superior root coverage in the treatment of gingival recession compared to the use of grafts alone. Furthermore, i-PRF has been demonstrated to reduce pain and lesion size in lichen planus, and to be as effective as corticosteroids in treating its erosive form. In the field of oral surgery, i-PRF has been shown to facilitate significant tissue repair, as evidenced by the findings of the study conducted by Giudice et al. on the resolution of oro-cutaneous fistulas.

CONFLICT OF INTEREST

The Authors declare no conflict of interest

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