Platelet-rich fibrin: Revolutionary boon to implant dentistry.

Arnab Pradhan[1], Sanjoy Karmakar[1], Saptarshi Mandal[1], Samiran Das[2], Soumadip Niyogi[3]
[1]PGT, Dept. of Prosthodontics and Crown & Bridge, Guru Nanak Institute of Dental Sciences and Research, Panihati, Kolkata.
[2]Professor, Dept. of Prosthodontics and Crown & Bridge, Guru Nanak Institute of Dental Sciences and Research, Panihati, Kolkata.
[3]Senior Lecturer, Dept. of Prosthodontics and Crown & Bridge, Guru Nanak Institute of Dental Sciences and Research, Panihati, Kolkata.

Abstract
Graft materials are utilized as scaffolds in defective surgical areas. Although, introducing platelet-rich fibrin (PRF) has multiple advantages over bone graft materials. PRF is a self generated biomaterial. It consists of growth factors or GFs and cytokines. It coalesces the fibrin sealing properties and GFs. This gives a classic condition for tissue regeneration and healing of the wound. The significant advantage of PRF is utilizes as self generated blood without extraneous thrombin. So, there is no immunogenic reaction. This article portrays the advanced application of PRF in the implant dentistry.

Keywords: Graft materials, PRF, Wound healing, Implant dentistry.

Address of correspondence: Dr. Arnab Pradhan, Suprava Appartment, 516 Purba Sinthee Bye Lane, Dumdum, Kolkata- 700030
Email address: - drarnabpradhan@gmail.com **Phone no:** 9064114326. **DOI:** 10.5281/zenodo.6986618
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Introduction

Platelet-rich fibrin is a fibrin-based autologous living biomaterial. It obtained from human own blood. Nowadays, a range of PCs has been developed and shown auspicious results. It assembles fibrin sealing properties and GFs in platelets. This provides a perfect environment for tissue regeneration and healing of the wound.[1] PRP is the primary generation PCs. It showed some complications during preparation. Cross-infection may occur due to utilization of bovine thrombin. So, more recent generation PCs- PRF has been developed.[2]

In cases of implants, PRF is used to enhance bone healing. Cytokines, GFs, cells are entrapped and should be escaped from the fibrin matrix (PRF) after a particular time. It can also function as an absorbable membrane. After activation GFs are escaped from the platelets. It invigorates the mitogenic response within the periosteum.[3]

Healing of defect in surgical area may be a eminent factor for healing of wound. Bioactive surgical additivities were used to accomplish the quantity of the defect, which control inflammation. It enhance the speed of the healing process. These have been extensively studied in implant dentistry, including various bone graft materials with proper surgical techniques. It invigorate the mitogenic response within the bone periosteum. So, it play a major role in reconstruct of the bone during healing of the wound. There are various outcomes in tissue regeneration.[4]

Key components of Platelet Rich Fibrin have been shown in Figure 1.

Evolution of patient blood-derived biomaterials:

Fibrin glue period:

- In 1970s, PRP was first used as "glue".
- Similar to the later day fibrin glue.
- Produced from platelet-poor plasma
- Constructive impact on regeneration of tissue.

• Positive impact on reconstruction of tissue.[5]

GF period:

Platelet-rich Plasma (PRP) and Plasma rich in growth factor (PRGF)-

• PRF is a repository for GFs. It would simplify regeneration of bone and healing of the wound.

• It transformed into a solid form before clinical use.

• This transformation is acquired by decrease the dispersion of GFs at the surgical site.

• In 1999, PRGF was developed by Anitua and associates.

• It eradicating leukocytes.[5]

The fibrin and leukocyte period – Choukroun's PRF:

• In 2006, introduced a supreme technique to simplify formulation of PRP.

•Also eradicate xenofactors.

•The result in the so-called Choukroun's PRF.

• It is taken from the patient's blood.

• It consists of a range of blood cells like :

• Stem cells

• Platelets

• B-lymphocytes

• T-lymphocytes

• Monocytes

• Neutrophilic granulocytes

• Growth factors

Blood concentrate period:

• Nowadays, blood concentrates have been introduced using various techniques.

• Depends on the force of centrifugation distinct cell types are dispersed distinctively. A-PRF and I-PRF (Injectable PRF) is produced by:

Deceasing the speed of centrifugation:

• Therefore, infiltration of leukocyte to the red blood corpuscle ratio is reduced.

• Leukocytes are rich in A-PRF and L-PRF.

In 2006, Concentrated growth factor or CGF has been introduced by Sacci.

• A centrifuge device is employed for the production of CGF that features a specially programmed spin cycle.[5]

The future - stem cell and regenerative bone period:

• PRF is often a novel source of hematopoietic stem cells. It may also play a significant role in regenerative tissue dentistry.

Preparation of PRF:

In 2000, Dr. Joseph Choukroun gave an insight about the PRF preparation technique. French Health Ministry authorized new PRF preparation technique where PRF is made ready without utilizing an anticoagulant during collection of blood.[6] For preparation of PRF, the blood sample is collected in 10 ml blood collection tubes by employing a butterfly needle from the patient without using anticoagulant. After the collection of blood, it's immediately centrifuged for 10 minutes at 3000 rpm on a table-top centrifuge. After centrifugation, three layers can be visualized within the test tube (Figure 2 and 3). The uppermost layer is made of acellular PPP (platelet-poor plasma), in the center is PRF clot, and collections of RBCs at the bottom of the tube. With sterile tweezers and scissors, the central layer of the prepared PRF clot is eliminated. Afterwards detached from the underneath RBC. Then it is transmitted to a sterile dish and kept in a refrigerator. According to Malathi K et al the junction of PRF to the RBC layer is rich in GFs; and for this reason, this region is conserved.[7]

Preparation of PRF membrane:

PRF membranes are often prepared by pinch out the fluid from the fibrin clot. The process involves removal of liquid from the PRF fraction by mechanical pressure between sterile gauze layers leading to formation a

reasonably solid, gel-like material. These are utilized as a filling material in defects. These are used as a suturing membrane for graft preservation.[8]

Other methods of preparing PRF membrane is by squeezing PRF clots in specially designed box, which after following a forms membrane of constant thickness and size alongside PRF exudate. It also holds GFs and specialized proteins which helps in enhancing attachment of cells to biomaterials and titanium and thus are often utilized for rinsing surgical sites, exhaustion of materials, graft material hydration and preservation of autologous grafts (Figure 4).[9]

Advantages of PRF:

1. Preparation is simple and cost-effective.
2. Bovine thrombin utilization is skipped. As a result, reduces the possibilities of cross-infection.

Bovine thrombin utilization could also be related to the antibodies production.[3]

3. Physiologic thrombin concentration can be achieved due to slow natural PRF polymerization with glass particles of the tube. While in PRP, certain advantages like sudden fibrin polymerization can be manipulated.[1]
4. Cytokine enmeshment and cellular migration is achievable due to fine and versatile three dimensionally stable structure of PRF. Tri-molecular or equilateral junctions in PRF which are attached to 3-D network.
5. It has encouraging effect on the natural defences of the body.[10]
6. Assist in achieving haemostasis.[10,11]

Roles in Implant Dentistry:

Clinical outcome can be improved in conditions like:

• During sinus lifting used as grafting material.
• Alveolar ridge preservation.
• Immediate post-extraction implant placement.
• Peri-implant tissue healing.
• Improving stability of implant.

Used as grafting material during sinus lift:

• As a filling material PRF can be used in sinus lifting.[12]
• Filling voids in lateral approach sinus lifting as a grafting material (Figure 5).[13]
• The PRF membrane is found to be a simply manipulated biomaterial substitution during sinus elevation. It cut back the healing time.
• Ability to slowly release growth factors of the fibrin matrix.[13]
• Proportionate mixing of PRF with bone allograft speed graft maturation.
• As a protective barrier PRF membranes can successfully cover the sinus membrane while grafting in window during osteotomy procedure. It guards the Schneiderian membrane. It reinforces healing by facilitate closure of wound.[14]

Preservation of Alveolar ridge:

• Filling the tooth extraction socket by PRF membranes promote healing of alveolar bone and maintains the width of the alveolar crest.[15]
• Utilized in compromised extraction sockets.
• PRF filled in the extraction socket gives a feasible beneficial option for site preparation for implant placement.
• Cystic destructions permit early regeneration of bone and gingival tissue essential for placement of implant.
• On the other hand, extraction socket is filled with bone substitutes and PRF mixture. a protective covering over the grafted socket (Figure 6).
• It can be useful while closure of gingival wound is impossible. It can also be used while closure of wound with sutures become difficult.

Immediate post-extraction implant placement:

• In the maxillary anterior region PRF is often selected as a biomaterial of potential healing with a therapeutic effect on tissues surrounding the implant.[17]

• The jumping gap surrounding the implant can be filled with PRF clot with bone substitute while performing immediate implant placement (Figure 7). [18]

• L-PRF or A-PRF membranes have special advantage to stimulate healing of bone and gingival tissue around the implant.

Management of peri-implant bony defects:

• Regardless of the defect, management of large defects surrounding implant with PRF and bone graft is more effective than flap surgery alone where bone loss is unavoidable (Figure 8).[19]

• For graft homeostasis and survival, the use of PRF is crucial for maintenance because sustained release of growth factors, leading to successful treatment outcome.[20]

• Using a CR: YCGG laser after debridement and detoxification of the defect a successful treatment outcome was reported. The defect was filled with artificial hydroxyapatite.[20]

Increasing the stability of implant:

• In the first period of healing, the application of PRF into the surgical site enhances the stability of implant. Application of PRF also helps in faster osseointegration.[21]

Conclusion:

This physiologic glue, which is a boon to dentistry, can be utilized solely or in collaboration with graft materials. It has wide range of utilization, like in periodontal defects, faster healing of extraction socket, in case of future implant placement, and in peri-implant areas. It's non-invasiveness and clinically proven lower-risk in surgical procedure make it a suitable alternative to bone substitutes in implant dentistry.

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FIGURES

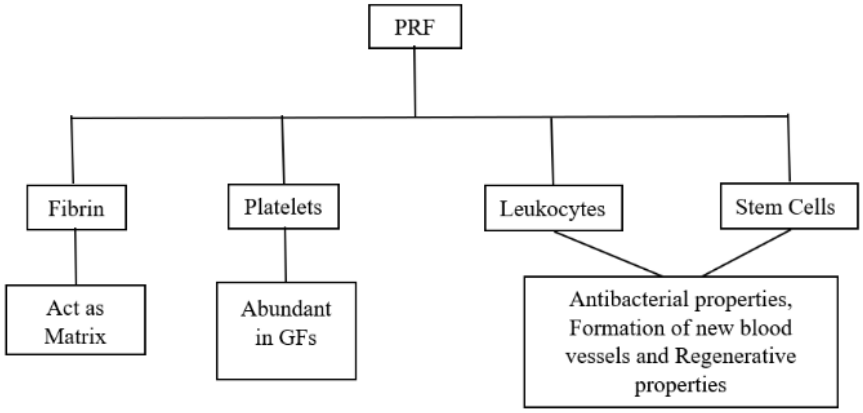

Figure 1

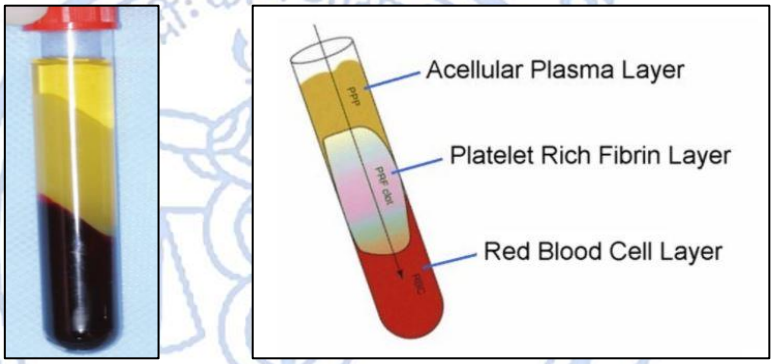

Figure 2

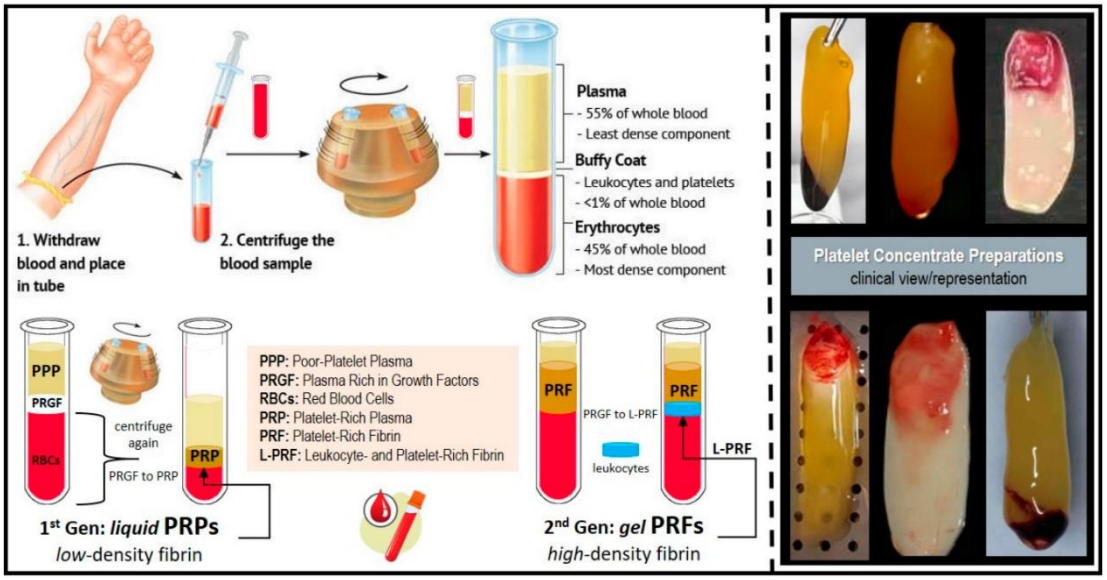

Figure 3

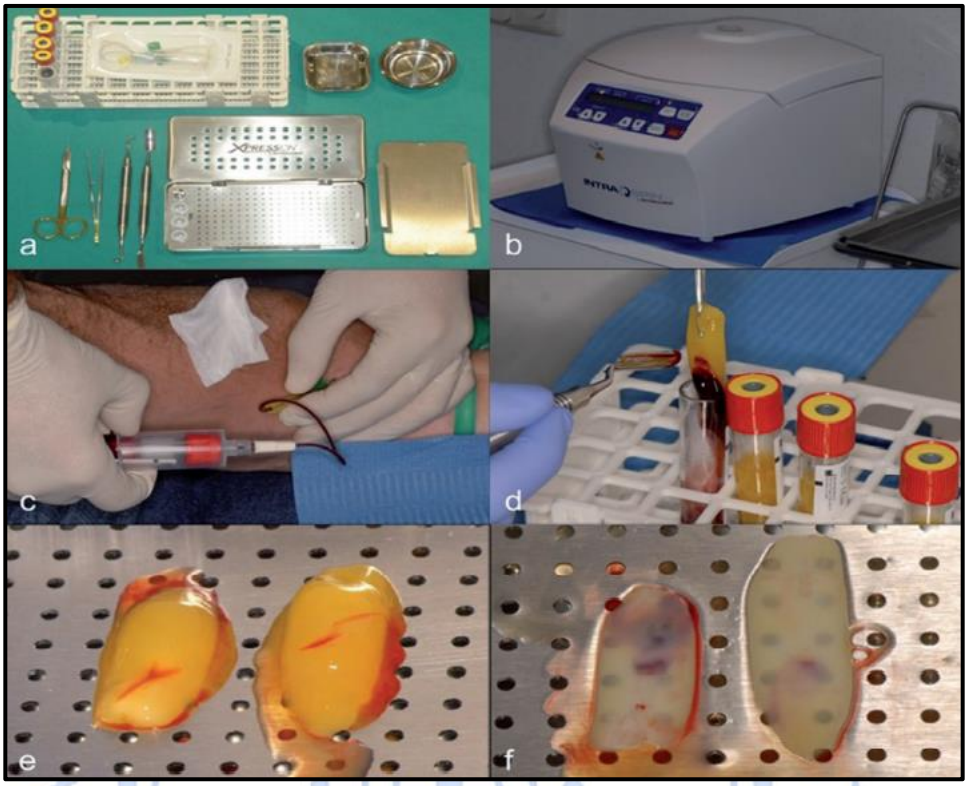

Figure 4

Figure 5

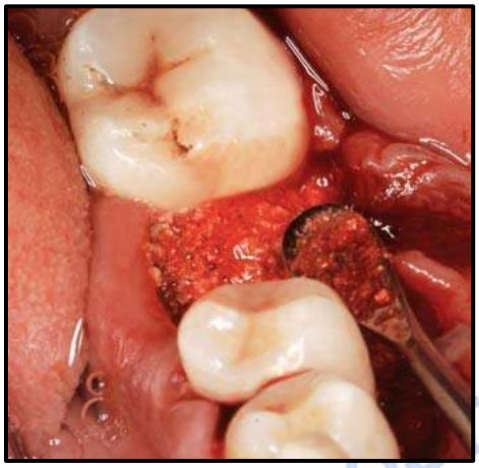

Figure 6

Figure 7

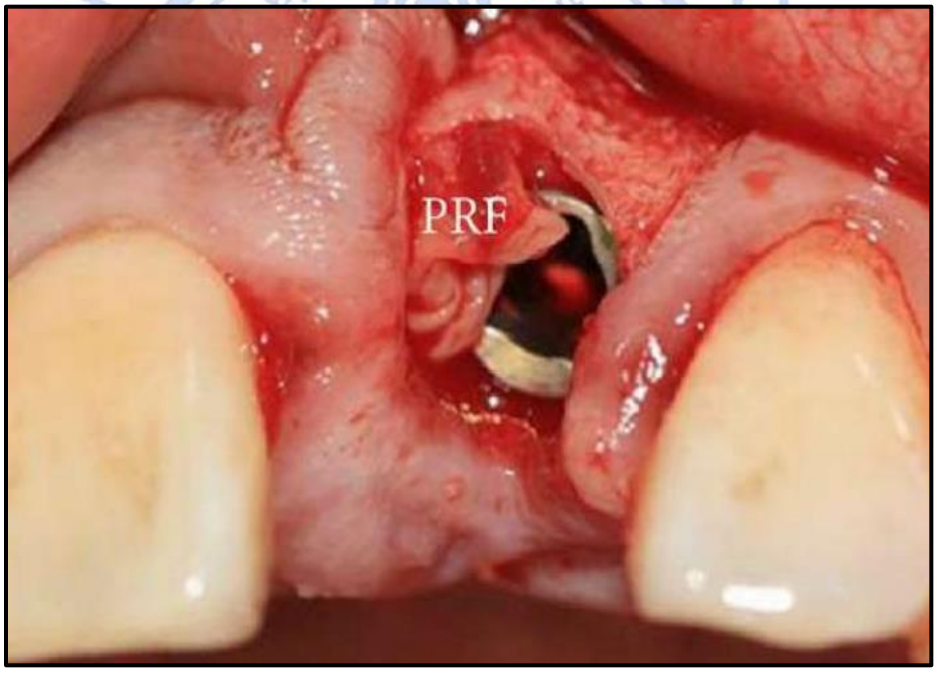

Figure 8