Original Article

Versatile Platelet Rich Plasma: Various Uses Of It

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Abstract

Prior to implant placement, augmentation may be necessary for severely atrophied or edentulous maxilla. As activated platelets release autogenous growth factors (GFs) into the wound healing site, this stimulates healing. Platelet rich plasma (PRP) has been proposed to improve and increase the healing of bone transplants. Numerous methods have been developed over the past few years to enhance the quantity and the quality of bone in preparation for the implantation of oral implants for oral rehabilitation. Autogenous bone is still the benchmark. Platelet-rich plasma is one of the supplementary procedures for bone augmentation. In a publication published in 1998, Marx et al. established this idea for clinical use. In this article, we emphasize on the use of PRP in dental implantology and examine and explain the method of particulate bone and PRP in patients. In addition, we were keen to investigate the early thrombotic events that PRP and whole blood caused on an implant surface as well as the utilisation of PRP to speed up bone repair surrounding dental implants.

Keywords: Platelet Rich Plasma (PRP), Dental Implants, Bone Regeneration, Fibrin Glue, Studies on PRP

INTRODUCTION:

Edentulism is referred to as the final indication of disease burden of oral health and is one of the public health problems for both young and old people.[1] For wellbeing and a good quality of life, adequate dentition is absolutely necessary. As the edentulous maxilla and mandible atrophies, the soft-tissue profile significantly alters and frequently calls for ridge augmentation to improve the masticatory function of prosthetics. By introducing significant advancements like dental implants, that have radically changed the way that oral rehabilitation is done traditionally, modern dentistry attempts to restore the masticatory efficiency, performance, and capacity.[2] Using dental implants to restore physiological function in patients who are completely or partially dentate is now seen to be the best course of action.[3]

For more than 30 years, research has focused on the use of endosseous implants in conjunction with edentulous jaw augmentation surgeries.[4] Clinicians and patients have had issues with the absence of jawbone volume and the effects of unfavourable forces acting on the implant supra-construction. The bone that is still present between the mental foramina makes it possible to treat the edentulous mandible, which is frequently atrophied. The severely resorbed edentulous maxilla, however, has significant restrictions because of anatomical markers including the nasal cavity, maxillary sinus, and the incisive canal, aside from being thought to be more challenging to treat with long-term implants.[5][6] Numerous methods have been developed over the years to increase bone volume and quality in preparation for the implantation of oral implants for oral rehabilitation.[7][8]

EDENTULISM AND ORAL HEALTH:

Having a major impact on residual ridge resorption, edentulism is a crippling and irreversible disorder that finally results in numerous anatomic degenerative alterations.[9] The loss of teeth is thought to have a significant impact on oral mucosal functional and neurophysiological deficiencies, such as decreased masticatory function, angular chelitis, altered facial features, oral dyskinesia, etc.[10]

Implant therapy is regarded as a dependable treatment with excellent long-term benefits to combat these degenerative and dimensional alterations. Implants are medical devices that are surgically inserted into the jaw to preserve the width and height of the bone after tooth loss in order to enhance or maintain face aesthetics, retention, function, and prosthetic retention and performance. An unloading healing period was historically thought to be necessary for implant osseointegration. [11] But, now with advances in implantology, implant stability is primarily dependent on the mechanical characteristics of the original bone (quality and quantity), the type of implant (geometry, diameter, length & surface characteristics), and the surgical techniques employed. And secondarily stability is enhanced by peri-implant bone

formation through gradual bone remodelling and osteoconduction of various existing and newly designed biomaterials. [12]

Platelet rich plasma (PRP): Even though autogenous bone graft remains the gold standard, intense research is continually looking for more efficient ways to enhance the bones. Platelet-rich plasma is one of the supplementary treatments for bone augmentation. After Whitman et al. [13] and Marx et al. [14] published their findings, PRP became more widely used in surgical procedures because it improves bone graft healing and implant integration by releasing autogenous growth factors into the wound healing site.

An autologous concentration of platelets achieved by sequestering and concentrating platelets using gradient density centrifugation is generally referred to as platelet-rich plasma.(Fig.1) The 38% platelet concentration seen in PRP provides concentration growth factors that the cells of the grafts may respond to, which promotes quicker healing. PRP is created by centrifuging peripheral blood, which, when combined with thrombin and calcium chloride, generates a gel-like substance comprising plasma, platelets, and leukocytes, forming an upper plasma layer and an intermediate buffy coat. [15] A variety of growth factors with chemotactic, mitogenic, and differentiation characteristics are induced and released from the -granules once platelets are activated. Instead of limiting the impact by utilising a single growth factor, the multiple factors together mimic the complex situation of natural tissue repair and improve the process such as immune response, angiogenesis, and inflammation. There is also evidence of antimicrobial potential,[16] and the survival of sensory neurons due to presence of multiple neurotrophic factors that act synergistically or in a defined sequence.[17][18]

To avoid contaminating the blood during the preparation of the PRP, aseptic handling conditions must be followed, and special care must be paid to the materials being used. This needs a good blood bank infrastructure and a competent professional. Both general-purpose and platelet-concentrating cell separators can be used in the preparation of PRP. It is not advisable to use different protocols to obtain PRP because they may cause different biological reactions. Instead, care should be taken, and a number of factors should be taken into account, including the quantity of platelets, the amount of growth factors, and the concentration of leukocytes and erythrocytes in order to successfully prepare PRP.

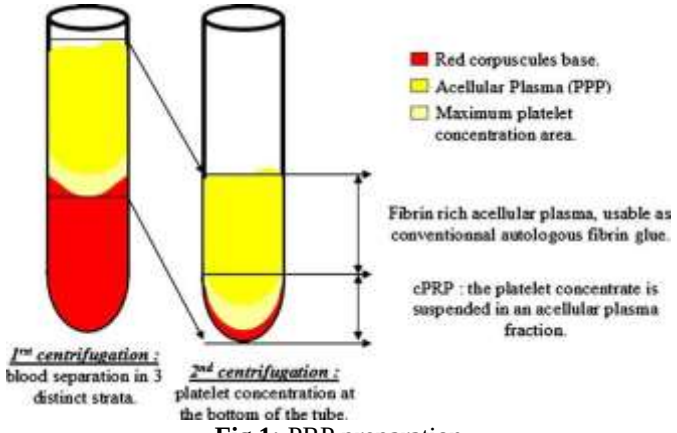

Fig 1: PRP preparation

Findings Regarding PRP in Animal Models: Paradoxical findings have been obtained from numerous evaluations of PRP's effects. The solution was used with implants, and the researchers noticed that platelet rich in growth factors obtained after centrifugation displayed a significant rise in BIC. [19] When PRP was recommended as a topical application of implants prior to implantation, Zechner et al.[20] saw a quick healing response. Numerous studies show that using PRP significantly speeds up the healing process and has good effects on either or both bone and soft tissue repair. These studies demonstrated improved bone regeneration. [21][22][23]

Authors have, however, also argued that there is little to no benefit from PRP treatment, which is contrary to the majority of scientific evidence. [24][25] When the implants were soaked in PRP before to implantation in their study on rabbits, Weibrich et al. [26] were unable to achieve high BIC values. Casati et al.[27] found that the dental bone density utilising the grey level values had no impact on regeneration when using the buccal dehiscence implant defect model in dogs and randomly filling the defect with PRP or blood as a control. The experiment's design or the too-short follow-up time, which prevented researchers from recognising the true variations in new bone, could have an impact on the study's findings.

Quantifying dental bone density and the PRP effect in dental implantations has only been tried in a small number of studies. In three distinct types of dental implants that were inserted into dogs, Gatti et al. [28] examined the change in bone density based on the grey level values around the implant. With and without PRP, Kim et al. [29] employed freeze-dried bone and plaster of paris that resembled dentin as filler material, and they discovered that PRP improved the results in terms of BIC. In rabbit calvarial defects filled with PRP as opposed to fibrin or blood, Jakse et al research's [30] revealed a non-significantly larger amount of newly produced bone. When used as rhBMP-2 delivery models, fibrin and PRP significantly boosted bone growth in the defects.

Effect of PRP on Peri-Implant Osseointegration: In general, guided tissue regeneration (GTR) utilising membranes has been used to treat periodontal abnormalities. PRP and bovine porous bone mineral (BPBM) have been combined with GTR and analysed by several writers. It is challenging to determine the impact of PRP, even though studies consistently demonstrate that practically all groups - test or control- heal well from flaws.

In a peri-implant defect, Ito et al team's [31] employed precultured dog mesenchymal stem cells (dMSCs), obtained by an iliac bone biopsy, together with PRP and fibrin. With a BIC of 25%, 49%, and 53% after 2, 4, and 8 weeks, respectively, they declared the experiment a success. They also investigated how dMSCs and PRP compared to autogenous bone and bone substitute (Bio-Oss®) in terms of their ability to repair bony deformities. After 10 months, the regenerate bone was examined and contrasted with the original bone. The newly created bone was mature and had better hardness test results compared to those of the other groups, according to the histology and mechanical characteristics of the bone.

Wojtowicza et al.[32] studied the regeneration of the maxillary alveolar process after PRP use in a 17-year-old patient who had lost the upper central incisors together with the alveolar bone because of a car accident. The regenerated bone was analyzed after 10 months and compared to the intact bone using the Fourier and fractal analysis of radiograms. Fractal analysis of intact and regenerated bone showed a higher fractal dimension for the intact bone in comparison with the regenerated bone, confirming a lower complexity of the newly formed trabecular structures. In dog mandibles, Choi et al research [33] found that autogenous bone grafts containing PRP remodelled more slowly than defects that were just filled with grafts. According to the study's findings, the early improved healing and greater amount of new bone formation is achieved by removal of the non-viable grafted bone.

Sammartino et al.'s [34] investigation of the split mouth design method and PRP's potential to treat periodontal defects. 18 individuals with surgically removed bilateral mesioangular third molars, a probing depth (PD) of less than 7.5 mm, and a probing attachment level (PAL) of less than 6 mm were used in the study. PRP can cause "substantial observable bone regeneration," according to the study, which found a significant (P 0.05) decrease in PD and PAL for the test locations. 88 patients with mandibular continuity deficits were enrolled in Marx et al.'s study[14] and randomly assigned to receive autogenous bone grafts with or without the inclusion of PRP. PRP was used to correct the problems because it had high quantities of TGF- and PDGF and positive TGF- and PDGF receptors. When comparing test and control groups, the authors observed a twice more rapid maturation of the PRP treated defects.

Based on a rather small number of observations, Anitua[35] reported that he saw positive effects on bone integration and adjunctive soft tissue healing in patients after introducing PRP into implant sites before installation. Monov et al.[36] used a split mouth setting, where PRP was inserted into the implant site in the posterior mandible before placement of implants. The same procedure was performed in the other site, but here no PRP was added. The implants were followed with RFA from installation up to 44 days. No differences between sides were seen. Additionally, the authors reported that the values of implant stability quotient (ISQ) between days 0 and 4 were reduced significantly in both groups. [37]

PRP in Cosmetics: Platelet-rich plasma (PRP) has been receiving considerable attention in the field of dermatology since the elucidation of its mechanism and reports of its clinical efficacy. PRP alone or in combination with other therapies has demonstrated benefits for some cosmetic problems and skin diseases.
Skin aging results in wrinkles, coarseness, pigmentation, and loose skin. PRP can induce remodelling of the extracellular matrix (ECM). This increases the expression of matrix metalloproteinases to remove photodamaged ECM components and stimulates the proliferation of dermal fibroblast and synthesis of collagen. [38] However, the PRP-mediated skin rejuvenation is not dose-dependent. Recently, 5% PRP was reported to induce the production of procollagen Type I carboxy-terminal peptide more strongly than 10% PRP. Botox works to relax the facial muscles so that you can be left with smoother skin without wrinkles and fine lines. PRP, on the other hand, uses your own blood to stimulate the skin on your face so that new, healthier skin cells can grow.

The mechanism of PRP treatment in relation to hair folliculogenes is and hair cycling has only been partially elucidated. The effect of PRP on the yield of follicular units in male baldness surgery was observed for the first time by Uebel et al [39] in 2006; they reported a significant improvement over conventional technique. Stevens et al [40] reported the positive effect of booster injections with PRP and an adipose-derived stromal vascular fraction, or “platelet-rich stroma,” in male patients with AGA. Hair density significantly increased at six and 12 weeks after injection. Only a few transient or short-term side effects have been reported with the use of PRP.

CONCLUSION:

PRP preparations have been proposed for various use in dental and oral surgery. The ease with preparation might be helpful to the dental professional in many surgical procedures, and their safety might encourage their wide employment. A lot of clarifying scientific work has been published giving promising results using PRP in regeneration and reconstructive dental procedures like sinus lift, bone defects, implant osseointegartion, cosmetic procedures, etc. Since it is free from potential risks to patients, not difficult to obtain and use, PRP can be employed as a valid adjunct material to many procedures However, controversy exists with respect to the clinical use of combining PRP with bone grafts for

enhancement of bone healing. Furthermore, there is a need for experimental and clinical studies to support the use of PRP in current practice.

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