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COMPARATIVE ANALYSIS OF OSSEOINTEGRATION WITH OR WITHOUT PRF (PLATELET RICH FIBRIN) IN ORAL IMPLANTOLOGY- A RANDOMIZED PROSPECTIVE CLINICAL STUDY

Dental Science

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ABSTRACT

INTRODUCTION: Dental rehabilitation of partially or totally edentulous patients with dental implants has become a popular treatment modality with reliable long-term results. These days' new methods are being used to improve the quality of osseointegration. Platelet Rich Fibrin (PRF) is a second generation platelet concentrate which is a new biotechnology, it has been suggested to be of great use in implant dentistry as it can enhance the quality of osseointegration. Various studies show that it improves healing of both hard as well as soft tissues.

Aim : To compare the quality of osseointegration using platelet rich fibrin over conventional implant placement.

Materials & Methods : 40 dental implants were placed in total for this study. 20 implants each were placed with PRF (Goup A) and without PRF (Group B) in the osteotomy site. After three months CBCT was done to evaluate and compare the quality of osseointegration between the 2 groups measured in gray value using the Galileos Implant Software- Sirona.

Result: Mean values obtained were ≈1928 in group A (with PRF) and ≈1734.6 in group B (without PRF). Independent Samples T-Test showed a significant p-value of 0.013 (p-value>0.05).

Conclusion: Results from our study show that PRF can play a promising role in the quality of osseointegration when used as a biomaterial in oral implantology. Our study provides a basis for future research with larger sample size and longer follow-ups to elucidate this outcome further.

KEYWORDS

Platelet Rich Fibrin, Implant, Osseointegration, Multiple teeth.

INTRODUCTION

Dental implants have become a popular treatment modality in recent times, with predictable long-term results for rehabilitation of partially or totally edentulous patients. Being next to natural teeth, dental implants have gained a great fame both amongst the clinicians as well as patients in a very short time. Once osseointegrated they have got better stability and life as compared to removable or fixed dentures. Achieving good osseointegration plays a major role in the long term stability of the implants; therefore these days' new methods are being used to improve the quality of osseointegration. Inspite of using correct surgical protocol and procedure there are still quite a few instances of implant failure in oral implantology.[1,2] Surgeons are constantly looking for a "breakthrough" that can act as a catalyst to the healing process to maximize predictability as well as the volume of regenerated bone. Platelet Rich Fibrin (PRF) is a second generation platelet concentrate which is a new biotechnology, it has been suggested to be of great use in implant dentistry as it can speed up and enhance the quality of osseointegration. Different studies show that it enhances the healing of bone. [3,4]So our study focuses on comparing the quality of osseointegration using platelet rich fibrin in dental implant placement over conventional implant placement.

MATERIALS & METHOD

A prospective research was designed with a follow up of 1st week, 1st and 3rd month postoperatively. All the patients who reported to the outpatient department for replacement of missing teeth or for extraction of a non-restorable tooth along with its replacement were taken for this study according to the inclusion and exclusion criteria.

INCLUSION CRITERIA:

1. All patients above the age group of 16 years;
2. Patients who need replacement of single or multiple teeth in the anterior or posterior region of the maxilla and mandible;
3. Presence of non-restorable teeth due to trauma, caries, root resorption, root fracture, endodontic or periodontal failure.

Exclusion criteria:

1. Medically compromised patients
2. Patients having craniofacial syndromes.

Sample Size

40 dental implants were placed in total. 20 implants each placed along with PRF (Platelet rich fibrin) [Group A] and without using PRF [Group B]. Patients were followed-up immediate post operatively, at 1st week, 1st month, and 3rd month. During follow-up period, the patients were assessed radiologically using CBCT by comparing their quality of osseointegration (in gray values) and amount of crestal bone loss at the end of 3rd month, and clinically for pain, implant exposure, infection, mobility and wound dehiscence .

Procedure

For Group A [Fig. 3-15] blood was drawn from the patient and is taken without anticoagulant in 10-mL glass coated plastic tubes that were immediately centrifuged at 3000 rpm for 10 minutes. After processing, 2 distinct samples will be collected [Fig. 1]. The supernatant layer represents platelet poor plasma (PPP) or acellular plasma, and PRF clot with an exudate trapped in the fibrin meshes [Fig. 2]. In order to collect it, we leave the PRF clots in a sterile metal cup for 10 minutes approximately to let them slowly release the serum contained therein [Fig. 8]. PRF is then obtained in the form of a membrane by squeezing out the fluids from the fibrin clot.[4] This is applied to the osteotomy site before placing the implant [Fig. 10]. Then the implant was placed and final closure was done. Post-operative instructions were given to the patient. The implants were placed similarly in Group B [Fig. 16-25] but without using PRF. The patients were recalled after one week for suture removal. This was followed by a 3 month waiting period. After which CBCT was done to evaluate the quality of osseointegration measured in grayvalue using the Galileos Implant Software- Sirona.

RESULTS:

BONE DENSITY IN GRAY VALUE (post operative CBCT after 3 months)

Table 01. Comparison of mean bone density around implants placed with and withour PRF postoperatively at the end of three months (Graph 01)

Group	N[a]	Mean Bone Density	Sd[b]	Mean Difference	Independent Samples T-Test	
					p-value	Significance
Group A (with PRF)	20	1928	75.31	-18.4	0.013	Significant
Group B (without PRF)	20	1734.6	78.25			

[a]**N – Number**
[b]**SD – Standard deviation**

The comparison of mean bone density around implants using CBCT (Gray value) between the two groups was done at the 3rd month using the **Independent Samples T-Test.** There was a ***significant (p-value>0.05)*** difference seen between the two groups.

PAIN

All the patients were evaluated for pain using Visual Analogue Scale (VAS) (0-10). The pain values ranged from 0-2 immediately postoperatively which lasted for one week. No patient had pain on subsequent follow ups.

IMPLANT EXPOSURE

No patients showed implant exposure at 1st week, 1st month and 3rd month follow-up in Group A, but it was present for 1 implant placed in Group B at 1st month and 3rd month.

INFECTION

All the implants were assessed clinically for infection according to surgical site infection criteria, none of the implants had signs of infection in both the groups.

MOBILITY OF IMPLANT

No patients showed mobility at 1st week, 1st month and 3rd month follow-up in Group A, but it was present for 1 implant placed in Group B.

WOUND DEHISCENCE

Wound dehiscence was evaluated clinically at every follow-up. No patients showed wound dehiscence at 1st week, 1st month and 3rd month follow-up in Group A, but it was present for 2 implants placed in Group B at 1st week follow up. We refreshed the margins of the flaps, and reapproximated them and on subsequent post – op follow-up of 1st month and 3rd month there was no wound dehiscense seen.

CRESTAL BONE LOSS (calculated from post operative x-ray after 3 months)

Comparison of mean crestal bone loss around implants placed with and without PRF postoperatively at the end of three months was evaluated. No significant difference was seen between the two groups.

DISCUSSION

Branemark et al. first proposed the concept of osseointegration [5] The replacement of lost teeth by implants have marked a revolution in oral rehabilitation with a significant advancement in restorative dentistry. Since then numerous upgrades were made in order to enhance the quality of osseointegration. Different biomaterials have been developed and used since then. PRF is a biomaterial that was first developed in France by Choukroun et al in 2001.[6] PRF is in the form of a platelet gel and can be used in conjunction with bone grafts that offers various advantages including promoting bone growth and maturation, wound healing, wound sealing, stabilization of the graft, also in the process of hemostasis, and enhances the handling properties of graft materials.[7] It is stated that PRF can also be used as a membrane.[8] In experimental trials on animals comparing the effect of PRF-induced osseointegration and bone-implant contact after placing implants with controls revealed better osseointegration and bone-implant contact in the ones soaked with PRF as compared to their control;[9] and also when used in combination with graft favoured the formation of new bone.[10]

Various studies suggest that the combination of growth factors and bone grafts contained in PRF may be beneficial in enhancing bone density.[11-15] It appears that the affinity of osteoblasts to the PRF membrane is superior.[11] PRF has been used in different forms, like as an adjuvant to bone grafts, or as a membrane for closure after implant placement, for filling bony defects or used in ridge split technique before implant placement and have found superior quality of healing and better osseointegration. Hence, for our study we decided to use PRF as the sole biomaterial before the implant placement. On radiological evaluation of 3 months post-operative CBCT of all the patients showed an excellent osseointegration of the surrounding bone. Mean bone density values obtained through CBCT shows that Group A has better osseointegration measured in gray value compared to Group B showing a significant difference in p-value. The mean values obtained showed similar results as mentioned in Harby et. Al's study [16] It is also similar to the standard normal bone values.[17]

The main advantages in using the platelet-rich fibrin are healing and bone regenerative properties in combination with its complete resorption after surgery, avoiding a second surgery time, important factor in the elderly patients. Currently, it has satisfactory clinical results such as preventing complications or implant failure particularly in elderly patients for age related conditions.[18] Kenawy et al. in 2014 from their study also concluded that immediate placement of implants with PRF membranes could be considered a valuable option to replace missing teeth.[19] Similarly in our study implants placed with PRF showed excellent osseointegration, we believe that PRF can play a positive role in enchancing the quality of osseointegration.

Patients were also evaluated clinically for pain, implant exposure, infection, mobility and wound dehiscence. Patients experienced pain in the 1st post operative week which gradually decreased in intensity in the subsequent follow-ups. None of the patients had infection postoperatively. Implant exposure & mobility was seen in 1 patient in the control group. Wound dehiscence was also present for 2 implants placed in this group. There was no evidence of implant exposure, mobility or wound dehiscence in implants placed with PRF. Taking the results into consideration we can say that implants when placed with PRF may have improved the quality of healing and minimized post operative complications since none of the patients had implant exposure, mobility or wound dehiscence in Group A. Several authors have found that PRF promotes wound healing, bone growth and maturation, and wound sealing [7] It can expedite bone regeneration.[3] PRF when used as a membrane resulted in good soft tissue coverage over the immediate implants and it enhanced bone stability.[20] Similarly Rathee et al in 2016 stated that immediate implant placement sometimes lacks soft tissue closure but PRF adjuvant in early placement of dental implant in aesthetic zone met with predictable outcome standards.[21] Implants placed shortly after tooth extractions have some limitations that include a probable lack of soft tissue closure over the extraction site, difficulty in matching the diameter of the implant with that of the extraction socket, partially or totally missing bony housings, and possible accompanying periapical and/or periodontal infection. Studies also show that PRF membrane placed over the implant site encircling peri-implant bone adjoining minimal bone loss around crestal bone.[21] However, in our study results show minimal crestal bone loss in both the groups.

Though PRF has not been studied for a long time, it can be revolutionizing if used in oral implantology. PRF is biocompatible and is known to induce fundamental regeneration of bone and soft tissues around implants by differentiating undifferentiated osteoblasts for improved stability and healing [22]. It can also be used for many clinical applications. This second generation platelet concentrate biomaterial not only improves early wound closure, the final esthetic result of the peri-implant and periodontal soft tissues but also helps in the maturation of bone grafts.[5]

CONCLUSION

PRP (Platelet Rich Plasma) has been widely used as a biomaterial for its known beneficial properties and with the discovery of PRF (Platelet Rich Fibrin) clinical trials have shown even more encouraging results. Evidence supports that PRF contains growth factors that help in hard and soft tissue healing; and since it is autologous, it can be a promising treatment modality in dental implant surgery. Even though not many clinical studies have been conducted on humans to demonstrate the efficacy of PRF in the role of osseointegration in dental implants, from the results of this study we can say that PRF plays a propitious role in the quality of osseointegration when used in conjunction to dental implants. It not only improves soft and hard tissue healing thereby reducing post operative complication but also shows promising results in terms of stability of the implant. Our study provides a basis for future

research with larger sample size and longer follow-ups to elucidate the efficacy of PRF in oral implantology for the replacement of missing teeth. We can say that it provides a convenient and affordable choice when used as a biomaterial in oral implantology. Therefore the popularity of this second generation platelet concentrate should increase in implant dentistry.

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