How to Cite:
Yanaka, K., Vaybase, V. A., Wagh, S. B., Das, S., Baig, F. A. H., Dhamali, D., & Das, A. (2022). Comparative evaluation of vertical bone loss after immediate implant placement with and without platelet rich fibrin placement. *International Journal of Health Sciences*, *6*(S2), 14579–14587. https://doi.org/10.53730/ijhs.v6nS2.8821

Comparative evaluation of vertical bone loss after immediate implant placement with and without platelet rich fibrin placement

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International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.
Manuscript submitted: 09 March 2022, Manuscript revised: 18 April 2022, Accepted for publication: 27 May 2022

***Abstract*---**Introduction: The specialty of dentistry has been growing in leaps and bounds in recent years with introduction of many advanced techniques and better understanding of the needs and demands of the patients receiving the treatment. The method of replacing the missing teeth with fixed partial dentures is slowly being replaced by root form implants as they are regarded as having high esthetic and functional acceptance by the patient. The aim of the present study was to evaluate and compare vertical bone loss in an IOPA/ OPG after immediate implant placement with and without PRF. Material And Methods: The present study was conducted in the Department of Oral and Maxillofacial Surgery, Kamineni Institute of Dental Sciences, Narketpally, Nalgonda, District, Telangana, in the patients who need immediate implant placement. Total Sample size taken was thirty patients in thirty six sites were selected between the ages of 18-45 years. Results: When vertical bone loss on mesial side was compared between Group 1 and Group 2, it was found that there was no significant difference in vertical bone loss between the groups at baseline. Whereas at 6 months, the mean difference was -.88889 which means the vertical bone loss was less in Group 1 as compared to Group 2. And this difference was statistically significant ($p < 0.05$). Conclusion: In the present study it was noted that use of PRF is Inexpensive, simple to handle and it leads to a production of a large quantity of bioactive autologous membrane with a powerful healing potential on both hard and soft tissues.

***Keywords*---**PRF, e-PTFE barrier, modified rehrmanplasty, blood derivatives.

Introduction

The specialty of dentistry has been growing in leaps and bounds in recent years with introduction of many advanced techniques and better understanding of the needs and demands of the patients receiving the treatment. The method of replacing the missing teeth with fixed partial dentures is slowly being replaced by root form implants as they are regarded as having high esthetic and functional acceptance by the patient[1]. In order to optimize the success in implant placement, many techniques such as delayed and immediate placement have been proposed which have their own merits and demerits[2]. A recent systematic review reported that, early implant placement, may offer advantages in terms of soft tissue stability[3]. Implant success in the anterior maxilla is judged by the osseointegration and by sound and stable peri-implant tissues[4]. The obvious advantages of immediate implant placement are minimal number of surgical procedures and shortest possible treatment time from tooth extraction to implant restoration[5]. When an implant is placed in a fresh extraction socket, a gap (jumping distance) between the implant surface and bone walls of the socket may occur[6]. The amplification of platelet-derived growth factor and transforming growth factor are seen as an available and practical tool for enhancing the rate of bone formation and the final quality of bone formed[7]. Platelet Rich Fibrin (PRF) has many advantages and has hence attracted the attention of many researchers

and clinicians as it plays an important role in bone regeneration which may also influence the thickness of soft tissue. It eliminates the redundant process of adding anticoagulant as well as the need to neutralize it. It has been shown from literature that it increases the rate of clinical graft consolidation and PRF enhanced grafts produce more mature and dense bone than grafts without PRF. PRF is in the form of a platelet gel and can be used in conjunction with bone grafts, which offers several advantages including promoting wound healing, bone growth and maturation, graft stabilization, wound sealing and hemostasis and improving the handling properties of graft materials[8].

Materials and Methods

A randomized, controlled clinical trial was designed to comparative evaluation of Vertical Bone loss after immediate implant placement with and without Platelet Rich Fibrin placement. A Total of thirty patients in Thirty six sites were randomly assigned into two groups, with in the age of 18 to 45 years. Each group consisting of 15 patients in 18 implant sites based on the treatment modality rendered to them, they are, Group 1- With PRF consist of 15 patients in18 sites and Group 2- Without PRF consist of 15 patients in 18 sites. Informed and written consent was obtained after explaining the proposed nature of the study. All the patients selected for the study, detailed case history& personal history were taken, clinical photographs and Intra Oral Periapical radiographs (IOPA) and Orthopantomogram (OPG) were taken and advised surgical profile. All the patients selected for the study underwent full-mouth scaling and were given oral hygiene instructions. IOPA / OPG were taken immediately following the implant placement to determine the initial crestal bone level around the implant and the vertical bone loss to be evaluated baseline, 3rd month and 6th month post-operative follow up last appointment to evaluate the vertical bone loss. The second stage surgical procedure was again performed 3 months after the first procedure. A crestal incision was made and implant was exposed without damaging the surrounding bone. Implant stability was recorded before placing the gingival former. After one week, abutment was placed and impressions were made, metal ceramic crown was fabricated and cemented with Glass Ionomer Cement. The response of the patient to the implant and its loading, prior to Osseointegration is then monitored over a follow up period of 6 months. The parameters included in the study were recorded three times, i.e.in 0 post-operative day, 3rd month and 6th month post operatively.

Results

The mean (in mm) Vertical Bone Loss on the mesial side in Group 1 patients at baseline 4.66+0.98, at 3 months, 3.70+0.97 and at 6 months, 1.73+0.51(Table 1). The mean (in mm) Vertical Bone Loss on the Distal side in Group 1 patients at baseline was 4.70+0.97, at 3 months was 3.65+0.79 and at 6 months was 1.94+0.74(Table 2). The mean Probing depth (in mm) in Group 1 at 3 months was 1.05+0.2 and at 6 months was 1.1+0.17. In Group 1, the mean bone density with Implant at baseline was observed to be 130.96 + 13.7, at 3 months, 140.77+ 10.25 and at 6 months, 154.27+ 8.78. The mean Bone density without Implant for Group 1 at baseline was observed to be 52.20+12.55, at 3 months was 62.5+10.26 and at 6 months was 78.02+11.9. In Group 1, the Mean Bite force at

6 months was observed to be 2.8N + 0.37. The mean (in mm) Vertical Bone Loss on the mesial side in Group 2 patients at baseline was 4.69+0.97, at 3 months, 3.70+0.87 and at 6 months 2.62+0.55. The mean (in mm) Vertical Bone Loss on the distal side in Group 2 patients at baseline was 4.59+0.96, at 3 months, 3.70+0.81 and at 6 months, 2.45+0.57. The mean Probing depth (in mm) in Group 2 at 3 months was 1.26+0.3 and at 6 months was 1.4+0.30. In Group 2, the mean bone density with Implant at baseline was observed to be 128.54 + 11.8, at 3 months, 137.38+ 8.86and at 6 months 146.95+ 10.52. In Group 2, the mean bone density without Implant at baseline was observed to be 58.54 + 11.33, at 3 months, 67.31+ 9.55 and at 6 months,146.95 + 10.52. In Group 2, the Mean Bite force at 6 months was observed to be 2.1N + 0.46 (Table 3).

Discussions

The original protocol of a dental implant was to place the implant into a healed alveolar socket which requires time to allow healing of the extraction socket. According to Branemark et al[9], Implant placement can been classified as immediate, early, or delayed with implants placed in the extraction site at the time of extraction, 2–4 weeks after extraction, or 4–6 months after extraction, respectively. In 2001, Choukron's[10] et al., had developed Platelet-rich fibrin (PRF), which is a second generation platelet concentrate owing to its inherent property to accelerate soft and hard tissue healing. Its advantages over the well known platelet-rich plasma (PRP) include ease of application, less cost and lack of biochemical modification (no bovine thrombin or anticoagulant is required). PRF is a strictly autologous fibrin matrix containing a large quantity of platelet and leukocyte cytokines. Adell[11] et al., described the importance of the timing relative to extraction and implant placement. The timing of tooth extraction and implant placement was classified as follows: Class I: Immediate – Extraction, immediate implant placement flapless or with a flap and osseous augmentation with guided bone regeneration (GBR). Class II: Early implant placement (6-8 weeks) – guided bone regeneration (GBR) can be performed at the moment of the extraction or when the implant will be placed. Class III: Delayed Implant placement- 4 to 6 months after the extraction with the preservation of the alveolar ridge with guided bone regeneration (GBR) as well soft tissue augmentation. In 1989, Lazzara[12] first reported immediate implant placement at an extraction socket. This method can avoid the concerns of bone resorption, multiple surgical procedures, increased treatment time, and unsatisfactory esthetics. Many other studies also have reported favorable results with immediate implant placement. Branemark[9] classic protocol of placement of implant has been under debate for more than a decade leading to development of immediate placement of implants after extraction. Adell[11] et al proposed primary stability has to be achieved during immediate placement of implants for preventing the formation of connective tissue layer between implant and bone, which depends on various actors like bone quantity and quality, surgical technique, and implant geometry, length, diameter and surface characteristics. Platelet-rich fibrin (PRF) which is a second generation platelet concentrate that facilitates favorable healing by virtue of its growth factors. Enhancement of the regenerative process of human body by utilizing the patient's own blood is a unique concept that has evolved in dentistry[9]. In the study conducted by Aroras[13] et al., the mean crestal/ vertical bone change was 0.88mm on mesial and 0.85mm on distal, 0.99mm on buccal and 0.97 mm on

palatal side in the group that was placed implants without PRF as compared to 0.45mm, 0.44mm and 0.52mm in the group that was placed implants with PRF. The mean difference was found to be statistically significant. ($p<0.5$). The findings of this study were in accordance with the vertical bone loss finding of the present study. In another study conducted by Anand U[14] et al, the radiographic bone level change was the main response variable used to evaluate the immediate loading of self tapping implants, bioactivated with PRP. Intraoral periapical radiographs taken at baseline, 3, 6, 9, and 12 months using long cone paralleling technique, were subjected to radiographic analysis using Image J software. The distance from the first implant thread to the first bone-implant contact on the mesial and distal sides of the implant was measured, and the values were within the success criteria of immediate loading. Schropp[15] et al., conducted a study to compare bone healing and crestal bone changes following immediate and delayed placement of titanium dental implants with acid-etched surfaces (Osseotite) in extraction sockets. Forty-six patients were randomly allocated to the both groups and received 1 implant at the incisor, canine, or premolar region of the maxilla or the mandible. The implants were placed an average of 10 days following tooth extraction in the immediate group and approximately 3 months after extraction in the Delayed group. The widths (parallel and perpendicular to the implant) and the depth of marginal bone defects around the implants were measured clinically just after placement and 3 months later at the abutment surgery. The crestal bone changes mesially and distally to the implants was also evaluated radio graphically by linear measurements. Rosenquist B[16] et al., conducted a study where in twenty sites with single missing tooth were replaced with immediate implants and clinical parameters like probing pocket depth (PD), and radiographic parameters like crestal bone level were assessed for a period of 9 months. It was concluded that the dental implants showed <1 mm of crestal bone loss at 9 months follow-up, clinically significant marginal bone loss occurred between the time of implant placement and 3 months. In the present study, No occurrence of implant mobility and no evidence of peri apical radiolucency were noted. These results were comparable to other short term studies by Kenawy et al[17]. Tomasi C [18] has proposed guidelines for implant placement and restoration which was described as follows:- Employ a conservative flap design, Evaluate the existing bone and soft tissue, Time the placement correctly, Visualize the three-dimensional position of the implant, Consider healing time before implant loading, Select a proper abutment and final restoration design. Devescovi V [19] et al., (1986) had proposed criteria to assess the success rate of implant, which was described as follows:- Individual unattached implant that is immobile when tested clinically and radiography that does not demonstrate evidence of peri-implant radiolucency. It has been stated by Covani[20] et that placement of an implant into a fresh alveolus will usually result in a gap/space between the occlusal part of the implant and the bone walls (“jumping space”), and immediate placement of implant cannot prevent dimensional changes of the alveolar ridge after extraction of tooth :- Bone loss that is less than 0.2 mm annually after the implant's first year of service, no persistent pain, discomfort or infection, by these criteria, a success rate of 85% at the end of a 5 year observation period and 80% at the end of a 10 year period are minimum levels for success. Gomez-Roman[21] et al. had shown 99% success in immediate post extraction implant placement after 1 year follow-up period and 97% after 5.6 years observation period. A first classification of platelets was proposed by Dohan[22] et al., in 2009 which is now widely accepted. The

classification is simple and is based on the presence or absence of leukocytes and the density of fibrin architecture in platelet concentrates. Reddy[23] et al placed 12 implants into extraction sockets in dogs. Six of these sockets were sealed by e-PTFE barrier membranes, and six were closed without membranes. In all cases, healing with bone formation around the implants was found.

Conclusion

In the present study it was noted that use of PRF is Inexpensive, simple to handle and it leads to a production of a large quantity of bioactive autologous membrane with a powerful healing potential on both hard and soft tissues. It accelerates healing and wound closure of the wound margins, protects the surgical site, helps in conserving the vertical bone adjacent to the implant, results in reduced probing depth, maintains optimal bite forces and implant stability when compared with placement of implants without use of PRF**.** Hence this study has put forth an emerging avenue of immediate placement of implant with PRF which portrayed many advantages with better hard and soft tissue maintenance and a better survival rate.

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Table 1: Vertical bone loss on mesial side of group 1 patient

	F		P VALUE
	55.260		000
(I)	(J)	MEAN DIFFERENCE(I-J)	P VALUE
BASELINE	3 MONTHS	.95833	0.004
	6 MONTHS	2.93056	0.000
3 MONTHS	BASELINE	-.95833	.004
	6MONTHS	1.97222	.000
6 MONTHS	BASELINE	-2.93056	.000
	3 MONTHS	-1.97222	.000

Table 2: Vertical Bone loss on Distal side of Group 1 patients

	F	P VALUE	
BETWEEN GROUPS	49.443	000	
(I) TIME	(J) TIME	MEAN DIFFERENCE(I-J)	P VALUE
BASELINE	3 MONTHS	1.05556	0.001
	6 MONTHS	2.76389	0.000
3 MONTHS	BASELINE	-1.05556	0.001
	6 MONTHS	1.70833	0.000
6 MONTHS	BASELINE	-2.76389	0.000
	3 MONTHS	-1.70833	0.000

Table 3: Mean values of various parameters in Group 2

VARIABLES	MEAN	STANDARD DEVIATION
Group 2 Vertical Bone Loss Baseline Mesial	4.6944	.97225
Group 2 Vertical Bone Loss Baseline Distal	4.5972	.96687
Group 2 Vertical Bone Loss 3 months Mesial	3.7083	.87971
Group 2 Vertical Bone Loss 3 months Distal	3.7083	.81462
Group 2 Vertical Bone Loss 6 months Mesial	2.6250	.55073
Group 2 Vertical Bone Loss 6 months Distal	2.4583	.57041
Group 2 Probing Depth (in mm) - 3 months	1.2639	.31474
Group 2 Probing Depth (in mm) - 6 months	1.4000	.30049
Group 2 Bone Density with Implant - Baseline	128.5483	11.83792
Group 2 Bone Density without Implant - Baseline	58.1828	11.33570
Group 2 Bone Density with Implant - 3 months	137.3806	8.86584
Group 2 Bone Density without Implant - 3 months	67.3122	9.55836
Group 2 Bone Density with Implant - 6 month	146.9533	10.52619
Group 2 Bone Density without Implant - 6 month	76.6122	11.29868
Group 2 Bite Force (in N) - 6 months	2.1972	.46056