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Original Research

Marginal bone loss around dental implants after implantation with platelet rich plasma: An observational study

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ABSTRACT:

Background: Dental Implant placement is seen as one of the promising disciplines of dentistry. These help in providing an ideal prosthesis for the stomato-gnathic apparatus which helps in restoration of both esthetics as well as function. It also helps in improving the overall oral health. Several adjunctive materials such as use of platelet concentrates along side various techniques have been proposed for enhancing and protecting harmony of surrounding marginal bone and peri-implant soft tissues for ascertaining longevity of the implant system**. Aim:** The aim of the study was to evaluate marginal bone loss around dental implants after implantation with platelet rich plasma. **Materials and methods**: Total of 300 study subjects who were categorized into- a) Group I (Implants with PRP) and b) Group II (Implants without PRP) were included in the study. Exclusion criteria was persons with any smoking habit. Various clinical and radiographic parameters were assessed such as- plaque index, bleeding on probing index, probing depth, mobility of implant and assessment of osseo-integration were studied. Collected data was statistically analyzed using Fisher's exact test and Chi square test for statistical significance. **Results:** No statistical difference was observed between both the study groups indicating no prognostic difference in clinical and final outcome. **Conclusion**: Present study found no difference in marginal bone loss in both the study groups. Hence, it can be concluded that the amount of marginal bone loss is unaffected by use of PRP concentrate during implant placement.

Keywords: Dental, implants, marginal bone, loss, radiographic, clinical, PRP.

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INTRODUCTION

A dental implant may be defined as 'a prosthetic material which is embedded within bone for maintaining retention and support for removable as well as fixed prosthetic appliance".[1] Rehabilitation of partially edentulous patients by means of implant supported prosthetic replacement is a common clinical practice with significantly reliable long-term result and greater than 90 % survival rate. [2]

The therapeutic success of a dental implant is characterized by following criteria- 1) An absence of mobility of the implant; 2) Less than 1.5 mm peri-implant bone loss and 3) Health of the soft tissues surrounding the implant. Branemark in 1950s to 1960s investigated osseo-integration between dental implants and bone interface. The process of osseointegration is influenced by the method of implant healing i.e., open or closed which is regardless to the relative positioning of positioning of implant with level of compact bone.[3] Lekholm and Zarb classified bone patterns and its quality fro implant placement as follows- a) type 1: Bone which is totally comprised of homogenous compact variety of bone; b) Type 2: This bone pattern is comprised of compact bone which surrounds a central trabecular coreof bone; c(Type 3: This type of bone pattern comprises of a thin compact bone layer which surrounds central dense trabeculae of bone and d) Type

4: This bone pattern comprises of thin compact bone which surrounds less dense trabeculae of bone.[4]

Another important criteria for assessing the stability of osseous integration and contact between bone and implant surface is assessing the functional loading capacity. Physiological functional loading on an implant may result in up to 1 to 1.5 mm of marginal loss of bone in first year and it is lesser than 0.2 mm every year, subsequently. The process of marginal bone loss is influenced and undergoes acceleration by various biological and mechanical factors. The crown-to-implant height ratio is a strong determinant of bone height. [5] As per Hingsammer et al (2017), the height ratio between crown and implant must not exceed 1.7 so as to minimize early bone loss.[6] Long-term studies on implants have demonstrated 1.5 to 2 mm of loss of bone surrounding the neck of an implant during first year following functional loading while a marginal bone loss measuring up to6.2 mm has been shown after first year. Most common reasons or risk factors for early loss of implants are their improper location and the design of the prosthesis. Excess surgical trauma along with an impaired ability of the wound to heal, microbial infection and excessive bio-mechanical loading are few of the reasons for late failure of implants. [7]

Early crestal loss of bone implants has been clinically associated with peri-implantitis, biological width, crest of implant, micro-gap, overloading of occlusal forces, surgical procedures etc. [8, 9] Heat generated during implant placement results in thermal damage to tissues. Insertion of an implant in posterior jaws is a difficult task as the application of adequate torque is done using various drills and rachets for insertion, retention of screws and abutments. [1] The osseointegration process in implant placement depend on a variety of factors which are related to the subject and the surgical technique employed such as- oral hygiene, biocompatibility of implant used and surface characteristics of an implant. The strength of an implant-bone interface is largely dependent upon quantity as well as quality of bone. The 'quantity of bone' may be defined as 'the height as well as width of residual alveolar bone' while the 'quality of bone' is determined by the thickness of cortical bone, trabecular bone thickness and rate of mineralization. The quality of bone is an important factor in achieving a good osseo-integration between implant surface and bone. Thus, implants which are inserted at sites with poor quality of bone demonstrate high odds of failure. [10, 11]

Platelet rich plasma (PRP) or platelet rich fibrin (PRF) are used as bone augmentation methods during implant placement to reduce the marginal loss of bone which usually follows insertion and placement of a dental implant. This product may be used along with bone grafts offers a variety of advantages, for example, promotion of wound healing, achieving hemostasis along with growth of bone. Various operative procedures like- plastic surgery, sinus-lift procedures, treatment of furcation defects, infra- bony defects, augmentation of extraction sockets and treatment of gingival recession cases managed with coronally displaced flap. [12]

Based upon the literature review, the aim of this study was ascertained as evaluation of Marginal bone loss around dental implants after implantation with platelet rich plasma by means of an observational study.

MATERIALS AND METHODS

A total of 300 subjects who had to undergo implant insertion were categorized into two groups- a) those with implant placement with platelet rich plasma (PRP) augmentation (n = 150) and b) those with implant placement with no PRP augmentation. Written informed consent was obtained as per the 'Declaration of Helsinki' guidelines. All subjects were inserted with the Branmark MK I TiUnite (Nobel Biocare), Switzerland implant system. The total follow-up of the study observation period was one year.

Clinical parameters assessed were-

1) Plaque index: The plaque index was evaluated using the Mombelli index. Assessment of plaque collected over the implant surface was graded as follows- a) Grade 0: No plaque was detected; b) Grade 1: Plaque detected by means of a probe; c) Grade 2: Visible plaque present and d) Grade 3: Large amount of plaque deposited.

2) Assessment of probing depth: The gingival sulci surrounding the implants were probed at four different sites- mesial, distal, buccal or labial and palatal or lingual.

3) Bleeding index: Bleeding from probing was from gingiva was measured at probing depths itself.

4) Grade for assessing mobility: The degrees of mobility of implants were categorized into following groups- a) Grade 0: Absence of mobility; b) Grade 1: Clinically visible mobility in horizontal direction measuring ≤ 1 mm; c) Grade 2: Clinically visible horizontal mobility measuring > 1 mm and d) Grade 3: Mobility of the implant elicited through labial or lingual pressure.

5) Assessment of osseointegration: The Periostat Classic device was used for evaluation of osseointegration. This device functions by tapping of the implant by means of a plunger. The dampening of an implant may be classified as follows-

i) Satisfactorily achieved osseointegration: -8 to 0;

ii) Mandatory clinical examination: +1 to +9 and

iii) +10 to +50: Insufficient level of osseointegration.

6) Radiographic parameters: Bone loss around implants was assessed by measuring alveolar crestal height both before and after implant placement and subsequently, the difference in both the values was calculated.

Statistical analysis: Clinical and radiographic parameters were recorded. All obtained values were evaluated by employing the Fisher's exact or Chi-square test for analyzing the variables, qualitatively. On the other hand, the quantitative variables were compared using Mann-Whitney and Wilcoxon's rank sum test. The statistical software, SPSS (Version 25.0) was employed for analysis of data.

RESULTS

Of total 300 patients treated with implants, 150 patients (group I) had PRP (Platelet Rich Plasma) augmentation with implant placement while Group II (n = 150) had implant placement without PRP augmentation. The age distribution of all study subjects were between 30 to 90 years. The gender distribution of subjects was 67.1 % and 32.9 % female and male subjects, respectively.

No statistical significance was obtained on comparing plaque indices in both the study groups (P= 0.6) (table 1). Similarly, no statistically significant difference was observed between the probing depths in both the groups (table 2).

On comparing the bleeding on probing index, in group 1, 65 % implants did not bleed on probing while 35 % demonstrated any absence of bleeding while in group 2, 28 % of implants reported bleeding while 72 % showed no bleeding after probing. On comparing both the study groups by using the Fisher's exact test, no statistically significant difference (P=0.15) was observed.

On comparing the mobility grading, no mobility was observed in both the study groups after implant placement. On comparison of osseointegration values in both the study groups using Fisher's exact test, no statistical significance between both the groups (P = 0.7) (table 3).

However, no significant difference in average bone loss was observed on comparison of both the study groups (P=0.6) (table 4).

Table 1: Table demonstrating plaque index in both the study groups

Plaque index	Platelet Rich Plasma (PRP) augmented implant site		Non-PRP augmented implant site	
	Number of implants	Percentage	Number of implants	Percentage
Grade 0	38	30.2 %	20	24.1 %
Grade 1	55	45 %	36	42 %
Grade 2	34	22 %	25	27 %
Grade 3	23	5.1 %	16	8.1 %

Table 2: Table demonstrating maximum probing depths in both the groups

Maximum depth of probing	PRP-augmented implant site (Group I)		Non-PRP augmented implant site (Group II)	
	Number of implants	% age	Number of implants	% age
2 mm	22	11 %	11	9.1 %
3 mm	39	26 %	47	37.1 %
4 mm	44	32.1 %	42	36.1 %
5 mm	33	13.1 %	28	12 %
6 mm	20	19.1 %	13	7.1 %
7 mm	05	7 %	09	4 %

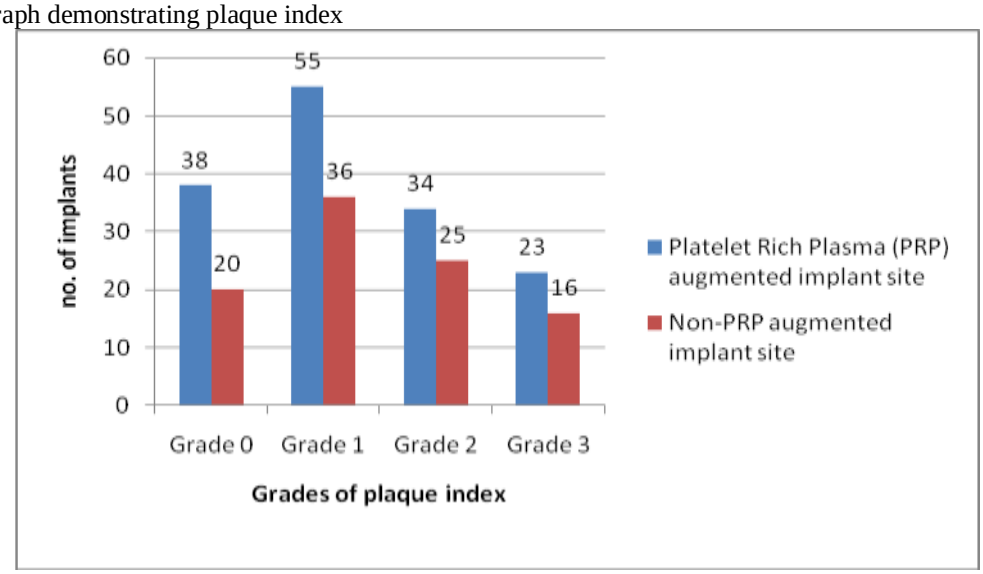
Table 3: table demonstrating Periostat values for grading of osseointegration

Osseointegration values	PRP augmented implant site		Non-PRP augmented implant site	
	No. of implants	% age	No. of implants	% age
a) Values between -8 to 0	85	76 %	56	69 %
b) Values between 1 and 9	55	24 %	24	31 %
c) Values ≥ 10	10	1 %	20	2.1 %

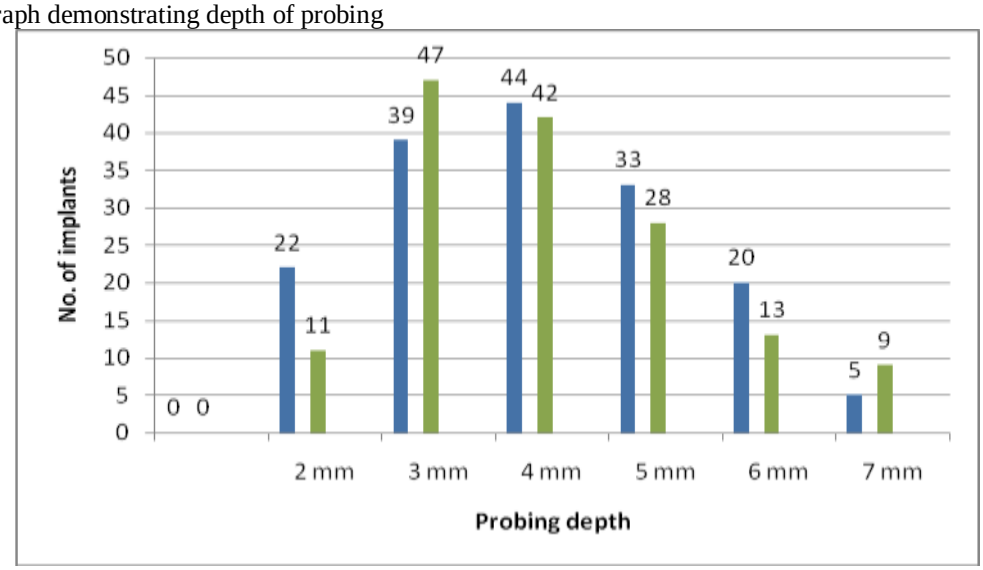
Table 4: Table demonstrating measurement of average bone height by mean bone loss in both groups

Subjects	PRP augmented implant site	Non-PRP augmented implant site
N	150	150
Mean	7. 241 mm	6.089 mm
Standard deviation	5.024 mm	5.52 mm
Minimum	1.29 mm	5.52 mm
Median	5.5 mm	6.42 mm
Maximum	20.15 mm	21.5 mm

Graph 1: Graph demonstrating plaque index



Graph 2: Graph demonstrating depth of probing



DISCUSSION

Most common reasons for removal of dental implants include- pain, mobility of implants, loss of crestal bone over half length of implant along with continuous pus exudation from tissues surrounding implants. Significant correlation has been observed between resorption of bone and autologous cancellous grafts leading to peri-implantitis. [13]

In our study, no significant differences were observed between any of the clinical parameters studied in subjects who had implant placement with PRP augementation and those with implant placement without PRP augmentation.

Akel in 2019 demonstrated a standardized mean difference of 1.07 when comparing marginal bone loss between smokers and non-smokers with an extremely significant statistical difference (P<0.00001). [9]

Lombardi et al in 2019 showed that the marginal bone loss during first year post function was significant after platform-switching was performed on implants with internal conical connection. [14]

Kim et al (2017) in their study evaluated inter-relationship between vertical implant abutment interface position and loss of marginal bone for a period of three years by radiological analysis. In this study, implants were grouped into three categories based upon vertical positioning of implant abutment interface- 1) Group A: Above the level of bone; 2) Group B: At level of bone and 3) Group C: Below the level of bone. It was observed that at 36 months follow-up after implant loading, marginal bone levels showed alterations of 0.99 ± 1.45 mm, 1.13 ± 0.91 mm and 1.76 ± 0.78 mm in the three groups, respectively. It was found that group C

showed significantly higher values than groups A and B. [15]

Koller et al in 2016 in their study demonstrated that inadequate occlusal guide patterns lead to production of unfavorable force on implant supportive structures and greater amount of stress on implant-bone surface contact. [6]

Many two staged surgeries for implant placement have demonstrated greater bone loss if load was applied to the implants following the second surgery. [16, 17, 18]

Wilkenheiser et al (1995) have reported that the amount of torque which is applied during implant placement affects the degree of resorption of bone. [19]

CONCLUSION

Platelet concentrates which are being actively used in dentistry help in improvement of biological properties of tissues in their vicinity. Over the last decade, use of platelet concentrates, such as, Platelet Rich Fibrin (PRF) and Platelet rich Plasma (PRP) specially in implant dentistry has shown an exponential increase which is mainly due to some of their properties like their ability to provide sustained release of various growth factors and also by providing a scaffold for tissue and stabilization of graft. However, present study did not demonstrate any difference in implant stabilized using PRP with those without it.

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