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A Radiographic Evaluation of Crestal Bone around Immediate Implants with and Without Platelet Rich Fibrin (PRF)–A Comparative Study

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ABSTRACT

Background: Human life expectancy has been increased by development in medical science. A longer human span life means that more patients will be partially or fully edentulous. A number of prosthetic techniques are available over time for the rehabilitation of partial or complete loss of tooth/teeth. In order to overcome the problems associated with conventional prosthetic treatment, the dental implants came into existence. With the increasing success rates of dental implants, clinicians and researchers have turned their approach toward making the duration of treatment shorter and more comfortable for the patients. **Methods**: A total of 30 implant fresh extraction sites were selected and randomly divided into two groups. Of these, 15 immediate implants were placed with platelet-rich fibrin (PRF), while the other 15 immediate implants were placed without platelet-rich fibrin (PRF). Patients were prospectively evaluated radio graphically using standardized intraoral peri-apical radiograph with Radio Visual Graph (R.V.G).Statistical Analysis Used: Student's unpaired t-test. **Results**: It was observed that the patients in test group are favored with rapid soft tissue regeneration, very less bone loss, and improve with early wound closure, which helps in achieving an esthetic outcome and better patient acceptance. It can be used to fill horizontal defect distance or jumping distance for complete resolution of the space. **Conclusion**: Immediate implants with PRF lead to stimulation and acceleration of bone regeneration and show tendency toward rapid soft tissue regeneration and reduced peri-implant pain and inflammation. Overall, it is recommended to use PRF as a viable option in improving success and reducing the treatment duration in immediate implants.

Keywords: Atraumatic extraction, Immediate implants, Platelet-rich fibrin.

INTRODUCTION

The goal of modern dentistry is to prevent tooth loss and provide a healthy dentition with optimal functional efficiency, structural balance and esthetic harmony.[1]The use of osseointegrated implants for treatment of edentulous patients was first described by Branemark et al (1960).[2] The placement of dental implant into fresh extraction sockets was introduced in 1970 and is a well-established treatment option for replacing missing teeth, allowing the restoration of masticatory function, speech, and esthetics .Immediate placement of a dental implant in an extraction socket was initially described by Schulte and Heike in (1976).[3] Placement of an immediate implant will reduce morbidity, treatment costs and treatment time.

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However, technical complications have been described regarding this technique.[4]
When an implant is placed in a recent extraction socket , a gap(jumping distance) between the implant surface and the bone walls of the socket may occur and there are various materials used to fill this gap for better osseointegration, such as autografts, allografts, xenografts, and alloplasts1.
However, these materials are either expensive or not so effective.Choukron's Platelet-rich fibrin (PRF) regenerative material (2001)5 has been recently proposed as an aid for promoting hard and soft tissue regeneration.PRF is a second generation PRP where autologous platelets, leucocytes and various growth factors fastened the healing of soft and hard tissues.Thus the objective of present study is to clinically compare the periodontal parameters for immediate implants with PRF and without PRF.

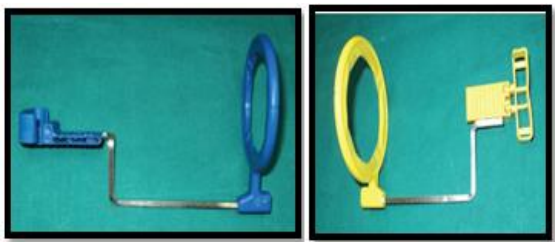
Aims and Objectives

The aim of this present study is to radiographically evaluate crestal bone level on mesial and distal sides around immediate implants with and without PRF.

MATERIALS AND METHODS

A prospective, randomized comparative study was conducted in total of thirty implant fresh extraction sites, within the age group of 18 to 65 years, comprising of 8 males and 7 females visiting the Out-Patient Department of Periodontics, Himachal Dental College, Sunder Nagar (H.P). Patients were randomly selected for the present study. The patient were randomly allocated to the immediate implants group with PRF(n-15)test group or immediate implants without PRF group (n-15) control group. Bone loss on mesial and distal aspect of implants was evaluated by using standardized intra-oral periapical (IOPA) radiographs at baseline3, 6, 9 months after placing the implants. Inclusion criteria were-systemically healthy patients with age group of 18 -65 years, willing to comply with all the study requirements, patient cooperation, motivation,good oral hygiene, no acute infection at extraction remnants at implant site, presence of non-restorable maxillary and mandibular teeth due to trauma, caries, root resorption, root fracture, endodontic or periodontic failure, grossly decayed tooth, adequate volume of bone, sufficient band of keratinized mucosa(2mm) to allow surgical manipulation and suturing. Exclusion criteria's were pathologic changes at recipient site Smoker, drug or alcohol abuse, uncontrolled diabetes, osteoporosis, malignancies and blood dyscrasias, Insufficient bone quantity, any parafunctional habit and periodontal diseases etc.

Pre-operative clinical photograph Preoperative OPG



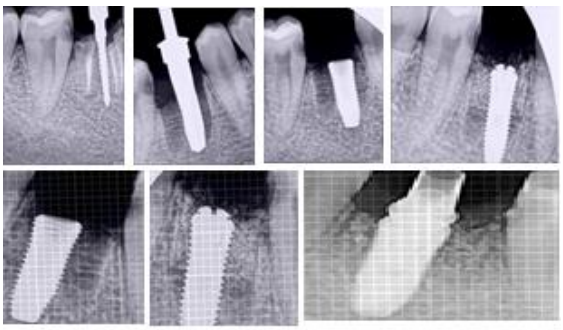
Rinn XCP film holder, Dentsply (for anterior teeth)
Rinn XCP film holder, Dentsply (for posterior teeth)

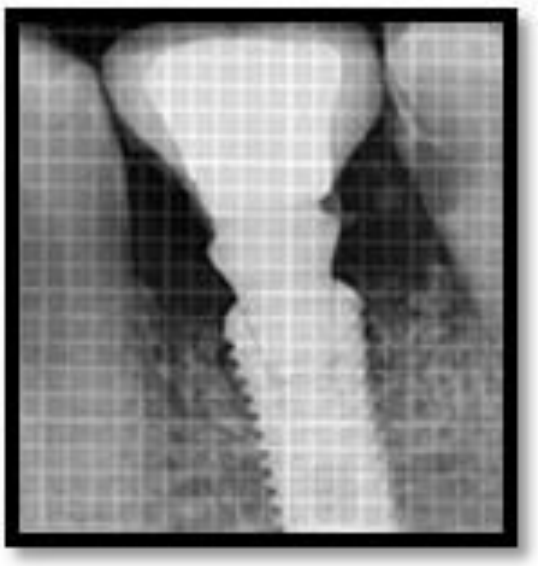
Customized occlusal bite jig

Pre-Surgical Procedure

All the patients included in the study were subjected to detailed medical and dental history. Complete clinical photographs, diagnostic casts. Routine blood investigation and oral prophylaxis. Pre-operative IOPA xray, OPG(orthopentogram) provided the necessary information regarding the available bone and distance of vital structures, i.e., maxillary sinus, floor of nasal cavity, mandibular canal from the implant site.

Intra operative radiographs:





Final prosthesis after 3rd month

OPG after placement of immediate implants

Standardized intraoral peri-apical radiograph with Radio Visual Graph (R.V.G) was obtained for each implant site at 1st, 3rd, 6th and 9thmonth after placement of the implant. The X-ray unit with long cone paralleling device was used. The level of bone was measured on the mesial and distal aspect of each implant. The reference point was taken from implant shoulder to the crest of interproximal alveolar bone. To assess the changes in bone height, the distance between the implant shoulder and the first visible bone-implant contact (DIB) was determined by measuring the squares on radiograph and expressed in millimetres

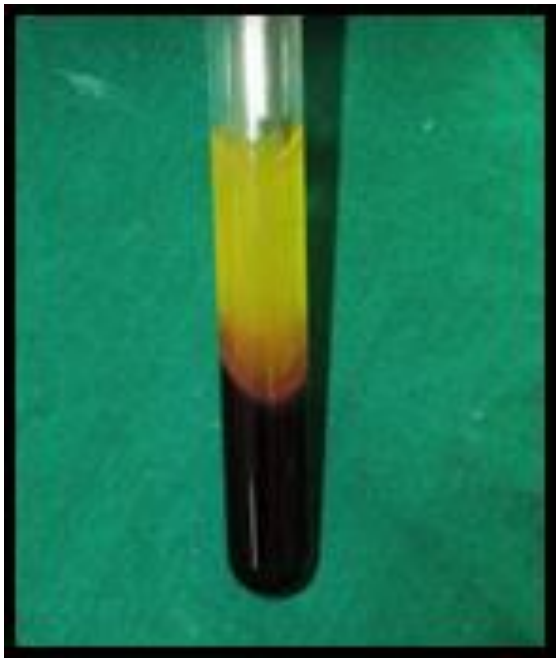


Figure 1: Photograph Showing Test Tube Containing

Figure 2: Separation of PRF from Blood Clot

Platelet Rich Fibrin Preparation

The PRF preparation for the test group was started 30 minutes before surgery. Just prior to surgery venous blood sample of patient was taken from median cubital vein present in antecubital fossa of the forearm in a standardized fashion. A convenient blood sample was taken from the patient in two sterile 10 ml dry glass tubes without the addition of an anticoagulant & centrifuged at 3000 revolutions per minute for 10 minutes. Blood centrifugation immediately after collection allows the composition of structured fibrin clot. PRF settles down between the platelet poor plasma (PPP) at the top and the red blood cells (RBC) at the bottom of the tube [Figure 1]. PRF was easily separated from red blood corpuscles base [Figure 3] using a sterile tweezers and scissors just after the removal of platelet poor plasma (PPP) and then transferred onto a sterile compress.A stable fibrin membrane was obtained [Figure 4].

Figure 3: PRF Separated From Blood Clot

Figure 4: PRF Membrane SqueezdedinA Gauze Piece

Surgical procedure:

The patients were scheduled for implant surgery after phase I therapy. All the surgical procedures were performed under local anesthesia 1:80,000 under strict aseptic conditions .Facial skin all around the oral cavity was scrubbed with Povidine iodine solution (5%) and the patient was made to rinse with 0.12% Chlorhexidinedigluconatemouthrinse for one minute prior to surgery. The tooth in question was extracted using a method involving minimal trauma to the bone and surrounding soft tissue. To ensure the same,extractions were accomplished using a periotome and luxators. Following extraction, bone file was used wherever required and the socket was then thoroughly degranulated with curettes and to remove all remnants of the periodontal ligament and granulation tissue.The approximate length and width of extracted tooth were measured with scale or William probe.

Stage 1 procedure:

2nd stage surgical procedure:

An osteotomy was prepared using pilot drill and twist drill sequentially were operated at max. 1000 rpm, 30-45Nm with copious irrigation and final drills (harvest drills) operated at 30-100 rpm/30-50Nm without irrigation. As per manufacturer's instructions. Dentium implants were used in the study. The implant site was generously irrigated with sterile saline to remove any residual bone chip/other residue following preparation.The depth of implant osteotomy site was ascertained with implant depth gauge. The implant was removed from the sterile vialusing ratchet with ratchet adaptor and delivered into the osteotomy site.Implants were then placed into prepared site with manual pressure aided by ratchet with ratchet adaptor engaging the internal hex inside the fixure. Primary stability was assessed with the torque controlled ratchet. Following implant insertion an appropriate cover screw was inserted.The bone grafts were placed as per the requirement.

The residual gap between socket wall and implant threads were grafted with PRF and then PRF membrane was placed in Group II and without PRF membrane in Group I over the cover screw.The procedure was completed by repositioning and suturing the surgical flap with interrupted silk sutures. Then, an immediate postoperative x-ray and RVG was done. At the end of the surgery, patients were prescribed amoxicillin and clavulanic acid (625 mg tds for 3 days) diclofenac potassium 50 mg + paracetamol 325 mg + serratio-peptidase 10 mg (3 days), and 0.2% chlorhexidinegluconate mouthwash (twice a day for 7 days). Sutures were removed after 7 to 10 days of surgery. A surgical re-entry was performed to remove the cover screw and place a healing cap. Abutment was placed Final restoration was given after 3 months.

The patients in both groups were recalled after 7 days for the suture removal.

RESULTS

A study was conducted to clinically evaluate radiographic parameters of crestal bone around

immediate implant with and without PRF. In our study 30 implants were placed 8 males and 7 females and randomly divided into two groups, Group I (Immediate dental implants without platelet rich fibrin n-15) and Group II (Immediate dental implants with platelet rich fibrin n-15). Radiographic parameters were recorded by using the standardized periapical radiographs. These radiographs made through long cone paralleling technique with the help of radiographic film holders (Rinn XCP; Dentsply).[15,16] A customized occlusal jig was fabricated by attaching modeling wax to the film holder and asking the patient to bite on this.[17] The jig was acrylized in heat-cured acrylic and saved for use at later visits to standardize the film placement and cone angulation.

The following parameters were recorded for both groups at different interval of time at baseline (after implant loading), 3rd month, 6th month and 9thmonth post operatively .Final prosthesis were delivered at 3rdmonth.

Table 1: Intergroup comparison of Radiographic changes of distal bone loss

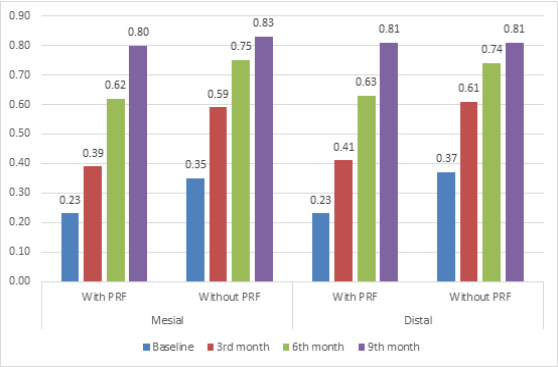
Parameter		Mean	SD	t	P
Distal bone loss at baseline**	With PRF	0.23	0.05	-5.04	0.000
	Control	0.37	0.09		
Distal bone loss at 3rd month **	With PRF	0.41	0.10	-5.41	0.000
	Control	0.61	0.11		
Distal bone loss at 6th month **	With PRF	0.63	0.08	-2.88	0.01
	Control	0.74	0.13		
Distal bone loss at 9th month *	With PRF	0.81	0.07	-0.27	0.79
	Control	0.81	0.06		

Unpaired t test. * Non-significant difference (p-value ≥ 0.05); **Highly significant difference (p - value ≤ 0.01)

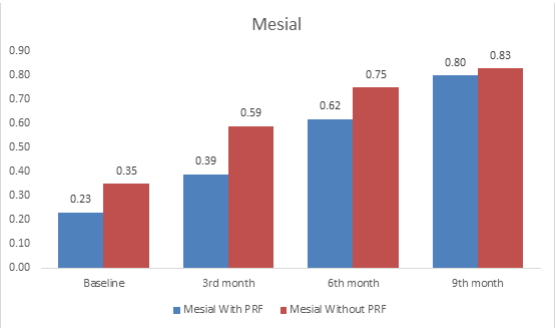
Table 2: Intergroup comparison of Radiographic changes of mesial bone loss

Parameter		Mean	SD	T	P
Mesial bone loss at baseline**	With PRF	0.23	0.06	-6.23	0.000
	Control	0.35	0.05		
Mesial bone loss at 3rd month **	With PRF	0.39	0.07	-6.93	0.000
	Control	0.59	0.09		
Mesial bone loss at 6th month **	With PRF	0.62	0.07	-3.52	0.000
	Control	0.75	0.13		
Mesial bone loss at 9th month *	With PRF	0.80	0.09	-0.81	0.426
	Control	0.83	0.09		

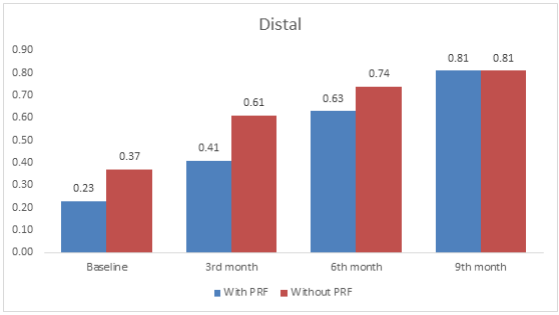
Unpaired t test. * Non-significant difference (p-value ≥ 0.05); **Highly significant difference (p - value ≤ 0.01)



Graph 1: Intra group comparison of radiographic distal bone loss and mesial bone loss in test and control group



Graph 2: Inter group comparison of mesial data



Graph 3: Intergroup comparison of distal data

Radiographic Assessment (RA) on mesial side and on distal side of implant

[Graph 1] Intra group comparison of radiographic distal bone loss and mesial bone loss in test and control group. The intragroup comparison of bone loss is represented in graph.[9] It was found that the mean values of both the parameters for both groups increased from baseline to 9th month.

[Table 1,2 & graph 2,3] shows Intergroup comparison of both mesial (mean value at baseline with PRF 0.23± 0.06 test group,.35± 0.05 control group) to 9th month at mesial side(mean value with PRF 0.80± 0.09, mean value without PRF 0.83± 0.09) and distal bone height(mean value at baseline for test group 0.23 ± 0.05, control group 0.37± 0.09 and at 9th month(mean value for test group 0.81±0.07, 0.81± 0.06 for control group), the

test group mean and control group mean obtained during the 9thmonth did not differ significantly from each other for both the parameters. Mean value at baseline to 6thmonth revealed that for measurements at different time intervals, the mean values obtained for test group (are significantly lower than the control group.

DISCUSSION

The success of implants is dependent on meticulous pre-operative treatment planning as well as careful follow-up during the healing phase to evaluate the success of osseointegration.[13] The radiographic evaluation of bone forms a very important and viable means of detecting health and stability of bone around the peri-implant hard tissue. A decrease of crestal bone level indicates that the implant is loosening its bony anchorage.[14] A study by Jung et al. found that more than 50% of the total bone loss recorded in 12 months period occurred during the first 3 months.[15] In intragroup group, comparison of the mean difference of mesial and distal radiological assessment in both Group I&Group II [Table 1, Graph 1] showed slight bone loss during baseline to 3rd month period as compared to baseline to 6th month and 3rdmonth to 6th month time period. The reason for bone loss during early period of healing may attributed to the surgical trauma, establishment of biologic width presence of a microgap, peri-implantitis, occlusal overload, implant crest module18. Both groups on mesial and distal surface showed increased bone loss from baseline (1st month) to 6thmonths' time interval more than that seen during baseline to 3rd month and 3rdmonth to 6th month interval. The results of this study are in accordance with those of Singh et al.[19] who found a mean bone loss of 0.6 mm on mesial and 0.9 mm on distal aspect of implant after 6 months of implant placement. Similar study conducted by Behneke et al.[20] observed a mean bone loss of 0.8 mm between implant placement and prosthetic restoration. These authors found 86% of the bone loss to take place in the first 6thmonths of implant placement.

A rapid bone loss in the initial months after implant placement may be because the fixtures are not loaded, so there is lack of physiologic stimulation and also there may be activities of remodeling which is a physiological change independent of loading and starts as soon as the implant is placed in bone. Pham et al. found that significantly more crestal bone loss was noted before functional loading than after the prosthesis was connected. Bone loss in our study showed statically non-significant results for Group I whereas for Group II the results were found to be significant for 3rd month to 6thmonth intervalon both mesial and distal surfaces. These results were significant in the Group II, because once the bone has healed and the implant is loaded, the interface remodeled again, as influenced by its local strains environment. This secondary remodeling action due to loading could be the reason of bone loss during this period. In intergroup comparison of bone mean difference of mesial and distal radiological assessment between Group I and Group II [Table 1,2 &Graph 2,3] showed slightly lesser bone loss in Group I in all three intervals as compared to Group II. And this difference was found statistically non-significant.

The reason for less bone loss in Group I could be due to the fact that with the fixture placement in fresh extraction socket, the risk of alveolar bone resorption after tooth extraction could be reduced and the gingival and crestal bone architecture are better maintained. They demonstrated that the amount of bone loss is more in the Group II than the Group I with a significant difference ($P > 0.05$) was observed in Group II. The literature is substantial in support of site preparation for implant therapy, not just in the esthetic zone but throughout the mouth. Clinicians have long known the benefit of preserving the ridge at the time of extraction to reduce the resorptive process and in many cases to avoid an additional surgical procedure to augment a deficient ridge In the present study we have used alloplast (Biograft-HT) is used in both groups when-ever needed and it has shown good results. Gangar R et al. (2013) who have also used different types of alloplasts.[21]

The present results also meet the success criteria for implant treatment proposed in the consensus report of the 1stEuropean Workshop on Periodontology: "The criteria of success include average bone loss of less than 1.5 mm during the first year after insertion of the prostheses". This loss of crestal bone could be attributed to the fact that whenever bone is stripped of its periosteum, its nutrition is affected, which could result in some amount of resorption of the crestal bone. This loss of crestal bone during the first year after placement of the implant could also be attributed to the process of wound healing at the bone-implant interface.

CONCLUSION

The immediate implant placement into extraction socket seems to be safe and predictable method. Main advantages of immediate implants are elimination of post-extraction healing period, reduced number of surgical sessions, preservation of alveolar width and height, reduction of alveolar resorption, better final rehabilitation, maintaining the natural tooth angle, lower risk of dehiscences or fenestrations around dental implant, better angulation leading to improved esthetics and axial occlusal loading and improved surgical orientation relative to pertinent anatomical structures. Immediate implant placement is a well-accepted

treatment modality that has been shown to have high cumulative survival rates ranging 92-100%. In the present study platelet-rich fibrin (PRF) has been used as regenerative material. In combination with immediate implant placement, PRF offers an easily procurable low-cost& less technique sensitive regenerative modality that offers an efficient way to improve soft-tissue and hard tissue attachment and regeneration around implants.

Clinical significances

Thus, some amount of post-operative crestal bone loss is inevitable but efforts should always be made to minimize the post-operative crestal bone loss for the clinical success and longevity of implants. Based on the results obtained from this study, following measures may be recommended to minimize the post-operative crestal bone loss during the initial months of healing but before prosthetic loading.

1. Implants may be selected with longer length, if bone quantity permits
2. Surgical trauma should be minimized during preparation of implant osteotomy site and implant placement
3. Patients should be encouraged for meticulous oral hygiene maintenance in the post-operative period
4. A regular follow-up is required to evaluate the osseointegration and the crestal bone levels in order to evaluate the clinical success and longevity of implants.

REFERENCES

1. Arora S, Bali S, Thukral P, Bhushan A, Taneja M, Aggarwal P. A Comparative Evaluation of Immediate Implant Placement in Fresh Extraction Socket with and without the Use of Platelet-rich Fibrin: A Clinical and Radiographic Study.10.5005/jp-journals-10012-1154
2. R. AdellULekholmB. RocklerP.-I. BrånemarkA 15-year study of osseointegrated implants in the treatment of the edentulous jaw.1981Volume 10, Issue 6, Pages 387–416
3. Schulte W, Heimke G. [The Tubinger immediate implant] Quintessenz. 1976;27:17–23. [PubMed] [Google Scholar]
4. Lang NP, Pun L, Lau KY, Li KY, Wong MC.A systematic review on survival and success rates of implants placed immediately into fresh extraction sockets after at least 1 year. Clin Oral Implants Res. 2012 Feb;23Suppl 5:39-66. doi: 10.1111/j.1600-0501.2011.02372.
5. ChandranPaArunSivadas Ab Platelet-rich fibrin: Its role in periodontal regenerationThe Saudi Journal for Dental ResearchVolume 5, Issue 2, July 2014, Pages 117-122
6. Bishara M, Kurtzman GM, Khan W, Choukroun J, Miron RJ. Soft-Tissue Grafting Techniques Associated With Immediate Implant Placement. CompendContinEduc Dent. 2018 Feb;39(2):e1-e4.
7. Eduardo Borie, Daniel GarcíaOliví, [...], and Ramón Fuentes.Platelet-rich fibrin application in dentistry: a literature review.Int J Clin Exp. 2015; 8(5): 7922-7929
8. Naik B, P KarunakarP, Jayadev M , Marshal Rahul V.Role of Platelet rich fibrin in wound healing: A critical reviewJournal of Conservative Dentistry 2013 - 16 -4
9. Ebenezer v, Balakrishanan k, AsirRV,SragunarImmediate placement of endosseous implants into the extraction sockets.J Pharm Bioallied Sci. 2015;7(Suppl 1):S234-7
10. H. Mohamad, Kenway E, Shinanvi u, Salem A and Ahmed F Efficacy of Platelet Rich Fibrin (PRF) Membrane in Immediate Dental Implant. Manoura Journal of Dentistry 2014;1(3):78-84.
11. Anitua E, Andia I, Ardanza B, Nurden P, Nurden A Autologous platelets as a source of proteins for healing and tissue regeneration,Thromb Hemostat2004;91:4-15.
12. Boora P, Manu Rathee M, Bhoria M Effect of Platelet Rich Fibrin (PRF) on Peri-implant Soft Tissue and Crestal Bone in One-Stage Implant Placement: A Randomized Controlled Trial . Journal of Clinical and Diagnostic Research. 2015 Apr, Vol-9(4): ZC18-ZC21
13. Ashley ET, Covington LL, Bishop BG, Breault LG. Ailing and failing endosseous dental implants: A literature review. J Contemp Dent Pract. 2003;4:35–50. [PubMed] [Google Scholar]
14. Branemark PI. Introduction to osseointegration. In: Branemark PI, Zarb GA, Albrektsson T, editors. Tissue-Integrated Prostheses: Osseointegration in Clinical Dentistry. Chicago: Quintessence Publ; 1985. pp. 11–76. [Google Scholar]
15. Kwon JY, Kim YS, Kim CW. Assessing changes of peri-implant bone using digital subtraction radiography. J Korean AcadProsthodont. 2001;39:273–80. [Google Scholar]
16. Boronat A, Peńarrocha M, Carrillo C, Marti E. Marginal bone loss in dental implants subjected to early loading (6 to 8 weeks postplacement) with a retrospective short-term follow-up. J Oral Maxillofac Surg. 2008;66:246–50. [PubMed] [Google Scholar]
17. Rao W, Benzi R. Single mandibular first molar implants with flapless guided surgery and immediate function: Preliminary clinical and radiographic results of a prospective study. J Prosthet Dent. 2007;97(6 Suppl):S3–14. [PubMed] [Google Scholar]
18. Hosseinzadeh A, Savabi O, Nassiri F. Average annual crestal bone loss of ITI implants following the first year of loading. J Res Med Sci. 2006;11:146–50. [Google Scholar]
19. Singh P, Garge HG, Parmar VS, Viswambaran M, Goswami MM. Evaluation of implant stability and crestal bone loss around the implant prior to prosthetic loading: A six month study. J Indian Prosthodont Soc. 2006;6:33–7. [Google Scholar]
20. Behneke A, Behneke N, d'Hoedt B, Wagner W. Hard and soft tissue reactions to ITI screw implants: 3-year longitudinal results of a prospective study. Int J Oral Maxillofac Implants. 1997;12:749–57. [PubMed] [Google Scholar]
21. Gangar R, Sidhwani S B, Achlia S, Sadhwani:Immediate placement into fresh extraction socket: a clinical study of seven cases.J-Pjournal- 10012-1086

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