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RESEARCH ARTICLE

ASSESSMENT OF BONE REGENERATION AFTER PLACEMENT OF IMMEDIATE IMPLANTS USING STICKY BONE AND CGF MEMBRANE

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Key words:-
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Abstract

Aim: Assessment Of Bone Regeneration After Placement Of Immediate Implants Using Sticky Bone And CGF Membrane.
Materials And Methods: The study was performed in a series of 10 patients aged 25- 40 years with hopeless prognosis of tooth and needing immediate implant replacement. After placement of implants, the sites were augmented with sticky bone and CGF membrane. The bone regeneration was assessed radiologicaly in 3, 6 and 12 months. The results were recorded.
Results: There was statistical significance comparative with intraoperative and 3,6,12 months postoperative was (p=0.001),(p=0.002),(p=0.004) suggesting there was significant difference there.
Conclusion: It was concluded thatImmediate implant placement along with sticky bone grafting provides good implant success with bone regeneration surrounding the implant**.**

Introduction:-

Immediate implant placement is a well-accepted protocol because of the preservation of esthetics, shorter total treatment time, maintenance of socket walls, reduced operative time, and better actual implant placement. The immediate implants in fresh extraction sockets allows placement of the implant during the same visit at which the tooth is extracted. Which reduces morbidity; decreases the treatment time by reducing the surgical procedures, thus improving the psychologic approach with the patient; and may achieve an optimal esthetic result. Furthermore, placement of an implant immediately after tooth extraction may help maintain the bone crest and lead to ideal implant positioning from a prosthetic point of view.

Aims And Objectives:-

AIM:

The Aim Of The Present Study Is the Assessment Of Bone Regeneration After Placement Of Immediate Implants Using Sticky Bone And CGF Membrane.

Objectives:-

To evaluate the bone regeneration after placing immediate implants with sticky bone.

1. Bone regeneration evaluation radiologically after 3 months
2. Bone regeneration evaluation radiologically after 6 months
3. Bone regeneration evaluation radiologically after 12 months

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Materials And Methods:-

This study was conducted at Department of oral and maxillofacial surgery, Best Dental Science College and Hospital, Madurai. The institutional scientific review board and ethical committee approved the protocol of this nonrandomized clinical prospective study. The study population comprised of immediate implant placement group with alveolar bone loss

Sample Selection:

Ten patients requiring tooth replacement following immediate extraction were selected from pool of a patients reporting to the Best dental science college. The patients were selected using inclusion and exclusion criteria.

Inclusion Criteria:

1. Patient willing for voluntary participation and have signed informed Consent for the described procedure
2. Patient having hopeless tooth need extraction and need immediate replacement of tooth
3. Age of the patient between 25 - 40 years
4. Systemically healthy subject

Exclusion Criteria:

1. Patients with systemic diseases contraindicating any type of surgery.
2. Patients receiving or who have received bisphosphonates.
3. Patients with use of tobacco and related products.
4. Pregnant ladies
5. Patients with improper oral hygiene.

Presurgical Assessment:

The selected patients underwent complete blood analysis and oral prophylaxis. Pre –operative IO-XRAY and OPG taken. Clinical evidence of boneloss in the operative field recorded before extraction.

Surgical Procedure:

Patients were prescribed prophylactic antibiotic therapy(Amoxicillin 500 mg tid) preoperatively and were asked to continue it for 5 further days after surgery.

As per sacco's protocol, patient's venous blood was collected and send for the AFG and CGF preparation.

The surgical field was prepared and anaesthetized with 2% lidocaine with epinephrine. With use of BP blade No 15 ,incision placed and full thickness mucoperiosteal flap raised. The tooth to be extracted removed carefully with the preservation of available bone. Subsequent curettage and antibacterial irrigation done.

Implant Placement Procedure:

Using the maximum available bone, osteotomy started with pointer drill, followed by sequence drills to the particular depth with minimum apical support of 3mm good quality bone

Implant was placed in that site with minimum torque of 30 Ncm. Bone defect area was covered with sticky bone and overthat CGF membrane was placed. .Tension free suture placed.

Immediately after implant placement , the bone volume was assessed by radiographically.

CGF Membrane And Sticky Bone Preparation:

Concentrated growth factors membrane and autologous fibrin glue (AFG) to make sticky bone is prepared at the same time. 20-60 ml of patient's venous blood is taken from patients' forearm, and the blood is divided to one to two non-coated vacutainers to obtain autologous fibrin glue (AFG), which will be mixed with allograft to make sticky bone Two to seven glass coated test tubes without anticoagulants is used to obtain CGF layer . The blood in the test tubes is centrifuged at alternate and controlled speed of 2400-2700 rpm using specific centrifuge with a rotor for 12 minutes . The centrifugation time for AFG varies from 2-12minutes.The centrifuge is stopped after 2 minute-centrifugation and take AFG tube out of the centrifuge first. The non-coated tube shows 2 different layers.

Upper layer is autologous fibrin glue (AFG) and bottom layer is red blood cell which will be is discarded. Then the vacant slot is filled with water filled test tube for weight balance and continued centrifugation . After centrifugation, silica coated tube shows three different layers. The most upper layer is platelet poor plasma, the middle layer is fibrin buffy coat layer represented by a very large and dense polymerized fibrin block containing the concentrated growth factors and the bottom layer is red blood cell layer.

CGF is taken from the test tube and placed in the metal storage box and compress with metal cover to convert to CGF membrane . The upper AFG is obtained with syringe and mixed with particulate bone powder , allows 5-10 minutes for polymerization in order to produce sticky bone which is yellow colored . For acceleration of polymerization , exudate taken in the bottom of metal storage box is added . The exudate contains growth factors and autologous thrombin , therefore auto-polymerization will be completed very rapidly. The sticky bone mixed with autologous thrombin in RBC layer shows red in color . This sticky bone, strongly interlinked in fibrin network doesn't migrate even shaking it. so the bone loss on the defect during healing period is minimized without use of bone tack or titanium mesh.

Figure 1:- Silica coated red cap tube shows three different layers. The most upper layer is platelet poor plasma, and the middle layer is fibrin buffy coat, bottom layer is red blood cell layer. Non-coated yellow cap tube shows two different layers. The upper layer is AFG layer and the bottom layer is accumulation of red blood cell.

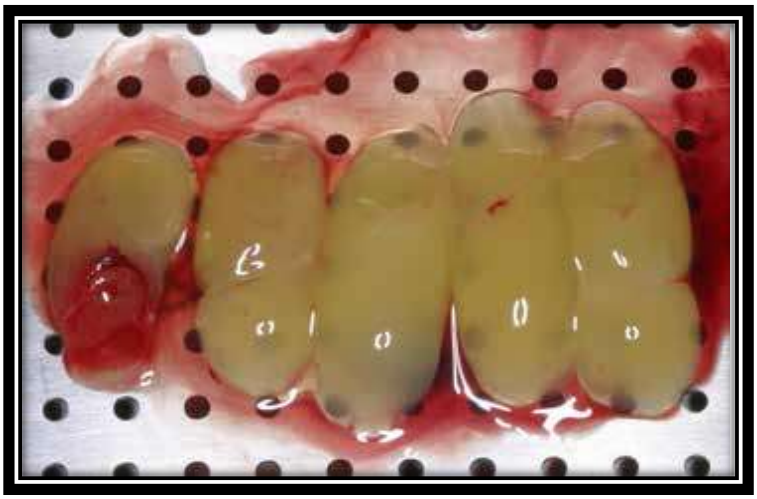


Figure 2:- CGF layer placed in the sterilized metal storagebox before compression.

Figure 3:- CGF membrane after compressing with metal cover. This membrane is used barrier membraneas alternative to collagen membrane and is used as alternative connective tissue graft for covering exposed root.

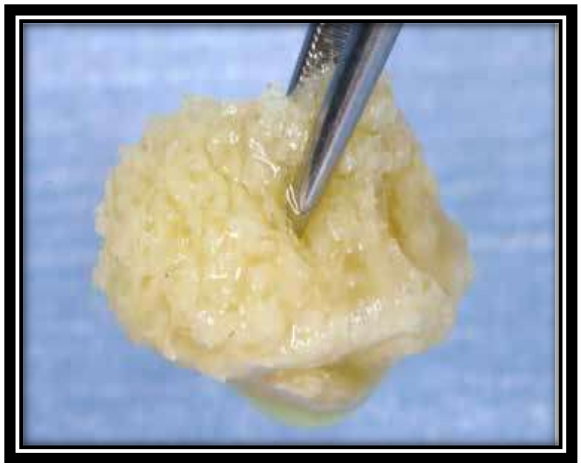


Figure 4:- Yellow colored sticky bone mixed with AFGparticulate bone powder.

Figure 5:- Red colored sticky Bonebone.

TABLE 4
Measure: MEASURE_1

(I) time	(J) time	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	4.700*	.731	.001	2.241	7.159
	3	3.900*	.690	.002	1.577	6.223
	4	3.600*	.698	.004	1.250	5.950
2	1	-4.700*	.731	.001	-7.159	-2.241
	3	-.800*	.133	.001	-1.249	-.351
	4	-1.100*	.163	.001	-1.649	-.551
3	1	-3.900*	.690	.002	-6.223	-1.577
	2	.800*	.133	.001	.351	1.249
	4	-.300*	.082	.031	-.575	-.025
4	1	-3.600*	.698	.004	-5.950	-1.250
	2	1.100*	.163	.001	.551	1.649
	3	.300*	.082	.031	.025	.575

Post Surggical Assesment:
Patient reviewed periodically and the bone volume was assessed in 3months, six months and one year by Radiologically.

Clinical Parameters:
The parameters assesed was bone regeneration after placement of sticky bone.

Results And Statistical Analysis:-

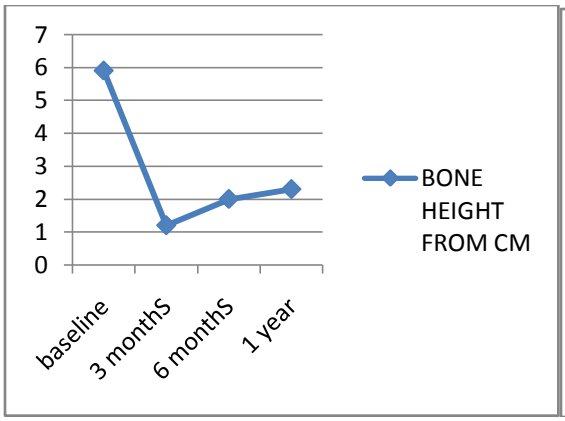
The collected patient data were tabulated and statistical analysis was performed. Microsoft Excel 2010 software to derive the mean and standard deviation and SPSS software version 21 was used for statistical analysis. Charts and graphic representations were obtained with the results.

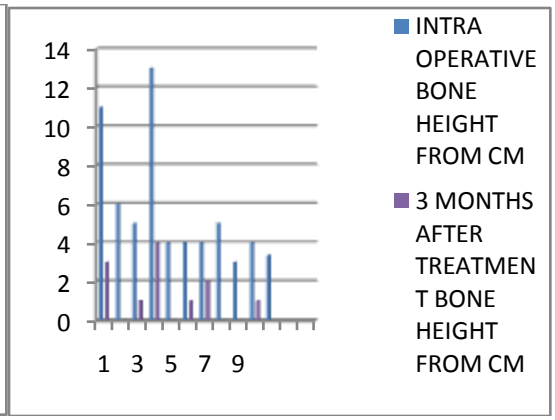
A total of 10 cases were placed with immediate implants , the bone deficient region due to various causes were augmented with sticky bone.The study includes 6 males and 4 females, the age group between 25 to 40 years. The volume of bone regeneration was assessed.Intraoperative bone loss was assessed, from coronal margin of the implant , after immediate implant placement.. The mean intraoperative bone loss was found to be 5.9(SD ±3.34). Post operative bone regeneration was assessed from cervical margin to available bone . The mean bone regeneration was found to be 1.2 (SD±1.39) ,2.00(SD±1.41), 2.3 (SD±1.39)in the postoperative period of 3months,6months,12months respectively.There was statistical significance comparative with intraoperative and 3,6,12 months postoperative was (p=0.001),(p=0.002),(p=0.004) suggesting there was significant difference there. This study indicates the possibility to perform immediate implant placement in fresh extraction sockets with the use of CGF as an alternative to conventional grafting. Further studies needs to be carried out on the subject to validate the results obtained in this study.

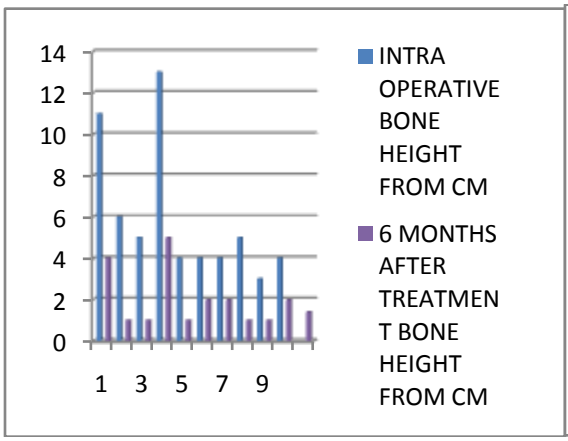
Descriptive Statistics

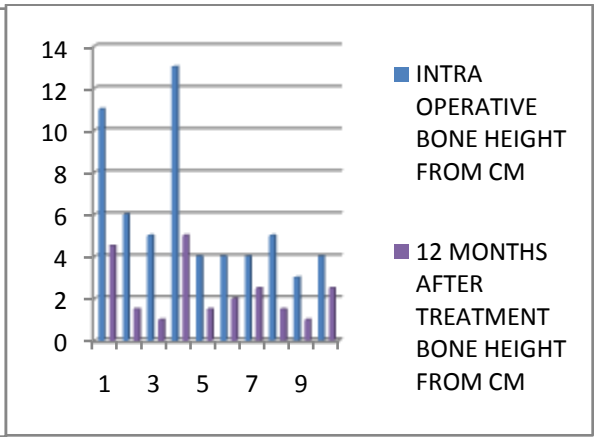
	Mean	Std. Deviation	N
INTRA OPERATIVE BONE HEIGHT FROM CM	5.90	3.348	10
3 MONTHS AFTER TREATMENT BONE HEIGHT FROM CM	1.20	1.398	10
6 MONTHS AFTER TREATMENT BONE HEIGHT FROM CM	2.00	1.414	10
12 MONTHS AFTER TREATMENT BONE	2.30	1.398	10

HEIGHT FROM CM			









Discussion:-

Rich growth factors are incorporated in platelets which are stimulate tissue regeneration. Various techniques are used for preparing platelet concentrates in surgicalfield. Platelet rich plasma and plasma rich in growth factors are the first generation of platelet concentrates which require chemical additives such as anticoagulants and thrombin or calcium chloride to induce fibrin polymerization.[42] Platelet rich fibrin and concentrated growth factors are second generation of platelet concentrate, which utilizes patient's venous blood alone to trigger platelet activation and fibrin polymerization. PRF and CGF are used as alternative to traditional barrier membrane over bone graft, they are very rich in growth factors, acceleration of tissue regeneration is acquired. PRF using constant centrifugation speed, whereas CGF utilizes alternated centrifugation speed to produce larger, denser and richerfibrin matrix containing growth factors.[40]

In 2010 Sacco introduced sticky bone. When Sticky bone is placed, as graft is in sticky in nature, it provides stabilization of graft in the defect, acceleratestissue healing and minimizes bone loss during healing period.[16]

Platelets are known to release high quantities ofgrowth factors such as platelet-derived growthfactor (PDGF), trans-forming growth factor-b1(TGF-b1) and b2 (TGF-b2), fibroblast growthfactor (FGF), vascular endothelial growth factor(VEGF), and insulin-like growth factor (IGF),which stimulate cell proliferation, matrix remodeling, and angiogenesis.[24]

PRF which was introduced by Choukron and CGF which was introduced by Sacco are recently developed platelet aggregation methods. These methods collect leukocyte and platelet richfibrin gel using a natural coagulation process.

Compared to PRP and PRGF, PRF and CGFare simple to make and doesn't require any syntheticor biomaterials, such as bovine thrombinand calcium chloride, to make gel condition.So it is free from the risk of cross-

contamination. Fibrin rich gel is known to release growth factors such as transforming growth factor, platelet-derived growth factor and vascularendothelial growth factor slowly and accelerates new bone formation when it mixed withbone graft in the maxillary sinus. You et al.reported that platelet rich fibrin gel can induce higher bone to implant contact than platelet rich plasma in bony defect around dental implant.

Jingg Qiao et al reviewed that concentrated growth factors (CGFs) are a new generation of platelets concentrates, which contain abundant growth factors. We assumed that CGFs might promote periodontal (gum) regeneration. In the present study, we used CGFs inthe treatment of periodontal intrabony defects.

Dean H. Whitmam et al described that Platelet gel has been used successfully in the area of reconstructive oral and maxillofacial surgery in conjunction with ablative surgery of the maxillofacial region, mandibular reconstruction, and adjunctive procedures related to the placement of osseointegrated implants.

Othman Shibly, Nishith Patel revealed that CGF membrane accelerates the bone formation and wound healing. As sticky bone has its ownbody and can be easily molded into the required shape. Use of CGF membrane as a barrier membrane over the sticky bone increases new boneformation due to the availability of growth factor enriched surrounding.

Jin kim et al concluded that Sticky bone is biologically solidified bone graft which is entrapped in fibrinnetwork. Sticky bone graft doesn't mobilise even upon being shaken with cotton plier because particulate bone powders are strongly interconnected with each other by fibrin network. Sticky bone has so many advantages:

1) It is moldable, so well adapted over various shape of bony defect
2) Due to the sticky in nature, micro and macro movement of grafted bone is prevented. So volume of graft augmentation is maintained during healing period.
3) Fibrin network entraps platelets and leukocytes to release growth factors
4) Unlike PRP or PRGF, sticky bone needs no chemical additives .
5) Fibrin interconnection in the sticky bone minimizes soft tissue in growth into the bone graft.

Our study includes a total 10 cases of immediate implant placement, requiring surgical removal of impacted tooth, and tooth associated with periapical cyst requiring surgical extraction.During surgical removal of these teethand cysticlesion,the amount of bone removal may vary depending on the requirement..So intraoperative bone loss is unpredictable in nature. Hence preoperative planning cannot be done accurately. Hence preoperative radiograph was not used in this study purpose.

Surgical procedures were performed under local anaesthesia.Implant was placed in the sound bone withgood primary stability achieved at the torque level of 30-40 cm. cover screw placed over the implant.Simultaneously patient's venous blood withdrawn from the patient's forearm and centrifuged to get AFG and CGF membrane. The autologus fibrin glue was mixed with alloplast material to get sticky bone.The sticky bone was placed in the bone deficient area of the implant site to cover all implant surfaces .Over thestickybone, CGF membrane was placed and completely cover the bonegraft and flap closed with primary closure.

Patient reviewed after three months,six months and after one year. The volume of bone assessed radiologically.Intraoperative bone loss was assessed, from coronal margin of the implant placed. The mean intraoperative bone loss was found to be 5.9(SD ±3.34). Postoperative bone regeneration was assessed from coronal margin of the implant to available regenerative bone. The mean bone regeneration was found to be 1.2 (SD±1.39), 2.00(SD±1.41), 2.3 (SD±1.39) in the postoperative period of 3months, 6months, 12months respectively.

The collected patient data were tabulated and statistical analysis was performed. Microsoft Excel 2010 software to derive the mean and standard deviation and SPSS software version 2.1 was used for statistical analysis. Descriptive data were presented in the form of mean, median, standard deviationand quartiles. Paired T test was used to compare boneheight before and after implant placement. Variation inbone density in the vicinity of implants after 6 months, and one year of implant placement was also compared. P value < 0.05 was considered as statistically significant. In the ten patients treated a total of ten implants wereplaced. After the twelve months follow up all the implantswere stable and functionally loaded with a 100%survival rate.

Summary And Conclusion:-

Immediate implant placement along with sticky bone grafting provides good implant success with bone regeneration surrounding the implantThere was statistical significance comparative with intraoperative and 3,6,12 months postoperative was (p=0.001),(p=0.002),(p=0.004) suggesting there was better result in bone regeneration in immediate implants with sticky bone grafting.CGF membrane and sticky bone is easy tomake and they are a very effective materialsfor the reconstruction of edentulous alveolarbone defect, based on the concept of minimally invasiveness on ridge augmentation.

Within the limitations of this study, we observed that significant increase in bone volume was evident at 6months and one year follow-up. A comparable increase was seen in thedensity of the new formed bone as well. Thus, extractionwith immediate placement of implant with CGF grafting can be a reliable alternative that is cost-effective and also it would eliminate the common risks thatare involved when using other grafting materials.This study indicates the possibility to perform immediate implant placement in fresh extraction sockets withthe use of CGF as an alternative to conventional grafting.