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RESEARCH ARTICLE

PERIODONTAL INFRABONY DEFECT GRAFTING WITH AND WITHOUT BIOCOMPATIBLE GRAFT MATERIAL DFDBA IN IMMEDIATE IMPLANT PLACEMENT AT EXTRACTION SITE

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Immediate Implant, DFDBA, Guided Bone Regenration, Jumping Gap

Abstract

Background: Immediate implant placement in contrast to delayed placement of implant may be advantageous butpresence of jumping gap, morphology of the site, presence of interdental crater or intrabony 2-3 walled defect complicates the placement of immediate implant at extraction site. To overcome these complicating factors bone substitute material ie DFDBA within the fixture-socket gap preserves alveolarridge volume by minimizing socket remodeling and encouraging de-novo bone formation.

Aim: To compare the hard tissue dimensions in immediately placed implants with and without biocompatible allograft material DFDBA at extraction site.

Material And Methods:A total number of 20 patients selected randomly from the Outpatient Department of Periodontology were categorized in two groupsCONTROL AND TEST GROUP.

Experimental GROUP "A":- Immediate implant placement without DFDBA Bone Graft in fresh extraction socketin 10 patients.**(Control Group)**

Experimental GROUP "B": Immediate implant placement with DFDBA Bone Graft in fresh extraction socket in10 patients.**(Test Group)**

Statistical Analysis: The data for the present study was entered in the Microsoft Excel 2007 and analyzed using the SPSS statistical software 23.0 Version.

Result: Test group showed increased bone dimensions post operatively after 6 months as compared to control group showing decreased bone resorption and encouraging de- novo bone formation property of DFDBA.

Conclusion: With guided bone regeneration by DFDBA for insertion of immediate dental implant displayed the predictable results when proper case selection and careful surgery was performed.

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Introduction:-

The replacement of a tooth using an implant is derived from an evolution in concepts, technology, and clinical applications, following years of basic research and fundamental studies on the concept of osseointegration. Several techniques and modifications have been proposed in implant dentistry throughout the past years to develop faster, less invasive, and more esthetic approaches during the placement of implants. One of these innovations was placing an implant immediately after tooth extraction, eliminating the need for 4 to 6 months postextraction healing and remodeling period.[1] Immediate implant placement has proven to be a highly successful approach and includes several advantages in comparison with conventional technique of implant placement, such as reduction in the number of surgical procedures, improved implant orientation during placement due to clear visualization of the extraction socket borders, preservation of the remaining alveolar bone dimensions, and improves esthetics by stabilizing the surrounding soft tissues.[2,3,4]

Presence of three-walled infrabony defect, crater at interdental bone adjacent to extraction socket or presence of resorbed buccal or lingual plates are most commonly seen around extraction socket at the time of immediate implantation that hinders the firm osseointegration and continues the further resorption of crestal bone around the socket.

Another main challenge that remains unresolved is that when an implant is placed immediately in the socket, a space is always present in the area surrounding the coronal portion of the implant, which is called "The Jumping Distance." This space is due to the discrepancy in size and form between the extraction socket and the implant morphology, which can lead to bone resorption and consequence formation of a bony defect especially in the labial area.[5]

Advanced bone grafting techniques have helped to eliminate concerns about bone deficiencies and allow implant placement according to prosthodontic needs. Localized osseous defects can be treated with various techniques such as grafting with bone blocks or particulates in an onlay form, an inlay technique with or without Guided Bone Regeneration (GBR), distraction osteogenesis, or orthodontic therapy.[6]

The rationale for the use of graft materials and membranes is to prevent the migration of cells from the gingival epithelium and connective tissues into this gap, thus permitting osteoprogenitor cells to occupy the established gap and eventually regenerate the bone tissue, thus supporting osseointegration.[2,7]

A number of graft materials are used for this purpose and these include the use of demineralized freeze-dried bone allograft (DFDBA), freeze-dried bone allograft (FDBA). DFDBA provides osteoconductive and osteoinductive factors. It induces the host undifferentiated mesenchymal cell to differentiate into osteoblasts with subsequent formation of new bone. It contains bone morphogenic proteins (BMPs) such as BMP 2, 4, and 7, which help stimulate osteoinduction.[6]

The advantages of allogeneic grafts include availability in adequate quantities, predictable results, and the elimination of an additional donor site surgery. The disadvantages of allografts include host incompatibility, potentially contaminated specimens resulting in recipient site infections, and potential transmission of disease from donor to recipient of the allograft and impractical or biologically ineffective usefulness.[6]

The present study is to evaluate clinically and radiographically the success of immediate implant placement at the time of extraction with and without DFDBA bone graft.

Aim:-

The purpose of the study is to compare the hard tissue dimension in immediate implantation with and without biocompatible allograft material DFDBA at extraction site.

Materials & Method:-

Source of Data

The present study was conducted in the Department of Periodontology, D.J College of Dental Sciences and Research, Modinagar (U.P). A total number of 20 patients selected randomly from the Outpatient Department of Periodontology were categorized in two groups.

Control and Test Group:

Experimental Group "A":-

Immediate implant placement without DFDBA Bone Graft in fresh extraction socket in 10 patients. **(Control Group)**

Experimental Group "B":-

Immediate implant placement with DFDBA Bone Graft in fresh extraction socket in 10 patients. **(Test Group)**

1) The following clinical and radiographic parameters were measured at baseline(pre-operative) and at 6 months (post-operative)

i) Plaque Index (PI) **SILNESS& LOE 1964**,Gingival IndexI(GI) **LOE & SILNESS 1963**,Pocket probing depth(PPD)

ii) Assesment of pain (VAS scale)

iii) Radiological – CBCT for defect size/bone remodelling

i) Implant success rate will be assessed by Implant Health Scale.

Statistical analyses were conducted to compare outcomes among the treatment groups.

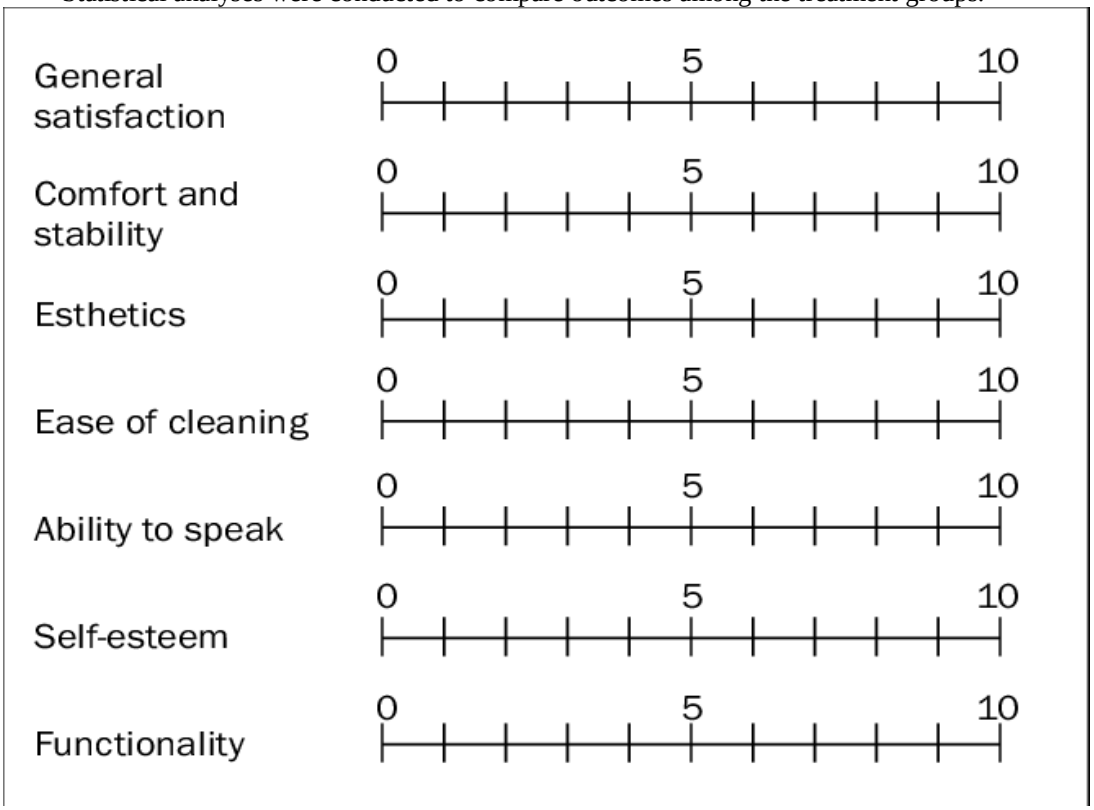

Fig:- 1 Vas Scale.

Inclusion Criteria

1. MALES AND FEMALES AGED BETWEEN 18 AND 65 YEARS.
2. GOOD GENERAL AND ORAL HEALTH (ASA 1 OR 2).
3. TOOTH REQUIRING EXTRACTION DUE TO LOSS OF SUPPORTIVE PERIODONTAL TISSUES, ROOT FRACTURES, ENDODONTIC FAILURES ETC.
4. PRESENCE OF AT LEAST 4 MM OF BONE BEYOND THE ROOT APEX.

Exclusion Criteria

1. PRESENCE OF SYSTEMIC DISEASES.
2. CONTRAINDICATED MEDICATIONS INCLUDING ANTI-INFLAMMATORY AND BISPHOSPHONATES) UP TO 2 MONTHS BEFORE SURGERY.
3. TREATMENT WITH RADIATION OR CHEMOTHERAPY (WITHIN A 5-YEAR PERIOD).
4. PREGNANT OR BREASTFEEDING WOMEN.

5. SMOKERS OR EX-SMOKERS.
6. ACUTE INFECTION AROUND THE IMPLANT SITES.

Implant Quality Scale Group	Clinical Conditions
I. Success (optimum health)	a) No pain or tenderness upon function b) 0 mobility c) <2 mm radiographic bone loss from initial surgery d) No exudates history
II. Satisfactory survival	a) No pain on function b) 0 mobility c) 2–4 mm radiographic bone loss d) No exudates history
III. Compromised survival	a) May have sensitivity on function b) No mobility c) Radiographic bone loss >4 mm (less than 1/2 of implant body) d) Probing depth >7 mm e) May have exudates history
IV. Failure (clinical or absolute failure)	Any of following: a) Pain on function b) Mobility c) Radiographic bone loss >1/2 length of implant d) Uncontrolled exudate e) No longer in mouth

*International Congress of Oral Implantologists, Pisa, Italy, Consensus Conference, 2007.

Fig 2:- Implant Health Scale.

Methodology:-

Pre-Surgical Procedure:-

All patients consented to the planned treatment strategy and received thorough scaling and root planing and oral hygiene instructions given.

The patient was advised to start pre-operative antibiotics(Cap, Amoxycillin 500mg three times a day, 1 day before surgery) and Tab. Ibuprufen 400mg 1 hour before surgery.

Surgical Procedure

The surgical incision was made around the tooth to be extracted (crevicular incision). Full thickness sub periosteal labial and palatal flaps were reflected to expose the crest to provide visualizationof the buccal and palatal or lingual bone plates.

Atraumatic extraction of the compromised tooth was done followed by socket debridement with surgical curette and irrigated with saline.

Standard conditions of asepsis and sterility were adhered to during implant placement procedure.The dimension of osteotomy was determined based on clinical and radiographic examination. Pilot drill usually 2mm in diameter was drillled in the implant site to establish the depth and axis of implant recipient site.The implant was placed with its axis parallel to the occlusal forces.Paralleling pins were used to check the parallelism of the drill holes to the adjacent teeth.The drills were used in a reduction gear hand piece along with physiodispenser enabling internal and external irrigation to prevent excessive heat generation.The drill was used at a speed of 800-1000 rpm with copious irrigation.

The paralleling pins were used at each stage of the surgery to ensure that the axis of the recipient site is not changed. Following the pilot drill, drills with gradually increasing diameter were used to enlarge the implant recipient site depending on the implant diameter. Implant (SIGDENT) was placed into the prepared site using torque wrench. Immediate implants were placed either with DFDBA(Test group- B) or without DFDBA(control group- A) as per the periodontal condition of the tooth, presence of jumping gap & prognosis. (DFDBA) was procured from **(Tata Memorial Hospital (TMH) Tissue Bank, Mumbai, Maharashtra, India).** Each vial contained 0.5cc of medium

particle size particulate bone graft ranging from 500-1024 microns. Simple interrupted (3-0 silk thread) sutures were used for the primary closure of wound to achieve stabilization of the flap.

Post Surgery

1. After finishing the procedure, patients were made to take analgesic medication within 30 minutes before local anaesthetic effects wear off.
2. Avoid the surgical site while brushing and eating.
3. 0.2% chlorhexidine mouthwash two times a day for 2 weeks.
4. Post-operative antibiotic and analgesics:

Cap: Amoxycillin 500 mg thrice a day for 5 days.
Tab: Ibuprofen 400 mg twice a day for 3 days.

Patient allergic to above medication, alternate medication was prescribed.

Tab: Ciprofloxacin 500 mg thrice a day for 5 days.

Sutures were removed 7- 10 days postoperatively.

Success Criteria

1.) Absence of any sign of peri- implant inflammation or infection.
2.) Absence of any clinical mobility.
3.) Absence of any peri-implant radiolucency when seen in intra oral periapical radiograph.

Instructionsto the Patient

1.) Advised to follow the prescribed medication.
2.) Don't spit.
3.) Ice application for 24 hrs and then warm saline gargle.
4.) To perform regular oral hygiene habits by appropriate brushing technique using tooth brush and tooth paste.
5.) 0.2% chlorhexidine gluconate rinse twice daily for 2 weeks after surgery.
6.) In case of discomfort or heavy bleeding, patients were advised to report immediately.
7.) Patients were instructed to maintain a soft diet.

The patients were dispersed and instructed to report at regular intervals.

Procedural Images

Group A – Non Dfdba (Control Group)

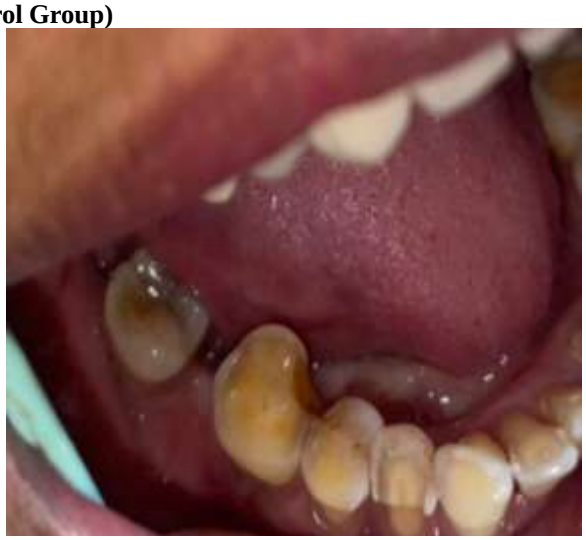

Fig. 3:- Pre Operative Clinical Photograph WRT 46.

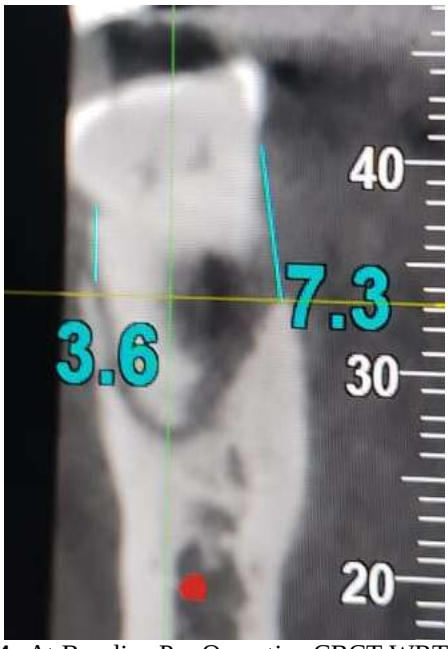

Fig.4:-At Baseline Pre Operative CBCT WRT 46.

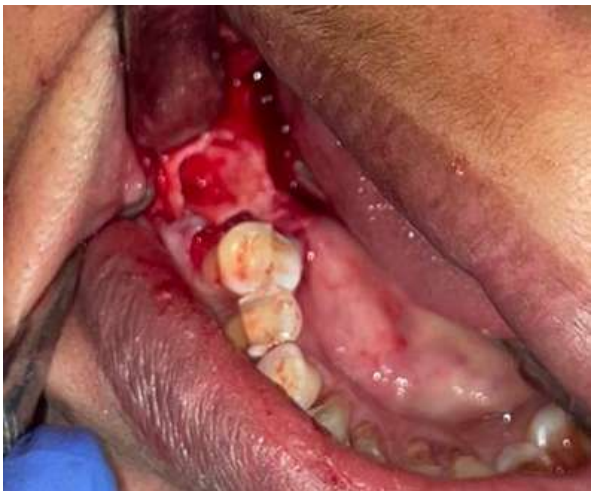

Fig 5:- Atraumatic Extraction Of The Tooth Wrt 46 & Debridement Of The Extraction Socket.

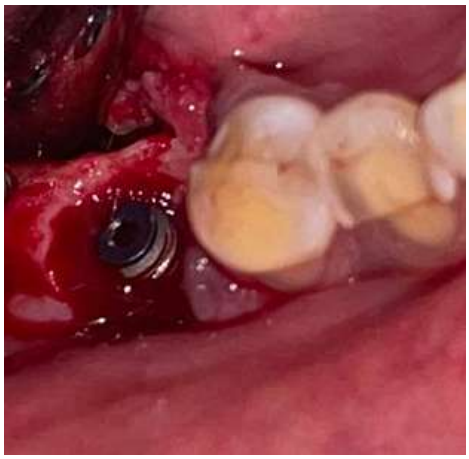

Fig. 6:- Sigdent Spiral Dental Implants Size – 4.2*8 Placed WRT 46.

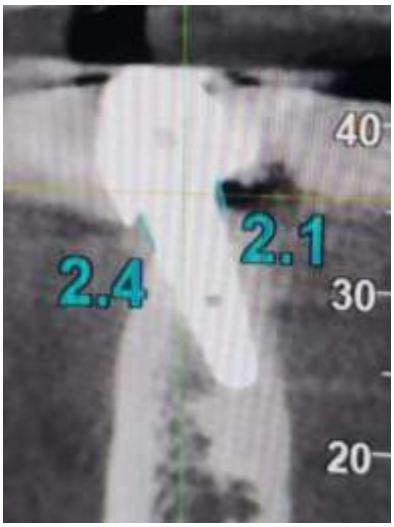

Fig. 7:- 6 Months Post Operative CBCT WRT 46.

Group B - DFDBA (TEST GROUP)

Fig. 8:-Pre Operative Clinical Photograph WRT 31 & 41.

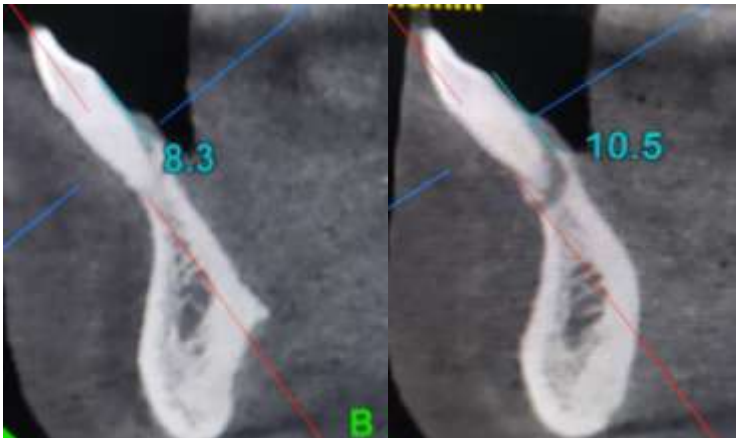

Fig 9:-At Baseline Pre Operative CBCT WRT 31 & 41.

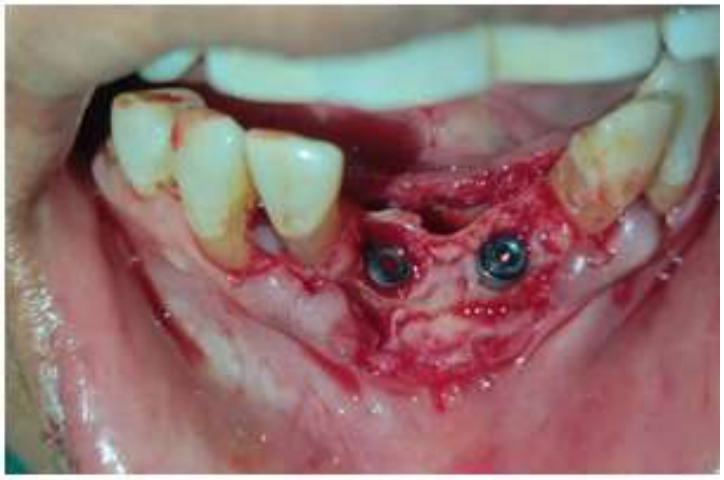

Fig. 10:- Sigdent Spiral Dental Implants
SIZE – 3.5*10 wrt 31 & 3.5*8 WRT 41 PLACED RESPECTIVELY

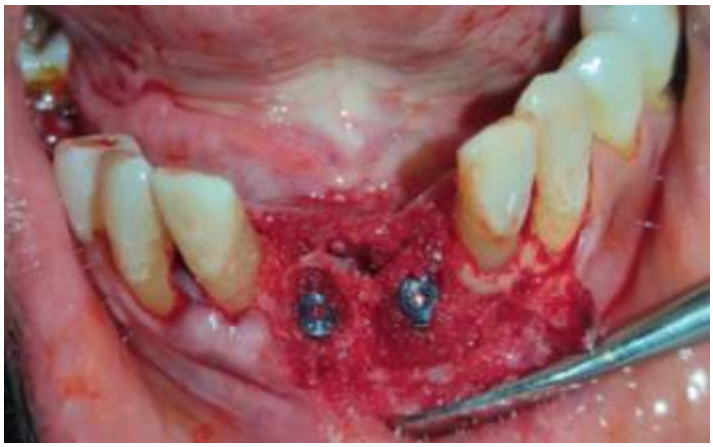

Fig11:-DFDBA Graft Material Placed AtExtraction Socket Along With Immediate Implant WRT 31 & 41

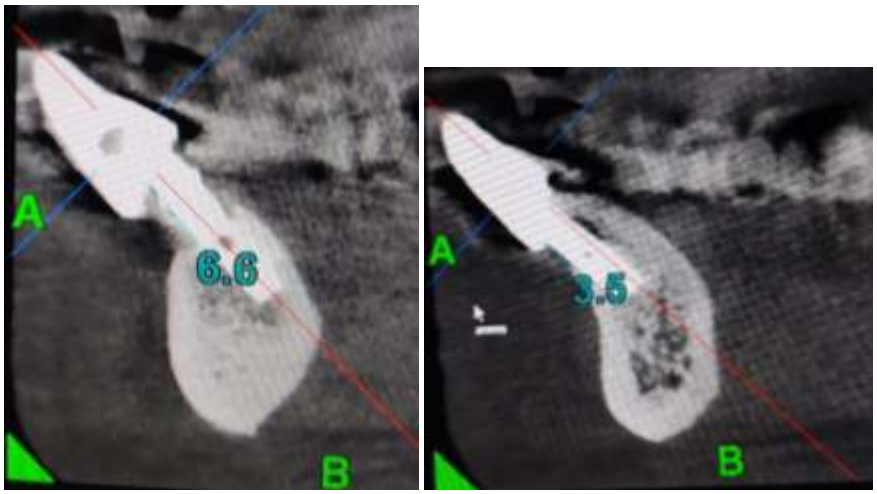

Fig. 12:- 6 Months Post Operative CBCT WRT 31 & 41.

Result:-

MEAN PAIN SCORES	GROUP	MEAN	STD DEVIATION	Std.Error Mean	P VALUE	SIGNIFICANCE
AT BASELINE	Non DFDBA	6.0000	1.33333	0.42164	0.761	NON-SIGNIFICANT
	DFDBA	5.8000	1.54919	0.48990		
AT 6 MONTHS	Non DFDBA	0.2000	0.42164	0.13333	0.556	NON-SIGNIFICANT
	DFDBA	0.1000	0.31623	0.10000		
IMPLANT STABILITY	**GROUP**	**MEAN**	**STD DEVIATION**	**Std.Error Mean**	**P value**	**Significance**
At Baseline	Non DFDBA	0.0000	0.00000	0.00000	1.000	Non – Significant
	DFDBA	0.0000	0.00000	0.00000		
At 6 Months	Non DFDBA	0.3000	0.48305	0.15275	0.254	Non – Significant
	DFDBA	0.6667	0.86603	0.28868		

		Pre Operative		Post Operative		Mean Change	P value
POCKET PROBING DEPTH		Mean	SD	Mean	SD	Mean	
	NON-DFDBA	2.90	1.197	2.10	0.316	0.80	1.000
	DFDBA	3.00	1.054	2.20	0.421	0.80	
		Pre Operative		Post Operative		Mean Change	P value
PLAQUE INDEX		Mean	SD	Mean	SD	Mean	
	NON-DFDBA	1.59	0.034	0.70	0.009	0.892	0.02
	DFDBA	1.56	0.051	0.56	0.055	1.004	
		Pre Operative		Post Operative		Mean Change	P value
GINGIVAL INDEX		Mean	SD	Mean	SD	Mean	
	NON-DFDBA	1.54	0.022	0.516	0.044	1.027	0.012
	DFDBA	1.52	0.030	0.416	0.018	1.112	

RADIOGRAPHIC EVALUATION		Pre Operative		Post Operative		Mean Change	P value
		Mean	SD	Mean	SD	Mean	
BUCCAL	NON-DFDBA	2.15	0.366	2.40	0.502	-0.25	0.001 (Sig)
	DFDBA	3.20	0.894	1.30	0.470	1.90	
LINGUAL	NON-DFDBA	2.85	1.039	3.85	1.039	-1.00	0.001 (Sig)
	DFDBA	2.90	1.410	1.25	0.550	1.65	

Statistical Analysis

The data for the present study was entered in the Microsoft Excel 2007 and analyzed using the SPSS statistical software 23.0 Version. The descriptive statistics included mean, standard deviation frequency and percentage. The level of the significance for the present study was fixed at 5%.

The intergroup comparison will be done using the independent t tests. The Shapiro–Wilk test was used to investigate the distribution of the data and Levene's test to explore the homogeneity of the variables.

Discussion:-

The placement of oral implants immediately following extraction was initially described by **William Schulte and Heimke** in **1976**.[8]

Chen and Buser and Nowzari et al(2006)[9,10], studied that immediate implantation prevents bone resorption and often helped preserve socket bone and the surrounding jaw.

A demineralized freeze- dried bone allograft (DFDBA) is an allograft composed of demineralized bone matrix (DBM) following the demineralization of a freeze dried bone allograft (FDBA). Though a variety of bone graft options have been used in the regeneration of periodontal regeneration, DFDBA is used the most often. When implanted in the bone that is already well vascularized, it has the ability to stimulate cell attachment, cell migration and osteogenesis. DFDBA provides osteoconductive and osteoinductive factors. It induces the host undifferentiated mesenchymal cell to differentiate into osteoblasts with subsequent formation of new bone. It contains bone morphogenic proteins (BMPs) such as BMP 2, 4, and 7, which help stimulate osteoinduction.[6]

In this study, full mouth plaque index and plaque index at implant site remained stable throughout the 6 months period. The difference between the control and test group was statistically non-significant with p value of 0.001 which was in accordance to the study done by **M. Viswambaran et al (2014)**[11] who reported that there was no clinical significant dfference between the two groups.

The mean gingival score in the control group was 1.54 at the pre operative time and 0.516 at the post operative time interval. In the test group the mean Gingival score was 1.52 at the pre operative time and 0.416 at the post operative time interval. The mean change from pre treatment to post treatment was statistically significant in both the groups ($p \leq 0.001$). The difference between the control and test group was statistically non-significant with p value of 0.112.

In our study we also evaluated probing depth a buccal, lingual, mesial and distal sites for both the groups. The probing depth was stable throughout the evaluation period. This study was in accordance with **Komal R et al (2022).**[12]

Assessment of pain was done by using VAS scale. The Visual Analogue Scale (VAS) consists of a straight line with the endpoints defining extreme limits such as 'no pain at all' and 'pain as bad as it could be. Difference in pain intensity measured at two different points of time by VAS represents the real difference in magnitude of pain which seems to be the major advantage of this tool compared to others.[13]

Misch et al(2008)[14] defined clinical criteria based on which implants are assigned to four groups. These included success (group I), satisfactory survival (group II), compromised survival (group III), and failure (group IV). The clinical criteria incude tenderness, mobility, radiographic bone loss nad history of exudates.

None of the implants showed any mobility at the end of 6 months showing a 100% success rate. There was no infection or periapical radiolucency in 20 implants placed. None of the 20 implants showed any clinical mobility. The clinical and radiological assessment of the implant site of all our subject showed no signs of loss of implant integration.

Research conducted by **Botticelli D et al (2004)**[5]showed that during the initial 4 month, of healing following tooth extraction and implant placement, height reduction was 1.9 mm (or 56%), whereas the equivalent reduction of lingual dimension was 0.8 mm (or 27%).

It has been observed that employing DFDBA for grafting extraction sockets resulted in a rise in the number of new bone trabeculae as well as the average size of new bone trabeculae at all time intervals.[15] This could be due to DFDBA particles osteoconductive and osteoinductiveproperties.The action of bone inductive proteins called BMPs revealed during the demineralization process was thought to cause DFDBA to induce bone formation. The BMPs are involved in a biologic cascade that includes chemotaxis and matrix attachment, cell proliferation, and differentiation into cartilage, bone, and marrow.[16]

All the implants were radiographically evaluated for bone resorption & jumping space between implant surface and bone at mesial and distal sites of the implants.

On the Buccal surface the mean Radiological values in the control group was 2.15 at the pre operative time and 2.40 at the post operative time interval. The mean increase from pre op to post op time interval was 0.25. On the Lingual surface the mean Radiological values in the control group was 2.85 at the pre operative time and 3.85 at the post

operative time interval. Results showed that the ridge measurements are decreased compared to that of the baseline in control group in immediate implant. This study was in accordance with**Brägger U, Pasquali L, Kornman KS(1988)**[17]carried out in the past.

In the test group on the buccal surface the radiological values were 3.20 at the pre operative time and 1.30 at the post operative time interval. The mean reduction from pre op to post op time interval was 1.90. On the Lingual surface the mean Radiological values were 2.90 at the pre operative time and 1.25 at the post operative time interval. The mean decrease from pre op to post op time interval was 1.65. The difference between the control and test group was statistically significant with p value of 0.001.This suggest that there is significant amount of bone remodeling happening around the implant in the test group and there is decreased gap width between implant shoulder and the bone post 6 months showing better efficiency of DFDBA allograft in immediately placed implant as compared to when no graft used while placing implant at extraction socket. This is a viable clinical technique to reconstitute the absence of the labial/bucaal cortical plate. This study was in accordance with **Komal R bhombe et al (2022)**[12]carried out in the past.

Capelli et al (2013)[18]reported that in immediately placed combination implants, when the distance between implant surface and the external aspect of the buccal plate is <4 mm, an internal and external grafting is needed to maintain the volume and contour of the ridge, gaining a successful outcome.

A systematic review done by**Quirynen and colleagues(2007)**[19] showed failure rate of less than 5% for immediate implantation using DFDBA and resorbable membrane between flap and buccal bone along with filling the gap, compared immediate implantation without use of DFDBA in filling gaps. This study was in favour with our study. When the outer expect of the buccal cortical plate is augmented, nutrition and blood supply of the buccal plate may majorly take place through a blood clot and granulation tissue that fill the gap. Filling one side of buccal bone can improve coagulum stability, create a scaffold for regenerating new bone, and reduce vertical buccal bone resorption. When two sides of buccal bone are filled with graft material, presumably due to a decrease in blood circulation to the buccal crest, soft tissue gain in the vertical dimension is smaller.[20] Contradictory to our study **Fickl et al(2009)**[21] reported in a study of animals that when doing socket preservation, overbuilding of buccal bone plate on the external aspect of the buccal plate was not advantageous over no overbuilding.

Hassan KS et al (2011)[22]evaluated on immediate dental implants and bone graft and they concluded that :-

To achieve a good osseointegrated implant with a high degree of predectibility, the immediate implant might be placed with bone graft without immediate loading.

The immediate dental implant placement with DFDBA graft was significantly superior than placing immediate implant without DFDBA suggesting that it could be an optimum bone substitute for treatment of infrabony defect around immediate dental implant.

Conclusion:-

Extraction sites present a great restorative challenge. Precise diagnosis and treatment planning are the key factors in achieving good outcomes after placing and restoring implants immediately after tooth extraction. The following advantages of immediate implantation over conventional placement has been illustrated in various literatures ie ithelps in putting a stop on bone resorption and socket remodeling that in other way happen; it maintains alveolarbone unification and anatomy; permits ideal placement of the implant with required load distribution; treatment time is reduced along with surgical procedures; preservation of gingival contours andheight in aesthetic zones, and it make better patient adoption of the treatment plan.[23]Concept of an osteogenic “jumping distance,” attribute a significant biologic relevance to the distance between an implant and the surrounding alveolar wall. Specifically, bony gap distances greater than 0.5 mm may not allow for predictable bone deposition on the implant surface without simultaneous use of a regenerative procedure.[24] Immediate implantationregenerative techniques minimizes horizontal bone loss changes in the buccal boneafter immediate implant placement.[12]With guided bone regeneration by DFDBA for insertion of dental implant displayed the predictable results when proper case selection and careful surgery was performed. However with longer time frame and large sample size standardized treatment approaches should be explored to enable goodand predictable long-term functional outcomes in alveolar bone regeneration and implant rehabilitation.

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