RESEARCH ARTICLE

A COMPARATIVE EVALUATION OF EFFICACY OF AUTOGENOUS BONE GRAFT AND BIOACTIVE GLASS ALLOPLAST IN THE TREATMENT OF INTRAOSSEOUS PERIODONTAL DEFECTS- A CLINICO-RADIOLOGICAL STUDY

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ABSTRACT

Aim : The aim of this study was to compare the efficacy of autogenous bone graft and bioactive glass in the treatment of infrabony periodontal defects.

Material and methods: The present study is a randomized controlled trial of 6 months duration with intrabony defects of three and two wall defects which were equally divided into test and control groups.

Results : The mean Pocket depth decreased significantly ($p<0.05$) from baseline to 6 months in the control group and test groups.

Conclusion: Periodontal osseous surgery tends to improve the clinical condition of gingiva of the patient leading to enhanced clinical results of periodontal therapy in periodontally affected sites.

KEY WORDS

Periodontal, autogenous bone graft, alloplast, perioglas etc

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INTRODUCTION

Periodontal disease is among the most prevalent disease worldwide and is the major cause of tooth morbidity. The disease is characterized by presence of gingival inflammation, periodontal pocket formation, loss of connective tissue attachment and alveolar bone around the affected teeth. The primary goal of periodontal therapy is to arrest the progression of periodontal disease and maintain the natural dentition in health and comfortable function.[1]

Different types of bone deformities can result from periodontal disease. Vertical and angular defects are those that occur in an oblique direction, leaving a hollowed-out trough in the bone alongside the root, the base of the defect is located apical to the surrounding bone.[2]

Bone grafting procedures with autogenous bone grafts, allografts, xenografts, and alloplasts are used to promote periodontal regeneration.[3] Among the different graft materials available, autogenous bone remains the gold standard for osseous regeneration[4] because autograft bone have osteogenic property, less chances of immunological reactions, minimal inflammatory reactions, rapid revascularization graft particle and potential release of growth factors(Marx1994)[5]

Clinical measurements usually involve measuring pocket depths and clinical attachment loss. Both of these measurements rely on the use of a periodontal probe. Probing measurements can often be inaccurate due to a variety of operator, armamentarium and patient dependent factors. These factors include probe angulation, force, diameter of the tine, amount of inflammation, anxiety and discomfort during clinical evaluation.[5]Van der Zee has found that probe tiny diameter and calibration may have an effect on the measuring pocket depth.[6] Theil found that probe readings were not a precise measurement of attachment loss, especially in areas of increasing destruction and on multi-rooted teeth.[7]

Three-dimensional imaging in dentistry has become popular and gives the clinician an ability to visualize and measure bone level without structures

being superimposed and enhance periodontal diagnosis compared to regular radiographs.[8]

Due to limited radiation exposure, ability to take a small focused field, and ability to avoid having distortion independent of the location of the tooth, CBCT has great potential for evaluation of depth and architecture of infrabony defects. The measurements from CBCT is as accurate as using periodontal probe and superior to PA's in diagnosing buccal and lingual defects. In difficult treatment planning cases, CBCTs have tremendous potential for making the initial exam more informative and the process of diagnosis and treatment planning more precise.[9]

Hence this prospective, randomized controlled trial is planned to evaluate the efficacy of autogenous bone graft in treatment of periodontal infrabony defects using CBCT as a diagnostic tool for appropriate diagnosis and treatment.

MATERIALS AND METHODS

The subjects for this study were selected from the Outpatient Department of Periodontology, I.T.S-CDSR, Muradnagar, Ghaziabad; Uttar Pradesh. The sample size of this study was 20 sites with three and two wall defects ,with angular defect. Patients will be assigned to the following two groups randomly and was followed for 6 months

GROUP 1- Defect sites were treated with application autogenous bone graft (TEST GROUP)

GROUP 2- Defect sites were treated with application of perioglas (CONTROL GROUP)

Inclusion criteria:

1. Systemically healthy subjects.
2. Subjects with age between 18- 50 years.
3. Patients suffering from chronic periodontitis and each subject having minimum number of 20 teeth present.
4. Patients having periodontal pockets with probing depth≥5mm.
5. Patients showing radiographic evidence of infrabony osseous defects.

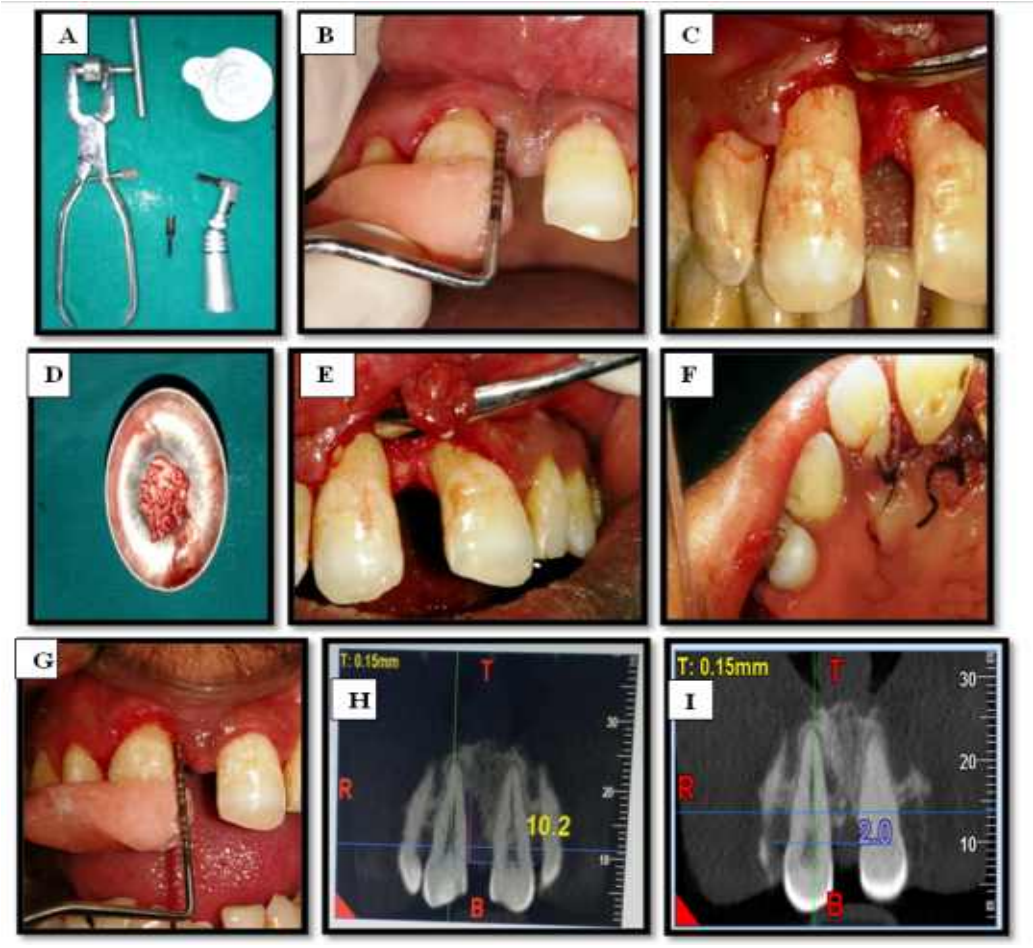


Figure 1: Armamentatrium and Surgical Procedure (test site) **A .** Contrangle Hand Piece with Trephine Bur and Bone Mill **B.** Pocket probing depth and RCAL at baseline **C.** Debridement of the defect **D.** Bone graft procured from extracted site **E.** Placement of the bone graft **F.** Sutures placed **G.** Pocket probing depth and relative clinical attachment level at 6 months **H.** CBCT at Baseline **I.** CBCT at 6 Months**.**

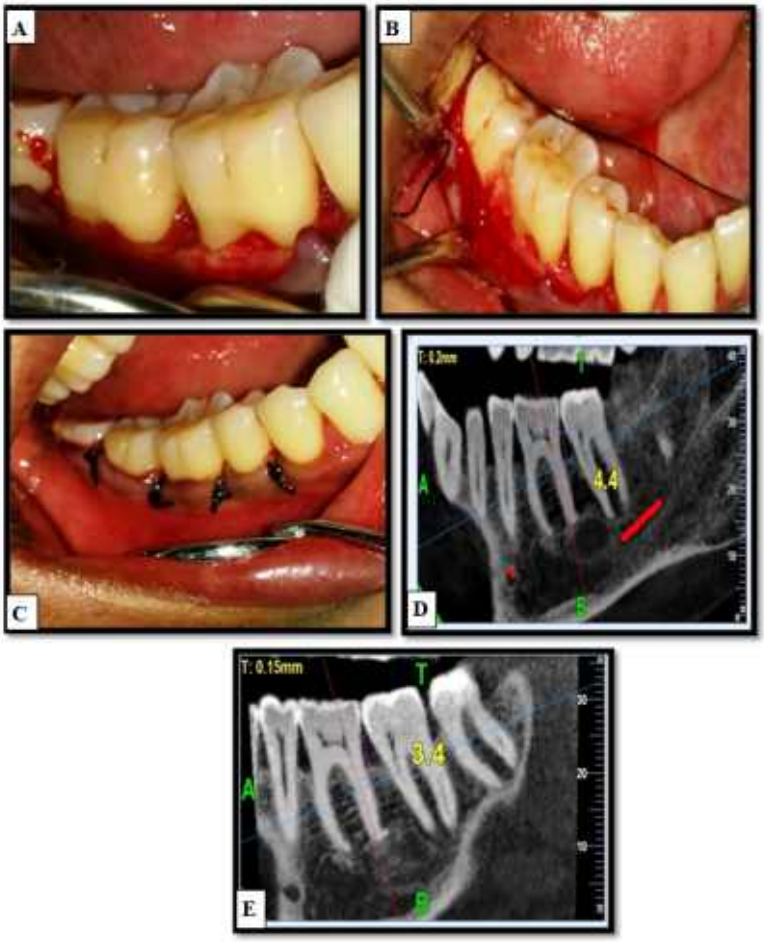


Figure 2. Surgical procedure (control site) **A.** Debridement of the defect **B.** Placement of the graft (perioglas) at the defect **C.** Sutures placed **D.** CBCT at baseline **E.** CBCT at 6months

6. Subjects who were willing to comply with all the study related procedure were allowed sign the inform consent form.

Exclusion criteria:

1. Patients who were medically compromised.
2. Patients with any history of allergy to the material used in this study
3. Patients who were on antibiotic or antimicrobial therapy in previous 6 months.
4. Patients on any drug therapy which was known to influence the periodontium.
5. Patients who were pregnant or lactating.
6. Patients who had undergone any type of periodontal flap surgical procedure or regenerative therapy 6 months prior to the initial examination.
7. Patients who were tobacco users.
8. Subjects unable to provide informed consent.

SURGICAL PROCEDURE

All the periodontal surgical procedure were performed on patients suffering from chronic periodontitis[1] under aseptic conditions. Standardized surgical procedure for the test sites was performed as follows:

Surgical area was anesthetized using local anesthesia (2% lignocaine with adrenaline 1:80,000) After intracrevicular incision, full thickness mucoperiosteal flap was elevated without any vertical incisions. Fully expose the infrabony defects followed by meticulous debridement and thoroughlt irrigated wit sterile saline. After the surgical site was prepared an adequate amount of particulate cortical bone harvested with the trephine bur from the buccal cortical plate 10 adjacent to the defect or any extracted site or parasymphysis region and put it into the bone crusher to squeeze out the bone and placed to the defect site. The flaps were repositioned to the presurgical level and sutured with 3-0 silk. Post operative medications included a single standard regimen of oral dministration of amoxicillin 500mg

thrice a day for 5 days, Ibuprofen 400 mg+ Paracetamol 325mg thrice daily for 5 days and 0.2% chlorhexidiene gluconate twice daily for a period of 2 weeks. sutures were removed after 7 days.

STATISTICAL ANALYSIS

Statistical analysis was performed using a commercially available software program **SPSS (Statistical Package for Social Sciences) version 21.0 and Epi-info version 3.0.Mann-Whitney U test** is used for comparison of mean value between 2 groups when the data does not follow the normal distribution. **Wilcoxon sign rank pair test** was used for comparison of 2 mean values obtained from a same group or a pair of values obtained from the same sample when the data does not follow the normal distribution. **Friedman's test** was used for comparison of more than 2 mean values obtained from a same group or a obtained from the same sample when the data does not follow the normal distribution.

RESULT

The purpose of the present clinical trial was to evaluate the efficacy of bioactive glass particles (PerioGlas®) and autogenous bone graft in the treatment of periodontal intrabony defects. For this study 20 patients in the age of 18-60 years fulfilling the inclusion and exclusion criteria contributing to a total of 20 intrabony defects, were recruited. The test group with 10 intrabony defects was treated with autogenous bone as bone graft material and while the control group 10 intrabony defects were treated with bioactive glass particle (PerioGlas®) alone.

All the surgical sites healed uneventfully. Neither allergic reactions nor suppuration or abscess formation was observed at any surgical site. No teeth were extracted during the course of the study.

Measurement of GI

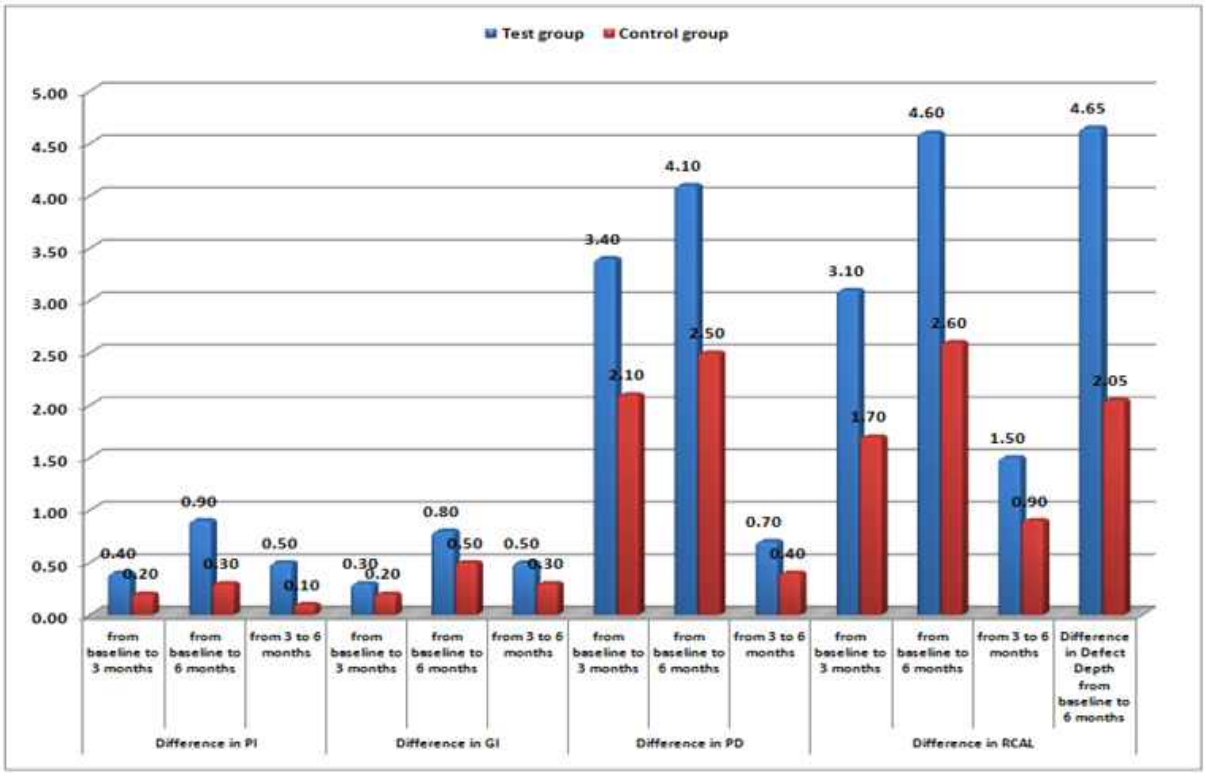
The mean GI 11at baseline for the control group and the test group was 1.20±0.42 and 1.00±0.00 respectively. The mean GI at 6 months was found to be 0.70±0.42 and 0.20±0.42 for the control and the test group respectively (TABLE1, GRAPH 1). The mean Gingival Index decreased significantly ($p<0.05$) from baseline to 6 months for test group (TABLE 3) as compared to the control group.

Measurement of PI

The mean Plaque Index12 at baseline for the control group and the test group was 1.20±0.42 and 1.20±0.42 respectively. The mean Plaque Index for the control and the test group at 6 months was 0.90±0.32 and 0.30±0.48 at 6 months respectively (TABLE 1, GRAPH 1). The mean Plaque Index decreased significantly from baseline to 6 months in test group (TABLE 3).But there was no significant change in the mean Plaque Index for the inter-interval comparison for control group (TABLE 3).

		Test Group		Control Group				
		Mean	Std. Deviation	Mean	Std. Deviation	Mean Difference	t-test value	p-value
Plaque index	Baseline	1.20	0.42	1.20	0.42	0.00	0.000	1.000
	3 months	0.80	0.42	1.00	0.00	-0.20	-1.500	0.151
	6 months	0.30	0.48	0.90	0.32	-0.60	-3.286	0.004*
Gingival index	Baseline	1.00	0.00	1.20	0.42	-0.20	-1.500	0.151
	3 months	0.70	0.48	1.00	0.00	-0.30	-1.964	0.065
	6 months	0.20	0.42	0.70	0.48	-0.50	-2.466	0.024*
Pocket depth	Baseline	6.50	1.43	6.20	1.14	0.30	0.519	0.610
	3 months	3.10	0.57	4.10	1.10	-1.00	-2.554	0.020*
	6 months	2.40	0.52	3.70	1.06	-1.30	-3.488	0.003*
RCAL	Baseline	9.70	1.95	9.70	1.16	0.00	0.000	1.000
	3 months	6.60	1.51	8.00	0.94	-1.40	-2.492	0.023*
	6 months	5.10	1.45	7.10	0.88	-2.00	-3.735	0.002*
defect depth	Baseline	8.34	2.07	8.48	1.87	-0.14	-0.159	0.876
	6 months	3.69	1.79	6.43	2.15	-2.74	-3.100	0.006*

TABLE 1: INTER GROUP COMPARISON OF CLINICAL PARAMETERS AT VARIOUS TIME INTERVALS. *SIGNIFICANT DIFFERENCE



GRAPH 1: MEAN PLAQUE INDEX, GINGIVAL INDEX, PROBING DEPTH, RCAL AND RADIOGRAPHIC DEPTH AT VARIOUS TIME INTERVALS IN TEST AND CONTROL GROUPS

		Test Group		Control Group				
		Mean	SD	Mean	SD	Mean Difference	t-test value	p-value
Difference in PI	from baseline to 3 months	0.40	0.52	0.20	0.42	0.20	0.949	0.355
	from baseline to 6 months	0.90	0.32	0.30	0.48	0.60	3.286	0.004*
	from 3 to 6 months	0.50	0.53	0.10	0.32	0.40	2.058	0.044*
Difference in GI	from baseline to 3 months	0.30	0.48	0.20	0.42	0.10	0.493	0.628
	from baseline to 6 months	0.80	0.42	0.50	0.53	0.30	3.406	0.047*
	from 3 to 6 months	0.50	0.53	0.30	0.48	0.20	2.885	0.038*
Difference in PD	from baseline to 3 months	3.40	1.43	2.10	0.74	1.30	2.555	0.020*
	from baseline to 6 months	4.10	1.45	2.50	0.71	1.60	3.138	0.006*
	from 3 to 6 months	0.70	0.48	0.40	0.52	0.30	1.342	0.196
Difference in RCAL	from baseline to 3 months	3.10	1.45	1.70	0.67	1.40	2.769	0.013*
	from baseline to 6 months	4.60	1.35	2.60	0.70	2.00	4.160	0.001*
	from 3 to 6 months	1.50	0.85	0.90	0.57	0.60	1.857	0.080
Difference in Defect Depth from baseline to 6 months		4.65	1.07	2.05	0.74	2.60	6.325	0.001*

TABLE 2: INTER GROUP COMPARISION OF MEAN DIFFERENCE IN CLINICAL PARAMETERS AT VARIOUS TIME INTERVALS.

*** SIGNIFICANT DIFFERENCE**

			Test Group		Control Group	
			Mean Difference	p-value	Mean Difference	p-value
Plaque index	Baseline	3 months	0.40	0.046*	0.20	0.157
	Baseline	6 months	0.90	0.003*	0.30	0.083
	3 months	6 months	0.50	0.025*	0.10	0.317
Gingival index	Baseline	3 months	0.30	0.043*	0.20	0.110
	Baseline	6 months	0.80	0.014*	0.50	0.243
	3 months	6 months	0.50	0.043*	0.30	1.000
Pocket depth	Baseline	3 months	3.40	< 0.001*	2.10	< 0.001*
	Baseline	6 months	4.10	< 0.001*	2.50	< 0.001*
	3 months	6 months	0.70	0.015*	0.40	0.110
RCAL	Baseline	3 months	3.10	< 0.001*	1.70	< 0.001*
	Baseline	6 months	4.60	< 0.001*	2.60	< 0.001*
	3 months	6 months	1.50	0.003*	0.90	0.002*
Defect depth	Baseline	6 months	4.65	< 0.001*	2.05	< 0.001*

TABLE 3: INTRA GROUP COMPARISION OF MEAN DIFFERENCE IN CLINICAL PARAMETERS AT VARIOUS TIME INTERVALS IN CONTROL GROUP. * SIGNIFICANT DIFFERENCE

	Test Group		Control Group				
Radiographic defect depth	Mean	Std. Deviation	Mean	Std. Deviation	Mean Difference	t-test value	p-value
Baseline	8.34	2.07	8.48	1.87	-0.14	-0.159	0.876
6 months	3.69	1.79	6.43	2.15	-2.74	-3.100	0.006*
Difference from baseline to 6 months	4.65	1.07	2.05	0.74	2.60	6.325	0.001*

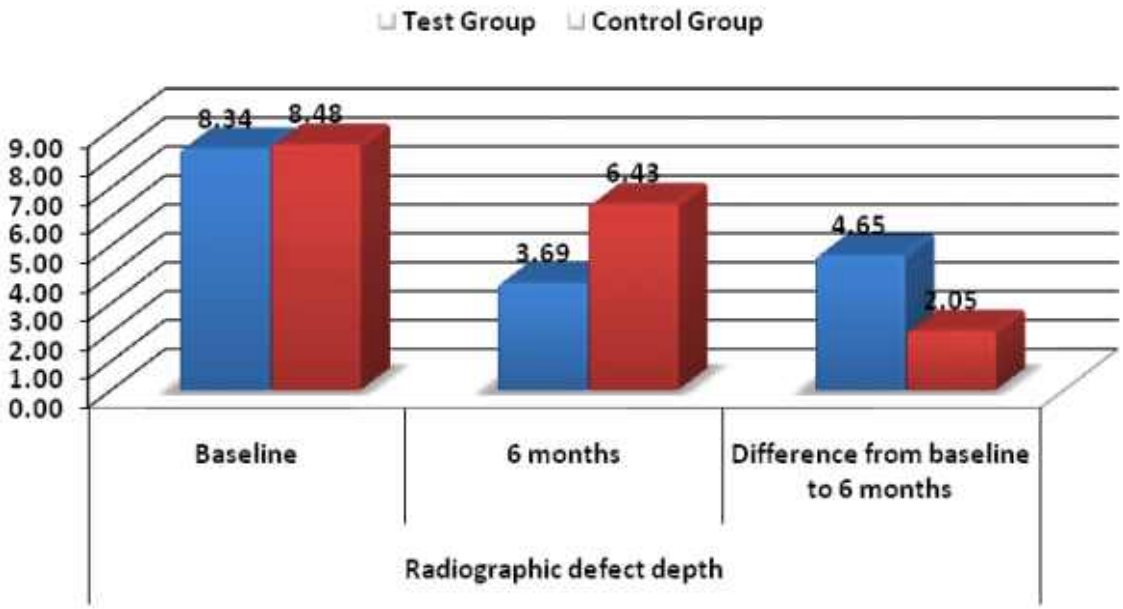
TABLE 4: THE COMPARISON OF MEAN DEFECT DEPTH AT BASELINE AND 6 MONTHS

Measurement of POCKET PROBING DEPTH (PD).

The mean PD at baseline for the control and the test group was 6.20±1.14 mm and 6.50±1.43mm respectively. At 3 months the mean PD reduced to 4.10±1.10 mm and 3.10±0.57 mm for the control and the test group respectively. The mean PD for the control and the test group was 3.70±1.06 mm and 2.40±0.52mm at 6 months respectively (TABLE 1, GRAPH 1). The mean difference in Pocket depth from baseline to 3 months and from baseline to 6 months was significantly more (p>0.05) in the Test group in comparison to Control group.(TABLE 3).

Measurement of RELATIVE CLINICAL ATTACHMENT LEVEL (RCAL)

The mean RCAL at baseline for the control and the test group was 9.70±1.16 mm and 9.70±1.95 mm respectively. At 6 months RCAL for the control



GRAPH 3 :MEAN DIFFERENCE IN DEFECT DEPTH BETWEEN TEST AND CONTROL GROUPS FROM BASELINE TO 6 MONTHS

7.10±0.88 and for the test group was 5.10±1.45 mm (TABLE 1, GRAPH 1). The reduction of RCAL in test group was significantly more from baseline to 6 months (p>0.05) as compared to Control group. (TABLE 2).

Measurement of RADIOGRAPAHIC DEFECT DEPTH

The mean radiographic defect depth at baseline for the control and the test group was 8.48± 1.87 mm and 8.34±2.07 mm respectively. At 6 months, the mean defect depth reduced to 6.43±2.15mm and 3.69±1.79mm for the control and the test groups respectively. (TABLE 4, GRAPH3). There was significant difference in mean difference in defect depth from baseline to 6 months between Control and Test groups. (TABLE 4, GRAPH2).The mean Defect depth decreased significantly from baseline to 6 months for control group and test group. (TABLE 3)

DISCUSSION

The goal of periodontal surgery is access for definitive calculus removal and surgical management of bony irregularities which have resulted from the disease process to reduce pockets as much as possible and improving the clinical attachment level. The mean **Relative Clinical Attachment Level** at baseline for the control and the test group was 9.70±1.16 mm and 9.70±1.95 mm respectively. At 3 months the mean RCAL reduced to 8.00±0.94 mm and 6.60±1.51 mm for the control and the test group respectively. The mean RCAL for the control and the test group was 7.10±0.88 mm and 5.10±1.45 mm at 6 months respectively. The results of our study are consistent with the study done by **keles et al**[14] who found the significant CAL gain of 4.50±0.80mm in the sites treated with Autogenous bone graft in a period of 6months which was in accordance with our study. **Orsini et al**[15] showed the CAL gain of 5.25± .75 in the group treated with autogenous bone graft at a period of 6 months. **Nevins et al**[16] in series of cases also recorded a mean CAL gain of 2.2 mm after 6 month following (Perioglas). The findings of our study are consistent with study by **Park et al**[13] who found a significant CAL gain in sites treated with bioactive glass compared to OFD at 6 months. Similar findings were observed in the study done by **Froum et al**[17] who reported significant improvement in clinical attachment level gain in the bioactive glass sites compared to the control sites. The gain in the CAL might have resulted from periodontal regeneration via new attachment or healing characterized by the formation of long junctional epithelium between the new regenerated tissues and the root surface.[95]

To substantiate the improvement in clinical parameters, radiographic assessment were done for alveolar bone changes. CBCT scans were done for radiographic evaluation of the test and control sites showed changes in the appearance of the graft material from the time of placement to 6 months. The mean **Radiographic Defect Depth** at baseline for the control and the test group was 8.48± 1.87 mm and 8.34±2.07 mm respectively. At 6 months, the mean defect depth was reduced to 6.43±2.15mm and 3.69±1.79mm respectively. The mean defect depth at 6 months was significantly more (p>0.05) among test

group in comparison to control group. These findings are in accordance with the study done by **Keles et al**[14] who showed the bone fill of 5.92±1.83 mm in the ACB graft-treated group. **Crea et al**[18] who reported statistically significant gain in defect depth of 3.03 mm in sites treated with (IMP + OFD) while the sites treated with OFD alone showed a linear bone growth of 1.69 mm. **Frorm et al**.[17] also found that defect depth reduction was significantly greater in the bioactive glass sites (4.36 mm) compared to the OFD sites (3.15 mm).

The success of periodontal therapy depends on many factors, one of the most important factors is an accurate image of the morphology of periodontal bone destruction for the differential therapeutic treatment plan. The clinical diagnosis of periodontal osseous lesions, such as vertical bone defects or furcation involvement, presents a challenge for the practitioner[20]. Therefore, it is widely recognized that the treatment of patients with advanced periodontal diseases requires not only extensive clinical recording but also radiological examination[21]. Radiographs are unavoidable to determine the extent and severity of the periodontal lesions [22]. In general, the accurate detection of bony defects is only possible after direct intraoperative/surgical control. Three-dimensional information is represented by two-dimensional plane, thus losing essential diagnostic value[23]. For this reason, the spatial representation of the alveolar bone has a significant role in periodontology, as therapy decisions and long-term estimates of tooth-related prognosis is based on it. Cone beam computed tomography (CBCT) images of periodontal bone lesions offer a highly informative value.

CONCLUSION

Within the limitations of this study, both Autogenous bone graft and alloplastic grafting led to similar improvements in clinical and radiographic parameters 6 months after the treatment of intraosseous periodontal defects. Autogenous bone grafts, a rich source of bone and marrow cells, have been accepted as the gold standard for bone grafting procedures. However, harvesting of intraoral bone is restricted to donor sites that yield comparatively limited graft volume. For the present study, more number of randomized clinical controlled trials with larger sample size and a longer follow up period along with histological examinations are required to further explore the benefits of Autogenous bone graft in the management of intrabony defects.

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