

Efficacy of Calcium Phosphate Composite Bone Graft in Treatment of Periodontal Intra-bony Defects: Clinico-Radiographic Study

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ABSTRACT

Background: The loss of alveolar bone support is the main symptoms of the destructive periodontal disease. Periodontitis leads to formation of the interbony defects. For resolution of the infection, the elimination of IBD is highly needed. For the filing of the IBD and regeneration of the bone in the periodontal therapy, different bone grafts are used.

Objective: The study aimed to evaluate the efficacy of calcium phosphate composite bone graft in patients suffering from periodontal intra-bony problems.

Study Design: It is a randomized and interventional study conducted at Multan Medical & Dental College, Multan and DOW University of Health Sciences, Karachi for the duration of six months from December 2021 to May 2022.

Material and Methods: The study was conducted on 16 patients that fulfilled the inclusion criteria. All the patients completed the follow-up. The radiographic parameters were also evaluated. The baseline data from six months and three months was analyzed and data was plotted.

Results: It was found that the primary closure was carried out for all the patients. There was no statistical significance found between the groups related to depth of the defect and the walls number groups before operation. There was a prominent reduction in plaque concentration and gingival index. In case of test group there was a greater statistical reduction in the test group as compared to the control. The recession of gingival parameter was seen in both the groups. There was no statistical difference observed here.

Conclusion This study helps to provide significant results and evidence that the easy graft crystal can be used for the treatment of periodontal intra-bony issues.

Keywords: Intra-bony defects and calcium phosphate composite bone graft.

INTRODUCTION

The loss of alveolar bone support is the main symptoms of the destructive periodontal disease. Periodontitis leads to formation of the interbony defects. These interbony defects provide shelter to the microorganisms. These interbony defects (IBD) basically worsen the prognosis. For resolution of the infection, the elimination of IBD is highly needed. The reconstitution of the lost part is defined as regeneration. The periodontal regeneration is defined as the development of the collagen fiber and bone. It also involve formation of the three layers of the tissue¹⁻³. For the filing of the IBD and regeneration of the bone in the periodontal therapy, different bone graft are used. Different types of graft available for the therapy are allogeneic, alloplast and autogenous. The autograph are replaced by the biocompatible alternative known as alloplast. They are capable of filling IBD most efficiently than the others. These also promote regeneration and labelled as surgically convenient type of grafts^{4,5}.

The graft that resemble to the human bone inorganic phase is highly known as Biphasic calcium phosphate ceramic. This graft comprises of beta-tricalcium phosphate and hydroxyapatite. The hydroxyapatite perform its function by maintaining the space. The beta tricalcium promote the regeneration of the bone. It basically dematerialised the phosphate and calcium ions that ultimately⁷⁻⁸ stimulate the formation of the new bone. It is observed that the regeneration of tissues in the periodontal area is not an easy task. In this complex bimolecular process, different biomaterial are required to stimulate the regeneration. To dentist used different techniques to complete the treatment. The study aimed to evaluate the efficacy of calcium phosphate composite bone graft in patients suffering from periodontal intra-bony problems.

MATERIAL AND METHOD

The study was conducted on 16 patients that fulfilled the inclusion criteria. All the patients completed the follow-up. The radiographic parameters were also evaluated. The baseline data from six

months and three months was analyzed and data was plotted. The ethical and review board committee of the hospital approved the study. The written consent was taken from the subjects who willingly participated in the study.

The diagnostic criteria was set in accordance to the guidelines provided by the International World Workshop⁹. Their criteria for the Classification of the periodontal disease and condition was applied to the study. Both male and female were included in the study. Out of the sixteen patients the six were female while other ten were male. The mean age range of the patients was 43.5 years. By using split mouth design¹⁰ the defects were randomly divided into two groups. The control sites were treated with the open flap debridement while the test sites were treated with the calcium phosphate ceramic graft crystal. According to the inclusion criteria following patients were selected for the study;

- The patients must be diagnosed with the periodontitis in accordance with the criteria applied to study.
- The depth of probing pocket must be > 5mm.
- The patients must be non-smoker.
- The patients must not be taking the medication or immunosuppressor.

The pregnant women and the other patients who were allergic to the drugs or smoking any form of tobacco were excluded from the study, in order to prevent the misinterpretation of the results.

RESULTS

The study included 16 patients that fulfilled the inclusion criteria. All the patients completed the follow-up. The efficacy of calcium phosphate composite bone graft in patients suffering from periodontal intra-bony problems was studied. It was found that the primary closure was carried out for all the patients. There was no statistical significance found between the groups related to depth of the defect and the walls number groups before operation. The

clinical parameters of both groups is summarized in the table. There was a prominent reduction in plaque concentration and

gingival index as shown in table 1. The results after three and six months were evaluated.

Table 1: Comparing the oral hygiene condition by gingival index and plaque index

Clinical parameters	Baseline	Three months	P value from baseline to three months	Six months	P value from baseline to six months
PI	1.84±0.52	1.42±0.35	P<0.002	1.31±0.32	0.001
GI	2.02±0.41	1.12±0.42	P<0.001	1.21±0.38	0.001

In case of test group there was a greater statistical reduction in the test group as compared to the control. The recession of gingival parameter was seen in both the groups. There was no statistical difference observed here. (Table 2)

Table 2: Intergroup evaluation of clinical parameters

Clinical parameters	Group	Baseline	Three months	P value from baseline to three months	Six months	P value from baseline to six months
PPD	Control	7.11±1.97	6.21±1.75	0.001	3.5±0.92	0.001
	Test	8.56±1.72	6.3±1.12	0.001	2.3±0.66	0.001
RAL	Control	13.1±1.87	12.1±1.65	0.001	9.55±1.34	0.001
	Test	14.2±1.98	11.2±1.44	0.001	7.34±1.29	0.001
GR	Control	6.88±1.04	6.55±0.98	0.001	7.39±0.98	0.001
	Test	6.3±0.78	6.51±0.78	0.001	7.01±0.56	0.005

The radiographic parameters were also evaluated and it was observed that the defect fill was higher in case of test group as compared to the control group. The p value came out to be 0.05.

Table 3: Intergroup analysis of radiographic parameters

Radiographic parameters	Group	Baseline –three months	P value	Baseline- six months	P value
DF	Control	15.22±7.44	0.001	33.1±12.92	0.05
	Test	33.1±13.1	0.001	58.2±16.55	
% DF	Control	17.2±6.6	0.001	3544±7.33	0.05
	Test	38.2±10.9	0.001	66±10.63	

Table 4 shows the statistical difference comparison between the groups. The baseline data from six months and three months was analyzed and data was plotted as shown in table 4.

Table 4: Statistical significance analysis of intragroup

Parameter		Baseline – three months	Baseline- six months
PPD	Control	0.001	0.001
	Test	0.001	0.001
RAL	Control	0.001	0.001
	Test	0.001	0.001
GR	Control	0.165	0.001
	Test	0.064	0.001
DF	Control	0.001	0.001
	Test	0.001	0.001
%DF	Control	0.001	0.001
	Test	0.001	0.001

DISCUSSION

The study was carried out to find the significance of calcium phosphate composite bone grafts for the patients suffering from periodontal intrabony issues. 16 patients participated and completed the follow-up. The regeneration of tissues in the periodontal area is very difficult task. There are a number of biomaterials used for the regeneration of periodontal tissue. Ranging from bone graft to the complex alloplastic implants dentist carry out a number of different techniques to get the treatment done. There is a great level of success achieved because of these materials as successful regeneration of periodontal tissue was made possible in no time¹¹⁻¹². Alloplasts are synthetic form of substitute for bone graft. The material used in their making is organic and biocompatible. It can be used feasibly to treat periodontal state. There is no need for any secondary surgery spot and there is no chance of transmission of disease¹³. Among all these substitutes that are used to treat periodontal condition calcium phosphate composite is one of the most successful and promising substitute. The biphasic form of calcium phosphate is made of hydroxyapatite and β TCP. It works by interacting with the inorganic phase of the bone tissue¹⁴. The idea to mix both HA and β TCP came long time ago when the scientists were working to maintain optimum balance between the two. This was done to

make the material soluble so that it will dissolve easily. The function of hydroxyapatite is to manage the space by retaining its form¹⁵⁻¹⁶. While the purpose of β TCP was to dissolve calcium and phosphate which stimulate the bone formation. The handling properties can be improved by coating of PLGA so that the alloplastic graft granules can be handled easily¹⁷. This helps in improving the biomedical properties of the material. There is in-situ hardening and stability of the material is increased. As there are a number of calcium phosphates that are used as a substitute, the clamor of the nascent material was taken. As the new material can help graft the crystal easily¹⁸.

Sinus augmentation was increased by using such material, the ridge preservation, the filling of cystic issues was all taken care of. Its use in few animal models have also been reported in some studies. this study was carried out to evaluate the efficacy of these crystals in the treatment of periodontal issues. The reduction in the clinical parameters was the main concern. As the crystal material was not used previously so a negative control was used to compare the results. After comparing the results from baseline the reduction in the GI and PI score was statistically significant for three months and six months' analysis. The analysis also measured the co-relation between PPD reduction and rise in RAL which led to have a better oral health for patients. These results are in consistence with the previous findings. As per another study that was carried out to study the efficacy of these crystal of calcium phosphate in the treatment of periodontal defects it was found that there was no significant difference found between the control and the test group¹⁹. After the surgery gingival recession was observed in both the groups, and the comparison shows that non-significant interaction was found between them. Similar results were found as per other findings²⁰. When the baselines were compared with the results it was found that there was a rise in the bone fill for both the groups and this value was statistically significant. As per studies there was no degradation in the graft particles but there was a complete defect bridging. This shape maintenance is mainly due to the fractional reabsorb-ability of the crystal just as told by the manufacturers. However as per another study the β TCP

concentration of the BCP content can also be replaced by HA which is calcium deficient. In our study there was no complications reported by the patients after the experiment. Similar results were obtained and no complications were observed by other studies as well²¹.

There are some limitations of this work for example there is no comparison between the regenerative materials. If there was a longer follow-up session it could help study the stability of the material more easily. There were less number of patients used for study.

CONCLUSION

The easy graft is a promising material that can be used to treat the intrabony defects. This study helps to provide significant results and evidence that the easy graft crystal can be used for the treatment of periodontal intrabony issues. It is far better than the conventional method where open flap debridement method was used for the treatment. However, there is need to study further by increasing the sample size and making the follow-up sessions longer for better and more precise results.

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