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Original article

Evaluation of the Efficiency of Modified Bone Graft in Putty Consistency in Treatment of Angular Bone Defect - A Pilot Study

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Abstract

Background: Periodontitis is the inflammatory disease of the periodontium which leads to destruction of the supporting bone and periodontium. Colocast is a bovine derived bone graft. This colocast when processed in a putty consistency constitutes the modified colocast. ***Aim:*** The aim is to evaluate the clinical efficiency of consistency modified bone graft material in the treatment of angular bone defects. ***Materials and Methods:*** Five patients with angular bone defects were included in this study. Bone defects were treated with bone grafts in putty consistency. Probing depth, clinical attachment level along with mesial and distal bone level were evaluated at baseline and three months after surgery. ***Results:*** There was a clinically and statistically considerable Probing depth reduction, Clinical Attachment Level gain and increase in bone formation at both mesial and distal aspect of treated teeth. ***Conclusions:*** The Modified bone graft in putty consistency has been proven to be effective in managing angular bone defects along with ease at handling the graft in this study.

Keywords: ***Guided Tissue Regeneration, Modified bone graft, Endo-perio Lesion, Periodontal Surgery***

Introduction

Periodontal disease causes variable destruction of soft tissue and the supporting bone around the teeth. These bony deformities are generally not uniform. The morphology of the bone loss determines the treatment modality[1]. Intraosseous defects which are deep represents a major challenge since sites with intraosseous lesions have been shown to be at higher risk of disease progression in subjects who had not received systematic periodontal therapy[2].

Treatment may include scaling and root planing with or without surgical access flap. In addition to this periodontal debridement additional resective or reconstructive therapy can be performed. Application of membranes, biological agents or grafting materials may be used in the place of bone deformities caused by destructive periodontal disease. Although the reconstructive procedures had proven their effectiveness, greater efficiency has been attributed to the graft material used[3].

Grafting biomaterials include autogenous grafts, allogenic grafts, xenogenic grafts and alloplastic materials. The assumption behind the clinical use of grafting procedures is that the complete regeneration of the attachment apparatus which includes new bone formation and new connective tissue attachment would be enhanced by the various biomaterials due to their osteogenetic potential, osteoinductive capacities, or osteoconductive properties.

However, due to the large variety of graft biomaterials, the magnitude of such improvements as well as the consistency of the advantage achieved when grafting procedures are used remains to be determined.

Colocast [Cologenesis Healthcare Pvt Ltd.] is one such grafting material which is a demineralized bone matrix of type I collagen. It is subjected to find the growth factors present in cortical bone samples which are demineralized, thereby making it non-immunogenic flowable particles.

Modification of consistency of bone graft (colocast):
Modified colocast is that in which the colocast is processed in a putty consistency for better handling by adding 20% of Polyethylene Glycol(PEG), 10% Glycerol and 0.4% preservatives to 70% of demineralized bone graft.

This pilot study was performed to evaluate the clinical effect of modified form of colocast in the management of angular bone defects

Aim and Objectives

The aim of this study is to evaluate the clinical efficiency of modified form of colocast in the treatment of angular bone defects.

Materials and Methods

A 3-month controlled clinical trial was carried out to evaluate the clinical effect of modified colocast in the treatment of angular bone defects. 5 patients with angular bone defects in either maxillary or mandibular arch were selected. The involved teeth were root canal treated 2 weeks prior to management. Flap surgery was performed in the test sites and modified colocast was placed. Clinical parameters were examined at baseline (preoperative) and at 3 months (postoperative). Before the commencement of the study, informed consent was obtained from the participating subjects and the study protocol was revised and approved by the institutional review committee.

Study Design

The study was conducted on the participants from the out patient department, Department of Periodontics, Adhiparasakthi Dental college and hospital, Melmaruvathur who came with the complaint of localized pain and mobility of tooth. Radiographic evaluation of these patients were conducted and the patients with angular bone loss around the affected tooth were included for the study.

- **Inclusion Criteria:**
  Age: 18-50 years, Non compromised systemic healthy patients, Non-smokers and presence of angular bone loss with probing depth above 5 mm.
- **Exclusion Criteria:**
  Usage of medication known to interfere with healing and to cause gingival enlargement, Pregnant or lactating females. Drug and alcohol abuse and Patients showing unacceptable oral hygiene following phase I therapy.

Initial Therapy:

All the patients voluntarily signed the informed consent before commencement of the study. A brief history of each patient was recorded. Each patient received initial therapy consisting of oral hygiene instructions, scaling and root planing. Routine blood investigations were carried out for all the subjects.

Clinical Parameters

The clinical parameters such as Probing depth, Clinical Attachment Level were recorded to the nearest mm with the help of University of North Carolina (UNC-15) probe and Radiographic bone level was measured using Radiovisiogram by single investigator for each surgical site before surgery (baseline) and at 3 months after surgery.

Endodontic Management

All the affected teeth was subjected to vitality test and was found to be non-vital suggesting it as Endo-Perio lesion. Root canal procedure was performed in all the teeth selected for this study for predictable prognosis. This was followed by the surgical procedure after a period of 2 weeks.

Surgical Technique

The surgical site was prepared with adequate anesthesia using 2% lignocaine HCL containing 1:200000 adrenaline. After local anaesthesia sulcular incisions were made and envelope flap was raised involving the interdental papilla. Granulation tissue was removed and saline irrigation done. Modified colocast was directly injected into the surgical site and cologuide (collagen membrane) was placed. Flap was repositioned and sutured using continuous sling suture (3-0 Silk). Periodontal dressing was placed at the surgical site.

Post-operative Care

Analgesics were prescribed to reduce the post-operative pain and edema. Patients were informed not to chew solid food using the treated area and not to brush their teeth in the treated area, but to rinse with chlorhexidine digluconate (0.2%, CHX) two times a day for 1 min. The sutures were removed after 10 days.

Patients were recalled every month after surgery for the evaluation of oral hygiene status. All patients maintained good oral hygiene and the clinical parameters were recorded only after 3 months.

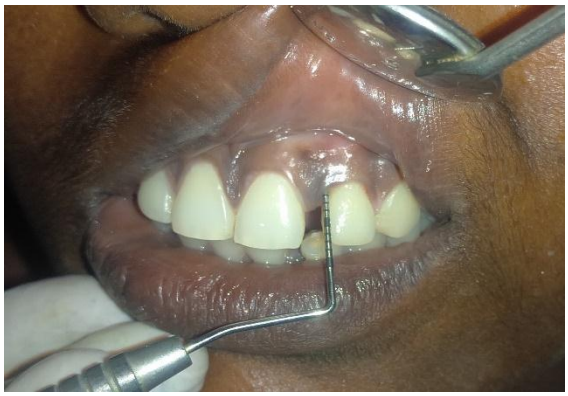

Figure 1: Pre operative probing depth of 6mm

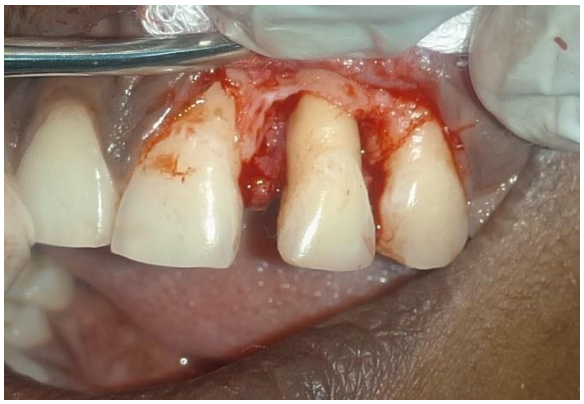

Figure 2: Full thickness mucoperiosteal flap elevated showing angular bone defect

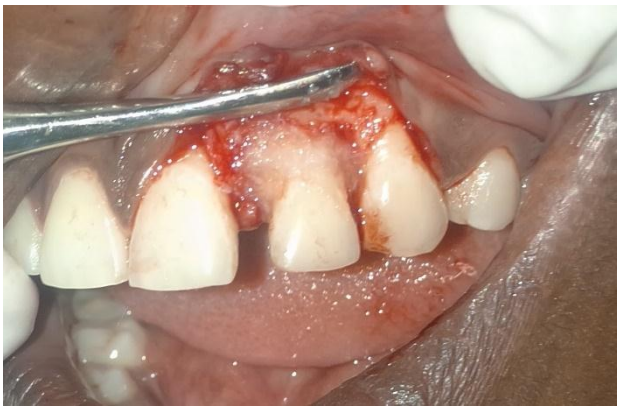

Figure 3: Modified colocast bone graft placed in the osseous defect

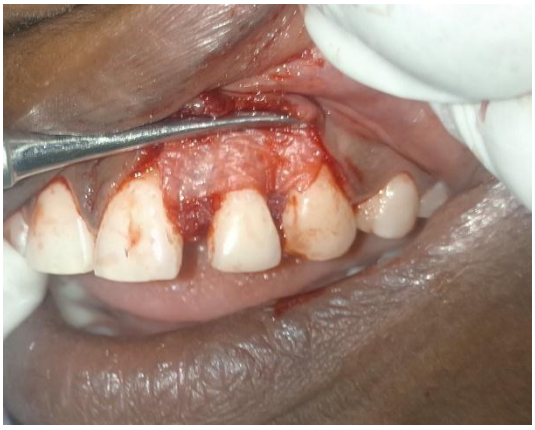

Figure 4: Membrane placed over the bone graft

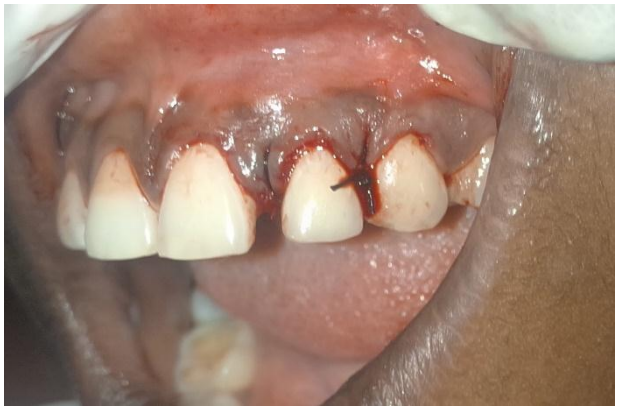

Figure 5: Independent Sling sutures placed using 3-0 Silk

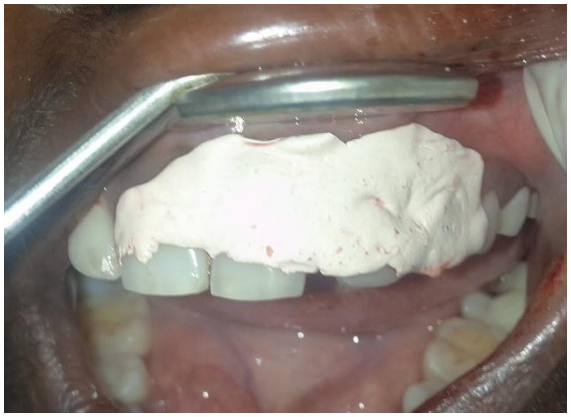

Figure 6: Coe-Pak Periodontal dressing given over the surgical site

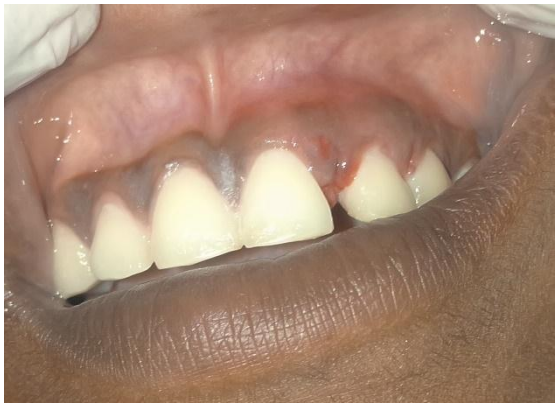

Figure 7: One week post operative image

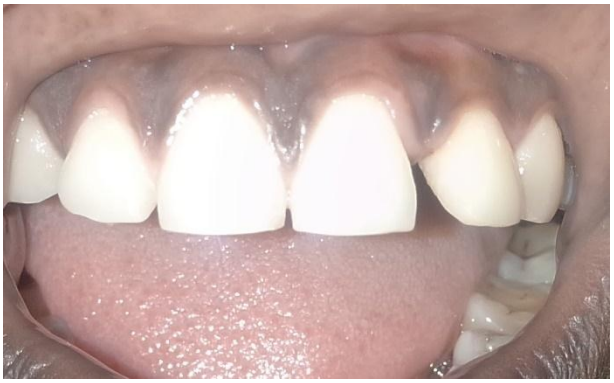

Figure 8: 3 months post operative image

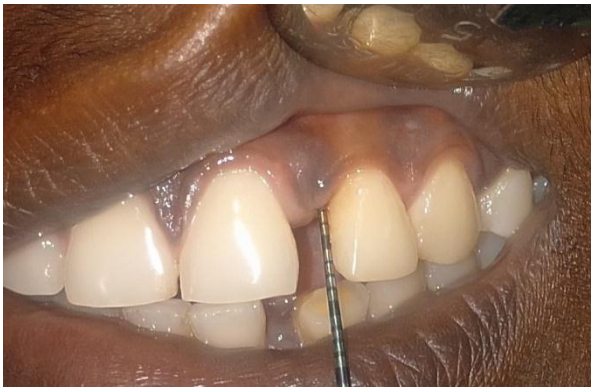

Figure 9: 3 months Postoperative probing depth of 2mm

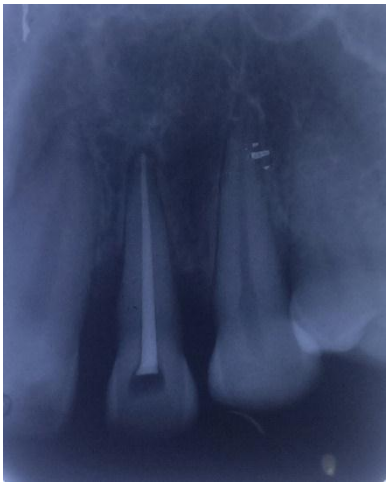

Figure 10: Pre-Operative IOPA showing bone loss in mesial and distal aspects of 22

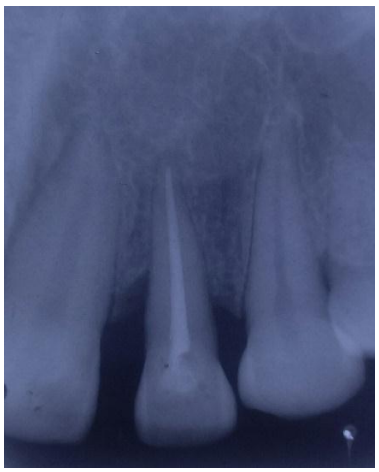

Figure 11: Post-Operative IOPA showing bone gain in mesial and distal aspects of 22

Table 1: Probing depth

Case/Tooth Number	Baseline (mm)	At 3 Months (mm)
1 (36)	14	5
2 (22)	6	2
3 (32)	6	2
4 (25)	9	3
5 (15)	8	2

Table 2: Clinical attachment level

Case/Tooth Number	Baseline (mm)	At 3 Months (Mm)
1 (36)	14	6
2 (22)	6	2
3 (32)	6	2
4 (25)	9	3
5 (15)	10	4

Table 3: Radiographic bone level measurement

Case/Tooth Number	Side	Baseline (mm)	At 3 Months (mm)	Bony Changes (mm)
1 (36)	MESIAL DISTAL	0 8	0 5	- 3
2 (22)	MESIAL DISTAL	7 8	3 4	4 4
3 (32)	MESIAL DISTAL	6 5	3 2	3 3
4 (25)	MESIAL DISTAL	11 4	7 2	4 2
5 (15)	MESIAL DISTAL	5 9	3 6	2 3

Table 4: Statistical analysis (Paired T Test)

Variables	Baseline			At 3 Months		T - Test	P - Value
	N	Mean	±SE	Mean	±SE		
Probing Depth	5	8.60	1.4697	2.80	0.5831	6.33	0.0032
Clinical Attachment Loss	5	9.00	1.4832	3.40	0.7483	7.48	0.0017
BLM-Mesial	5	5.80	1.7720	3.20	1.1136	3.47	0.0255
BLM-Distal	5	6.80	0.9695	3.80	0.8000	9.49	0.0007

Result

The clinical parameters were measured before procedure and at the end of 3 months (Table: 1,2&3). Statistical analysis (Table: 4) showed the mean probing depth measured preoperatively was 8.60 (S.E ± 1.4697) and post operatively was 2.80 (S.E ±0.5831) for which P value is 0.0032 (P<0.01). The mean clinical attachment level measured preoperatively was about 9.00 (S.E ±1.4832) and post operatively was 3.40 (S.E ±0.7483) for which P value is 0.0017 (P<0.01). The mean bone level measured radiographically from CEJ to the apical aspect of defect, preoperatively on the mesial aspect was 5.80 (S.E ±1.7720) and post operatively was about 3.20 (S.E ± 1.1136) for which the P value is 0.0255 (P<0.05). The mean bone loss measured preoperatively on the distal aspect was 6.80 (S.E ± 1.7720) and post-operative measurement was about 3.80 (S.E ± 0.8000) for which P value is 0.007 (P<0.01).

Discussion

Bone grafting and guided tissue regeneration are two techniques with the best histological evidence of periodontal regeneration. Bone grafts have been claimed as an adjunctive to claim blood clot stability into the periodontal defect. Greater loss of alveolar bone height was demonstrated in non-grafted than grafted sites. The demand for an ideal bone graft has lead to the production of various grafts in the market which claim to be more efficient than the others, each of which has certain properties and rationale in an attempt to stimulate regeneration. However, most of these lack scientific evidence. Autografts, allografts, xenografts and alloplasts with or without the use of barrier membrane are most widely used therapeutic strategies for correction of osseous bone defects. Among the various bone grafts, xenografts have already proven to be efficient. Innumerable evidence has been provided on the positive efficiency of xenografts in managing bone defects.

Xenografts are grafts shared between different species. The xenografts that are available currently as bone replacement grafts in periodontics are bovine bone and natural coral. Xenografts have the property of osteoconduction and are free of disease transmission. Anorganic bovine bone is the hydroxyapatite "skeleton" that retains the macroporous and microporous structure of cortical and cancellous bone remaining after chemical or low-heat extraction of the organic component. Currently available bovine-derived hydroxyapatite is deproteinated, retaining its natural microporous structure, which supports cell-mediated resorption.

In summary, bovine-derived hydroxyapatite bone grafts tend to increase the surface area so that, it acts as a scaffold which is osteoconductive as they are porous and their mineral content is comparable to that of human bone, thereby allowing them to integrate with host bone. They have been used in successful treatment of intrabony defects and ridge augmentation[16]. Colocast is one such bone graft which has once again emerged to prove the efficiency of xenografts.

The main purpose of this study is to clinically and radiographically evaluate the efficiency of modified colocast as a bone graft in treating angular bone defects. Five cases, both male and female were involved in the study. The cases performed in this study had localized angular bone loss involving more than 5 mm of bone level when measured radiographically from the CEJ to the apical aspect of the defect, on either the mesial or the distal aspect of the teeth or both. Root canal treatment of the involved teeth was performed.

This was followed by open flap debridement and placement of modified colocast along with cologuide in the defect site. Measurements were taken 3 months postoperatively. The pocket depth reduction was statistically significant with a P value of 0.0032 (P<0.01). The clinical attachment gain was statistically significant which exhibited a P value of 0.0017 (P<0.01). Probing depth reduction, even though it does not attribute to regeneration, it is a major factor in decision making in routine patient care scenarios. On a daily basis, treatment decisions by clinicians are made based on their judgment as to being able to maintain a probing depth of a certain length or not.

While improvement in clinical parameters can be a result in actual gain in attachment, it should be remembered graft material placement in the osseous defect may modify gingival tissue consistency and impede penetration of the periodontal probe

without necessarily having induced any gain in clinical attachment. Bone fill data derived from surgical re-entry is important to substantiate routine postoperative measurement data. But this study was performed by radiographically assessing the bone level to make the procedure minimally invasive as possible.

The changes in bone level were measured radiographically measuring from the cementoenamel junction to the apical aspect of the bone defect. The measurements on the mesial and distal aspect were taken separately. The mean bone level on the mesial aspect at baseline was 5.80 mm while that after 3 months postoperatively was about 3.20mm which still was found to be significant with a P value of 0.0255 ($P<0.05$). The mean bone level on the distal aspect preoperatively and postoperatively were 6.80mm and 3.80mm respectively with a P value of 0.007 ($P<0.01$) which had a greater significance than on the mesial aspect.

The modified form of colocast has the additional advantage of handling the material at ease through its consistency which could be directly applied on the defect site without the need to manipulate the product. This could also lead to limited amount of contamination of the product prior to its application in the recipient site in addition to the ease of handling it. It also reduces the time taken at the chair-side which has a positive effect on both the patient and the surgeon.

The values obtained at the post-operative period of three months when compared to the baseline values have indeed proven the efficiency of modified colocast. When analyzed using the paired t-test, the inter-clinical parameters have showed a statistically significant value in respect to probing depth, clinical attachment level, mesial bone loss and distal bone loss.

Conclusion

The modified form of Colocast has been proven to be effective in managing angular bone defects along with ease at handling the graft. But further studies including randomized clinical trials are deemed necessary to evaluate the long-term success of the modified form of Colocast.

Funding Statement

Nil

Conflicts of Interest

Nil

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