Periodontal Regeneration of Intra Bony Defects using Demineralized Bone Matrix (ColoCast®) alone and in Conjunction with β Tricalcium Phosphate (R.T.R®) : A Randomized Controlled Clinical Trial

Samba Shiva Reddy¹, Krishna Kripal¹, Sushma Reddy Bhavanam², Prathush Ajith Kumar³, Kavita Chandrasekaran², Aiswarya Dileep², Manjunath SM²

¹Professor, Department of Periodontology, Rajarajeswari Dental College and Hospital, Bangalore, Karnataka, India
²Post graduate student, Department of Periodontology, Rajarajeswari Dental College and Hospital, Bangalore, Karnataka, India

Abstract

Aim: Aim of the present study was clinical and radiographic evaluation and comparison of the efficacy of periodontal regeneration of intrabony defects using demineralized bone matrix (ColoCast®) alone and in conjunction with beta tri calcium phosphate (R.T.R®).

Materials and Methods: A total of 45 intrabony defects were treated in 28 patients. Defects were randomly divided by using lot technique into group I (n=15; ColoCast®), group II (n=15; ColoCast® + R.T.R®) and group III (n=15; OFD). Clinical parameters included of plaque index, gingival index, probing depth (PD), clinical attachment level (CAL), gingival recession (GR), and cemento enamel junction from a fixed reference point (acrylic stent). Radiographic parameters included radiographic defect depth, radiographic defect fill, percentage defect fill and radiographic bone density analysis. Radiographs were recorded and analyzed using radiovisiography (RVG) and film grid. All the parameters were recorded at baseline, 3, 6 and 9 months visits.

Results: The mean PD reduction, gain in CAL, mean GR, reduction in mean radiographic defect depth and mean percentage defect fill was 3.87mm, 2.87mm, 0.33mm, 2.73mm and 27.8% respectively in group I at 9 months. The mean probing depth reduction, gain in clinical attachment level, mean gingival recession, reduction in mean radiographic defect depth and mean percentage defect fill was 5.20mm, 4.60mm, 0.33mm, 4.33mm and 30.7% respectively in group II at 9 months. The mean PD reduction, gain in CAL, mean GR, reduction in mean radiographic defect depth and mean percentage defect fill was 2.93mm, 2.73mm, 0.47mm, 3.07mm and 26.3% respectively in group III at 9 months.

Conclusion: Within the limits of the present study, it can be concluded that regenerative periodontal surgery with both demineralized bone matrix (ColoCast®) alone and in conjunction with beta tri calcium phosphate (R.T.R®) resulted significant clinical improvements in intrabony defects when compared to open flap debridement alone, as evidenced by reduction in probing depths and gain in clinical attachment level and satisfactory defect fill. Improvement of clinical and radiographic parameters at sites treated with ColoCast® + R.T.R® were better compared to that of sites treated with ColoCast® alone and OFD.

Keywords: Intrabony Defects, Open flap debridement, ColoCast®, R.T.R., Film Grid, density analysis.

Corresponding author: Krishna Kripal
Professor, Department of Periodontology, Rajarajeswari Dental College and Hospital, Bangalore, India. Tel: +91 9632597504,
E-mail: kripalkrishna@yahoo.com
Citation: Krishna Kripal et al. (2018), Periodontal Regeneration of Intra Bony Defects using Demineralized Bone Matrix (ColoCast®) alone and in Conjunction with β Tricalcium Phosphate (R.T.R®) : A Randomized Controlled Clinical Trial. Int J Dent & Oral Heal. 4:9, 130-142.
Copyright: ©2018 Krishna Kripal et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.
Received: August 10, 2018
Accepted: August 20, 2018
Published: September 24, 2018

Introduction

Periodontitis is a bacterially induced inflammatory disease of the supporting tissues of the teeth.¹ The consequence of periodontitis is commonly the formation of intrabony defects. Vertical defects are more amenable for regenerative procedures.² Periodontal regeneration remains a fundamental therapeutic goal for the preservation of teeth through the restoration of health, function, and esthetics of the periodontium.³ Several treatment procedures have shown histologic proof of principle that the periodontal ligament apparatus can be regenerated in human studies. Several materials have been introduced as bone grafts, i.e., autografts, allografts, xenografts and alloplastic grafts. These grafts contribute to new bone formation through osteogenic, osteoconductive or osteoinductive mechanisms.⁴ Xenografts used in the treatment of intrabony defects can be both bovine bone and natural coral.⁵ DBM (demineralized bone matrix) is considered as a good osteoinductor in bone grafting biomaterials. DBM can be produced through decalcification of cortical bone in order...
to reduce the potential for infection and immunogenic host response. Thus, DBM can be more osteoinductive than standard mineralized allograft.[8]

Over the years beta tri calcium phosphate has been successfully used in the treatment of periodontal osseous defects. Beta-tricalcium phosphate (β-TCP) is one popular choice among alloplastic grafts. Biodegradable TCP has been associated with the repair of lost periodontium. There is also evidence that it possesses the potential to inhibit osseous resorption. Beta-TCP has also been shown to be resorbable and simultaneously capable of supporting new bone formation both in animal models and in human trials.[9]

To the best of our knowledge there is no study comparing the regenerative potential of demineralized bone matrix (ColoCast®) (Figure 1) alone and in conjunction with beta tri calcium phosphate (R.T.R®) (figure 2) in the treatment of periodontal intrabony defects. Therefore this study was aimed to evaluate clinically and radiographically the regenerative potential of demineralized bone matrix (ColoCast®) and beta TCP (R.T.R®) in the treatment of periodontal intrabony defects and to compare the regenerative potential of demineralized bone matrix (ColoCast®) alone and in conjunction with beta (R.T.R®) with that of open flap debridement in the treatment of periodontal intrabony defects.

![Figure 1: © Bone Graf: ColoCast T](image1)

![Figure 2: R.t.r® Bone Graft](image2)

**Material And Methods**

**Source of data**

Patients who visited to the Department of Periodontology, RajaRajeswari Dental College and Hospital, Bangalore were included in the study and the study was approved by the Ethical committee of Rajarajeswari dental college and hospital.

**Method of collection of data**

A total of 45 randomly selected intrabony periodontal defects in the localized or generalized periodontitis patients between the age group of 20-50 years are selected for the study and grouped as follow:

- Group I – 15 intrabony defects treated using ColoCast®.
- Group III – 15 intrabony defects treated using open flap debridement.

Inclusion criteria are 1) Presence of intrabony defect with probing depth > 6mm, with radiographic evidence.2) Systemically healthy patients.3) Patients who had not taken any medication within last 6 months which may alter the periodontal status. 4) Patients with no history of allergy to materials and drugs used or prescribed in this study. Exclusion criteria 1) Smokers. 2) Pregnant and lactating mothers. 3) Patients who have undergone periodontal treatment within a period of 1 year.4) Patients with plaque index > 1 and who don't follow oral hygiene instructions after phase I therapy. 5) Patients who did not accept terms and conditions of the study.

Clinical Parameters recorded were Probing depth (PD) - was measured from fixed reference point to base of the pocket. Clinical attachment level (CAL) - was measured from CEJ to the base of the pocket. Gingival recession (GR) - measured from fixed reference point to gingival margin. The following calculations were made from the radiographs:

1. Amount of defect fill = Initial defect depth – defect depth at recalled time interval.
2. Percentage (%) of defect fill = Amount of defect fill /baseline defect depth x 100.
3. Radiographic density changes in the defects were assessed using Kodak Densitometric Software.

**Procedure**

All subjects were explained about the need and objectives of the study. Only those subjects who agreed to participate in the study are included after obtaining an informed consent. Each patient underwent scaling & root planing, oral hygiene instructions, and occlusal adjustment where indicated. Only when the patient demonstrated adequate plaque control, surgery was performed. Prior to surgery, a customized acrylic stent was fabricated. The stent was grooved in an occlusal apical direction with a tapered bur to make a fixed reference point (FRP). Measurements for clinical parameters are recorded from the fixed reference point (stent). All measurements were recorded by a single investigator. The following measurements were recorded for test and control teeth using a Williams graduated periodontal probe.

1. Stent to cemento-enamel junction (CEJ) 2. Stent to gingival margin (GM) 3. Stent to base of the pocket (BOP). Standardized radiographs of the defect sites will be taken using radiovisiography (RVG) and Film Grid.
**Surgical Procedure**

The surgical procedures were performed under local anesthesia of 2% lignocaine containing adrenaline at a concentration of 1: 80,000. Buccal and lingual / palatal sulcular incisions were placed using Bard Parker handle with no[12] surgical blade & interdental incisions were placed using no[15]. surgical blade and mucoperiosteal flap was reflected. Care was exercised to preserve as much interproximal soft tissue as possible. After reflection of flap and exposure of osseous defect, a thorough surgical degranulation of the infected tissue from the osseous defect and thorough root planing was done with curettes.(Figure 3) The defects were randomly assigned to group I or Group II or Group III and treated with ColoCast® with R.T.R® graft or ColoCast® and with open flap debridement alone respectively. Antibiotics (Amoxicillin 500mg, every 8 hours for 5 days), analgesics (Imol/Diclomol every 8 hours for 3 days), 0.2% chlorhexidine gluconate rinses (every 12 hours for 2 weeks) were prescribed. Post-surgical instructions were given to the patients.

**Post Surgical Procedures**

One week following surgery, the periodontal dressing and sutures were removed and the area was irrigated thoroughly with normal saline. Any signs of swelling, infection, flap displacement, haematoma and necrosis were noted and if needed periodontal dressing were reapplied for another week. Symptoms regarding discomfort, pain and sensitivity were asked to the patient. Patients were recalled 3 months, 6 months and 9 months post-surgery and at each visit, oral hygiene instructions were re-enforced and scaling was done if necessary. Postoperative patient evaluation was done clinically and radiographically at 3 months, 6 months and 9 months.

**Statistical Analysis**

Data was expressed as mean ± standard deviation of the parameters evaluated. In all the groups, clinical and radiographic parameters were recorded at baseline, 3, 6 and 9 months post operatively. Comparisons were made within each group between baseline, 3, 6 and 9 months evaluation using the one-way analysis of variance (ANOVA) followed by Student –T test.

1. Intragroup comparisions were done using paired Kruskal Wallis and ANOVA
2. Intergroup analysis i.e change in PPD, CAL, REC and Radiographic bone fill were compared between the test and control group using unpaired t test
b. Indices were compared using repeated measure one way Analysis of Variance (ANOVA) test from baseline and at different time intervals.

---

**Results**

Age distribution of the participants are reflected in the table A, and the table B shows the gender distribution of the patients that were included in the study, male (n=15) and female (n=13).

---

Citation: Krishna Kripal (2018), Periodontal Regeneration of Intra Bony Defects using Demineralized Bone Matrix (ColoCast)® alone and in Conjunction with β Tricalcium Phosphate (R.T.R)® : A Randomized Controlled Clinical Trial. Int J Dent & Oral Heal. 4-9, 130-142.
The intergroup comparison of group I (ColoCast®), group II (Colo-Cast® + R.T.R®), and group III (OFD) with respect to plaque index (PI) scores at different time intervals from baseline to 3 month, 6 month and 9 month were assessed by Wilcoxon matched pair test (Table 1 & Graph 1). The intra group comparison with respect to PI, at different time intervals was carried out by using Kruskal Wallis ANOVA test (Table 1 & Graph 2). The mean plaque index scores at baseline was 0.78 ± 0.40, 0.85 ± 0.32 and 0.80 ± 0.38 and was reduced to 0.57 ± 0.22, 0.60 ± 0.18 and 0.53 ± 0.19 at the end of 9 months in group I, II and III respectively. The plaque index results showed improvement at all time intervals of all the three groups (19.15%, 25.53%, 27.66% in group I, 17.65%, 25.49% and 29.41 in group II and 20.83%, 31.25%, 33.33% in group III at 3, 6 and 9 months respectively).

### Table A: Age distribution of the participants in different groups

<table>
<thead>
<tr>
<th>GROUP</th>
<th>20-29 YEARS</th>
<th>30-39 YEARS</th>
<th>40-49 YEARS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP I</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>GROUP II</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>GROUP III</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>TOTAL</td>
<td>0</td>
<td>11</td>
<td>8</td>
<td>28</td>
</tr>
</tbody>
</table>

### Table B: Gender distribution of the participants in different groups

<table>
<thead>
<tr>
<th>GROUP</th>
<th>MALES</th>
<th>FEMALES</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP I</td>
<td>4</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>GROUP II</td>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>GROUP III</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>TOTAL</td>
<td>15</td>
<td>13</td>
<td>28</td>
</tr>
</tbody>
</table>

### Table 1: Comparison of three study groups (i, ii, iii) with respect to plaque index scores at baseline, 3, 6 and 9 months time intervals by kruskal wallis anova.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Baseline Mean ± SD</th>
<th>3 Months Mean ± SD</th>
<th>6 Months Mean ± SD</th>
<th>9 Months Mean ± SD</th>
<th>Changes from baseline to 3 Months Mean ± SD</th>
<th>8 Months Mean ± SD</th>
<th>9 Months Mean ± SD</th>
<th>% change in group I</th>
<th>% change in group II</th>
<th>% change in group III</th>
<th>p-value 3 Months vs 9 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP I</td>
<td>0.78 ± 0.40</td>
<td>0.27 ± 0.22</td>
<td>0.22 ± 0.15</td>
<td>0.15 ± 0.20</td>
<td>19.15%#</td>
<td>25.53%#</td>
<td>27.66%#</td>
<td>0.0179*</td>
<td>0.0179*</td>
<td>0.0177*</td>
<td>0.8910</td>
</tr>
<tr>
<td>GROUP II</td>
<td>0.85 ± 0.32</td>
<td>0.19 ± 0.16</td>
<td>0.18 ± 0.21</td>
<td>0.15 ± 0.22</td>
<td>17.65%#</td>
<td>25.49%#</td>
<td>29.41%#</td>
<td>0.0284*</td>
<td>0.0144*</td>
<td>0.0087*</td>
<td>0.9174</td>
</tr>
<tr>
<td>GROUP III</td>
<td>0.80 ± 0.38</td>
<td>0.27 ± 0.17</td>
<td>0.53 ± 0.33</td>
<td>0.27 ± 0.35</td>
<td>20.83%#</td>
<td>31.25%#</td>
<td>33.33%#</td>
<td>0.0277*</td>
<td>0.117*</td>
<td>0.0077*</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

*p<0.05, #applied Wilcoxon matched pairs test
The intergroup comparison of group I (ColoCast®), group II (ColoCast® + R.T.R®), and group III (O.F.D) with respect to gingival index (GI) scores at different time intervals from baseline to 3 month, 6 month and 9 month were assessed by Wilcoxon matched pair test (Table 2 & Graph 3). The intergroup comparison with respect to GI, at different time intervals was carried out by using Kruskal Wallis ANOVA test (Table 2 & Graph 4). The mean gingival index scores at baseline was 0.95 ± 0.42, 0.90 ± 0.35 and 0.88 ± 0.36 and was reduced to 0.58 ± 0.20, 0.58 ± 0.18 and 0.60 ± 0.18 at the end of 9 months in group I, II and III respectively. The gingival index results showed improvement at all time intervals of all the three groups (31.58%, 33.33% and 38.60% in group I, 22.22%, 27.78% and 35.19% in group II and 16.98%, 32.08% and 32.08% in group III at 3, 6 and 9 months respectively).

<table>
<thead>
<tr>
<th>Groups</th>
<th>Baseline</th>
<th>3Months</th>
<th>6Months</th>
<th>9Months</th>
<th>Changes from baseline to</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>GROUP I</td>
<td>0.95</td>
<td>0.42</td>
<td>0.63</td>
<td>0.16</td>
<td>0.58</td>
</tr>
<tr>
<td>GROUP II</td>
<td>0.90</td>
<td>0.35</td>
<td>0.70</td>
<td>0.27</td>
<td>0.58</td>
</tr>
<tr>
<td>GROUP III</td>
<td>0.88</td>
<td>0.36</td>
<td>0.73</td>
<td>0.20</td>
<td>0.60</td>
</tr>
</tbody>
</table>

% change in group I: 31.58% * p=0.125
% change in group II: 22.22% * p=0.152
% change in group III: 16.98% * p=0.0093

H-value: 0.0740 1.4440 1.0270 0.0920 1.4800 0.0290 0.1670
p-value: 0.9640 0.4860 0.5980 0.9550 0.4770 0.9850 0.9200

GROUP I vs GROUP II: p=0.9904 p=0.8519 p=0.7716 p=0.9504 p=0.4937 p=0.8519 p=0.9174
GROUP I vs GROUP III: p=0.8035 p=0.2809 p=0.5615 p=0.8519 p=0.2717 p=0.9835 p=0.7089
GROUP II vs GROUP III: p=0.8519 p=0.4307 p=0.3837 p=0.7875 p=0.6041 p=0.9339 p=0.7716

*p<0.05, # applied Wilcoxon matched pairs test

Table 2: Comparison of three study groups (i, ii, iii) with respect to gingival index scores at baseline, 3, 6 and 9 months’ time points by kruskal wallis anova

Citation: Krishna Kripal (2018), Periodontal Regeneration of Intra Bony Defects using Demineralized Bone Matrix (ColoCast®) alone and in Conjunction with ß Tricalcium Phosphate (R.T.R®)® : A Randomized Controlled Clinical Trial. Int J Dent & Oral Heal. 4:9, 130-142.
The intergroup comparison of group I (ColoCast®), group II (ColoCast® + R.T.R®), and group III (OFD) with respect to probing pocket depth (PPD) scores at different time intervals from baseline to 3 month, 6 month and 9 month were assessed by paired t test (Table 3 & Graph 5). The intragroup comparison with respect to PPD, at different time intervals was carried out by using ANOVA test (Table 3 & Graph 6). The PPD scores at baseline was 8.27 ± 1.58, 8.73 ± 1.10 and 8.60 ± 1.06 and was reduced to 4.40 ± 0.83, 3.53 ± 0.52 and 5.67 ± 0.72 at the end of 9 months in group I, II and III respectively. The probing pocket depth scores showed significant improvement at all time intervals in all the three groups (22.58%, 33.06% and 46.77% in group I, 32.82%, 45.80% and 49.54% in group II and 20.16%, 27.91% and 34.11% in group III at 3, 6 and 9 months respectively).

Table 3: Comparison of three study groups (i, ii, iii) with respect to probing depth scores at baseline, 3, 6 and 9 months time points by one way anova

<table>
<thead>
<tr>
<th>Groups</th>
<th>Baseline</th>
<th>3Months</th>
<th>6Months</th>
<th>9Months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>GROUP I</td>
<td>8.27</td>
<td>1.58</td>
<td>6.40</td>
<td>0.74</td>
</tr>
<tr>
<td>GROUP II</td>
<td>8.73</td>
<td>1.10</td>
<td>5.87</td>
<td>0.99</td>
</tr>
<tr>
<td>GROUP III</td>
<td>8.60</td>
<td>1.06</td>
<td>6.87</td>
<td>0.64</td>
</tr>
</tbody>
</table>

| % change in group I | 22.58% | p=0.0001* |
| % change in group II | 32.82% | p=0.0001* |
| % change in group III | 20.16% | p=0.0001* |

<table>
<thead>
<tr>
<th>F-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5395</td>
<td>0.5870</td>
</tr>
<tr>
<td>5.8276</td>
<td>0.0005*</td>
</tr>
<tr>
<td>16.1266</td>
<td>0.001*</td>
</tr>
<tr>
<td>35.0903</td>
<td>0.001*</td>
</tr>
</tbody>
</table>

* p<0.05, # applied paired test

Citation: Krishna Kripal (2018), Periodontal Regeneration of Intra Bony Defects using Demineralized Bone Matrix (ColoCast®) alone and in Conjunction with ß Tricalcium Phosphate (R.T.R®)® : A Randomized Controlled Clinical Trial. Int J Dent & Oral Heal. 4:9, 130-142.
The intergroup comparison of group I (ColoCast®), group II (ColoCast® + R.T.R®), and group III (OFD) with respect to clinical attachment level (CAL) scores at different time intervals from baseline to 3 month, 6 month and 9 month were assessed by paired t test (Table 4 & Graph 7). The intragroup comparison with respect to CAL, at different time intervals was carried out by using ANOVA test (Table 4 & Graph 8). The CAL scores at baseline was 6.07 ± 1.53, 6.73 ± 1.10 and 6.53 ± 1.19 and was reduced to 3.20 ± 0.68, 2.13 ± 0.74 and 3.80 ± 0.77 at the end of 9 months in group I, II and III respectively. The clinical attachment level scores showed significant improvement at all time intervals of all the three groups (28.57%, 37.36% and 47.25% in group I, 41.58%, 55.45% and 68.32% in group II and 25.51%, 34.69% and 41.84% in group III at 3, 6 and 9 months respectively).

The intergroup comparison of group I (ColoCast®), group II (ColoCast® + R.T.R®), and group III (OFD) with respect to probing pocket depth scores at baseline, 3, 6 and 9 months time points

The intragroup comparison of group I (ColoCast®), group II (ColoCast® + R.T.R®), and group III (OFD) with respect to probing pocket depth scores at baseline, 3, 6 and 9 months time points.
The intergroup comparison of group I (ColoCast®), group II (ColoCast® + R.T.R®), and group III (OFD) with respect to gingival position changes (GR) scores at different time intervals from baseline to 3 month, 6 month and 9 month were assessed by paired t test (Table 5 & Graph 9). The intra group comparison with respect to GR, at different time intervals was carried out by using ANOVA test (Table 5 & Graph 10).

The GR scores at baseline was 4.07 ± 0.80, 3.93 ± 0.80 and 4.00 ± 0.85 and was reduced to 3.73 ± 0.96, 3.60 ± 0.91 and 3.53 ± 0.74 at the end of 9 months in group I, II and III respectively. The GR scores showed improvement at all time intervals of all the three groups (6.56%, 9.84% and 8.20% in group I, 6.78%, 8.47% and 8.47% in group II and 5.00%, 8.33% and 11.67% in group III at 3, 6 and 9 months respectively).

<table>
<thead>
<tr>
<th>Groups</th>
<th>Baseline (in mm)</th>
<th>3 months (in mm)</th>
<th>6 months (in mm)</th>
<th>9 months (in mm)</th>
<th>Changes from baseline to 3 months</th>
<th>Changes from baseline to 6 months</th>
<th>Changes from baseline to 9 months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Group I</td>
<td>4.07</td>
<td>0.80</td>
<td>3.80</td>
<td>0.86</td>
<td>3.67</td>
<td>0.90</td>
<td>3.73</td>
</tr>
<tr>
<td>Group II</td>
<td>3.93</td>
<td>0.80</td>
<td>3.67</td>
<td>0.82</td>
<td>3.60</td>
<td>0.83</td>
<td>3.60</td>
</tr>
<tr>
<td>Group III</td>
<td>4.00</td>
<td>0.85</td>
<td>3.80</td>
<td>0.86</td>
<td>3.67</td>
<td>0.90</td>
<td>3.53</td>
</tr>
</tbody>
</table>

Table 5: comparison of three study groups (i, ii, iii) with respect to gingival position changes scores at baseline, 3, 6 and 9 months time points by one way anova
The intergroup comparison of group I (ColoCast®), group II (Colo-Cast® + R.T.R®), and group III (OFD) with respect to radiographic defect depth (RDD) scores at different time intervals from baseline to 3 months, 6 months and 9 months were assessed by paired t test (Table 6 & Graph 11). The intragroup comparison with respect to RDD, at different time intervals was carried out by using ANOVA test (Table 6 & Graph 12). The RDD scores at baseline was 5.60 ± 1.24, 6.40 ± 1.18 and 6.07 ± 1.03 and was reduced to 2.87 ± 0.52, 2.07 ± 0.80 and 3.00 ± 0.38 at the end of 9 months in group I, II and III respectively. The RDD scores showed significant improvement at all time intervals in all the three groups (32.14%, 38.10% and 48.81% in group I, 41.67%, 53.13% and 67.11% in group II and 32.97%, 43.96% and 50.55% in group III at 3, 6 and 9 months respectively).

Table 6: Comparison of three study groups (i, ii, iii) with respect to radiographic defect depth scores at baseline, 3, 6 and 9 months time points by one way anova

Graph 9: Intergroup comparison of three study groups (i, ii, iii) with respect to gingival position change scores at baseline, 3, 6 and 9 months time points

Graph 10: Intragroup comparison of three study groups (i, ii, iii) with respect to gingival position change scores at baseline, 3, 6 and 9 months time points
The intergroup comparison of group I (ColoCast®), group II (ColoCast® + R.T.R®), and group III (OFD) with respect to radiographic defect fill (RDF) scores at different time intervals from baseline to 3 month, 6 month and 9 month were assessed by paired t test (Table 7 & Graph 13). The intra group comparison with respect to RDF, at different time intervals was carried out by using ANOVA test (Table 7 & Graph 14). The RDF scores increased to 2.00 ± 0.65, 2.47 ± 0.64 and 1.53 ± 0.64 at the end of 9 months in group I, II and III respectively.

Table 7: Comparison of three study groups (i, ii, iii) with respect to radiographic defect fill scores at baseline, 3, 6 and 9 months time points by one way anova
The intergroup comparison of group I (ColoCast®), group II (ColoCast® + R.T.R®), and group III (OFD) with respect to radiographic bone density (RBD) scores at different time intervals from baseline to 3 month, 6 month and 9 month were assessed by paired t test (Table 8 & Graph 15). The intra group comparison with respect to RBD, at different time intervals was carried out by using ANOVA test (Table 8 & Graph 16). The RBD scores at baseline was 64.87 ± 2.85, 65.47 ± 3.11 and 63.67 ± 3.85 and was increased to 75.07 ± 1.28, 75.87 ± 2.42 and 73.00 ± 2.88 at the end of 9 months in group I, II and III respectively. The RBD scores showed improvement at all time intervals of all the three groups (10.89%, 12.44% and 15.72% in group I, 10.29%, 12.93% and 15.89% in group II and 9.42%, 12.36% and 14.66% in group III at 3, 6 and 9 months respectively).

<table>
<thead>
<tr>
<th>Groups</th>
<th>Baseline</th>
<th>3 months</th>
<th>6 months</th>
<th>9 months</th>
<th>Changes from baseline to 3 months</th>
<th>6 months</th>
<th>9 months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Group I</td>
<td>64.8</td>
<td>2.85</td>
<td>71.9</td>
<td>1.87</td>
<td>72.9</td>
<td>1.75</td>
<td>75.0</td>
</tr>
<tr>
<td>Group II</td>
<td>65.4</td>
<td>3.11</td>
<td>72.2</td>
<td>2.18</td>
<td>73.9</td>
<td>2.31</td>
<td>75.8</td>
</tr>
<tr>
<td>Group III</td>
<td>63.6</td>
<td>3.85</td>
<td>69.6</td>
<td>3.72</td>
<td>71.5</td>
<td>2.85</td>
<td>73.0</td>
</tr>
</tbody>
</table>

% of change in group I
% of change in group II
% of change in group III

F-value = 1.1385, P-value = 0.3238

Group I vs Group II
p=0.8726
Group II vs Group III
p=0.5832
Group I vs Group III
p=0.3038

#p<0.05, *applied paired t test

Table 8: Comparison of three study groups (i, ii, iii) with respect to radiographic bone density scores at baseline, 3, 6 and 9 Months time points by one way anova.
Discussion

Periodontal disease involves a major part of global problems of oral diseases. Use of specific biomaterials was more effective than open flap debridement (OFD) in improving attachment levels in periodontal defects\(^9\). Bone grafting is the most common form of regenerative therapy and has been used for almost 100 years in attempts to stimulate healing of bony defects. Linhart and colleagues \(^10\) concluded that calcium phosphate cement represents a good alternative to autogenous bone transplantation, especially in elderly patients when tri-calcium phosphate was compared with inorganic bovine bone in dogs with mandibular defects, tri calcium phosphate showed significantly greater bone formation at 12 and 24 months and better resorption than inorganic bovine bone.

In a study published in 2008 by Dori F, at 1 year after therapy, the sites treated with platelet rich plasma and β-TCP using GTR showed a reduction in mean PD from 9.1 ± 0.6 mm to 3.3 ± 0.5 mm (P<0.001) and a change in mean CAL from 10.1 ± 1.3 mm to 5.7 ±1.1 mm.\(^11\) Studies on animal have revealed, bovine bone granules possess better osteoconductive potential than bioglass crystal and hydroxyapatite when tested in on rabbits in New Zealand.\(^12\) Pure phase beta-tricalcium phosphate is fully resorbed and replaced by vital bone over six months’ time as shown histologically in animal studies, where bovine derived grafts are not\(^9\). Graft replacement ensures the regenerated bone will be able to remodel according to the stresses placed upon it in the future. This non-immunogenic and resorbable material provides the basis for complete, predictable, and reproducible bone regeneration. For these reasons, pure phase β-TCP is an ideal bone augmentation material as has been shown in multiple publications\(^9,10\). The in vitro study demonstrated that β-TCP granules scaffolds with sizes of 1 mm and 1–2.5 mm can improve the proliferation of BMSCs and promote the expression of osteogenic genes and osteogenesis-related proteins.\(^16\) From the outcome of the study, it could be interpreted that ColoCast® +R.T.R® when compared to ColoCast® alone and OFD showed a statistically significant difference in clinical / radiological outcome. There was notably significant reduction in PPD, CAL gain and increase in radiographic bone fill when intragroup comparison was done in all the three groups.

Conclusion

Within the limits of the present study, it can be concluded that regenerative periodontal surgery with both demineralized bone matrix (ColoCast)\(^9\) alone and in conjunction with beta tri calcium phosphate (R.T.R)\(^9\) resulted significant clinical improvements in intrabony defects when compared to open flap debridement alone, as evidenced by reduction in probing depths and gain in clinical attachment level and satisfactory defect fill. Improvement of clinical and radiographic parameters at sites treated with ColoCast® + R.T.R® were better compared to that of sites treated with ColoCast® alone and OFD.


