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# Comparative Clinical and CBCT Assessment of the Efficacy of Autologus Bone Block Graft Block Graft versus Resective Osseous Surgery and Open Flap Debridement in management of Hemiseptal Periodontal Defects: A Pilot Study

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## Abstract

**Aim:** The present study aimed to comparatively evaluate autogenous bone graft (ABG), resective osseous surgery (ROS), and open flap debridement (OFD) in the treatment of hemiseptal periodontal defects.

**Material and Methods:** Patients with 15 hemiseptal defects were selected and randomly divided into 3 groups; Group I: 5 hemiseptal defects treated by ABG, Group II: 5 hemiseptal defects treated by ROS and Group III: 5 hemiseptal defects treated by OFD. After 4 weeks of non-surgical periodontal therapy, the clinical and radiographic parameters were recorded and respective surgery was performed and patient was called for a 6 month follow up. The data was entered and analyzed using the Statistical Package for Social Sciences. Confidence intervals were set at 95%, and a p-value ≤ of 0.05 was considered statistically significant.

**Results:** Comparison between Gingival Index, Pocket Probing Depth and relative Clinical Attachment Level scores of Groups I, II and III at baseline, and 6 months post-operatively showed significant difference with p= 0.01. No significant difference (p>0.05) was seen between Group I vs Group II. In Group I, the mean radiographic defect depth score reduced to 2.44±1.16, in Group II, it reduced to 1.0±0.91 and in Group III, it reduced to 2.0±1.62 at 6 months post-operatively. (p>0.05).

**Conclusion:** Thus, our study concluded that procedures like autogenous bone graft yielded favourable results if executed properly and can be further explored by future studies in hemiseptal defects. Long-term clinical research with larger samples, confirmatory histological evaluations, and advanced radio diagnostical assessment can enhance understanding of the clinical benefits and regenerative process of various periodontal procedures for hemiseptal defects.

## Introduction:

Chronic Periodontitis(CP) is characterised by active phases in which inflammatory chemical mediators impair the periodontal support structures, alternating with quiescent phases indicated by remission from the destructive process.[1] Clinically, there are two categories of osseous defects resulting from periodontal disease: angular (or vertical) defects and horizontal defects. [2] The bone loss in vertical or angular osseous destruction is asymmetrical; alveolar crest is not aligned to the line

connecting cementoenamel junctions of the neighbouring teeth.[3]

A hemiseptum defect is a one wall defect condition characterised by the preservation of a single bony wall of the interseptal bone, following the degradation of both mesial and distal segments of interdental bone.[4] Periodontal disease is managed using various therapy techniques that target soft and hard tissue defects. [5]

Over time, the most frequently employed treatment for bone defects has been conventional autologous bone graft(ABG). Its widespread application was facilitated by a variety of factors, including its ease of acquisition, its ability to combine osteogenic, osteoinductive, and osteoconductive properties, and its lack of immune response or infectious disease transmission.[4,6] Moreover, ABG can be procured in various shapes and dimensions from several donor sites.[7] Multiple authors advise against employing non-vascularized grafts for defects over 5 mm.[8,9]

Destruction of periodontal tissue is marked by bleeding on probing, formation of extensive periodontal pockets and loss of clinical attachment.[10] This is largely dependent on the restoration of physiological bone and the rectification of defects in alveolar bone surrounding affected teeth. [11] Osseous resective surgery(ROS) is one of the most reliable surgical therapies for attaining stable pocket reduction.[12] It consists of a sequence of meticulously planned procedures for the proper re-contouring of alveolar bone and the management of the overlaying soft tissues, which may be either additive or subtractive.[13,14]

Periodontal regenerative therapy has demonstrated superiority over conventional surgical therapies, such as open flap debridement(OFD), in reducing probing pocket depth(PPD) and clinical attachment loss(CAL) in the treatment of intra-bony defects, as evidenced by multiple articles.[15-19]

In the majority of trials assessing regeneration methods for intrabony defects, the control has been OFD. [20] Despite the findings being inferior to those of the regenerative process under examination, the treatment has shown significant favourable effects. A systematic review by Needleman et al. gathered evidence about guided tissue regeneration (GTR) efficacy for infrabony defects and determined that GTR was superior to OFD in enhancing attachment levels. Nonetheless, significant diversity existed within studies, and extensive conclusions on the therapeutic advantages of GTR are constrained by this heterogeneity. They asserted that OFD should continue to serve as the control in these trials.[21] Although numerous trials

have assessed regeneration therapy for intrabony defects, there is scant data regarding hemiseptal defects and on a comparison of these three approaches, particularly within the Indian community. The current study sought to conduct a comparative evaluation of ABG, ROS, and OFD in the management of hemiseptal periodontal defects.

**Material and Methods**

**Study Design and Setting:** The present clinical experimental study was performed on participants chosen from the outpatient department of Periodontics at the SPDC, Wardha. The study received institutional scientific and ethical approval prior to its commencement. The current pilot study was conducted over a period of one year, from June 2021 to June 2022. Patients were advised that their voluntary and an informed consent was taken from all patients.

**Sample Selection:** Patients were included if they were diagnosed with CP exhibiting hemiseptal periodontal defects, possessed periodontal pockets with probing depths of 5 to 8 mm, and radiographic evidence of vertical bone loss. They were in ages 35 to 55, in good general health, and did not have a history of systemic disease, failed to maintain adequate oral hygiene during the presurgical phase or history of using anti-inflammatory medications or antibiotics in the last 90 days were excluded from the trial. 15 patients with hemiseptal defects were included and randomly assigned to three groups using computer software. Group I: 5 hemiseptal defects addressed with ROS; Group II: 5 hemiseptal defects managed via OFD; Group III: 5 hemiseptal defects treated with ABG.

**Study Procedure**

**Pre-surgical protocol:** Subsequent to a preliminary assessment and treatment planning, all chosen patients received comprehensive guidance on plaque management techniques and were subsequently administered full mouth SRP. Revaluation was conducted 4 weeks following the initial therapy. All sites were assessed to document the clinical and radiological characteristics.

**Periodontal assessment:** The Gingival Index (GI) was employed to mitigate severity and quantify periodontal inflammation.[22] PPD and RAL were evaluated on designated teeth using Williams graduated periodontal probe and a customised acrylic stent. A cold-curing acrylic resin was employed to create a custom acrylic occlusal stent that was to be affixed to the designated teeth of each patient model. The acrylic stent was designed with a groove to enable the probe to be inserted into the pocket at a

standardised access point prior to surgery and during subsequent follow-up appointments.

PPD was assessed using a William graduated periodontal probe, which measured the distance from the marginal gingival tip to pocket base. Data was recorded in a customised proforma that was specifically designed for the study. To mitigate deformation and obtain measurements at 3, and 6 months postoperatively, custom acrylic stents were affixed to casts that had been previously prepared.[23] A probe was carefully inserted through the aperture of the acrylic stent, and it was positioned on the designated teeth. The distance between the gingival margin and the apical border of the acrylic stent was measured. PPD was adjusted to account for the distance in order to determine CAL.[24]

**Radiographic parameters:** Intraoral periapical radiovisographs of specific defect sites was obtained utilising the long cone paralleling approach. Exposures were conducted at 70 kVp, 8 mA; 0.6 seconds, alongwith filtering of 2mm Al. XCP holders were implemented to generate visual graphs of radio data. The radiographs were consistently obtained by the same radiologist throughout the trial to reduce mistakes. The radiographic assessment utilised radiographic defect depth (RDD) and cone beam computed tomography for three-dimensional evaluation of bone fill (RBF). All radiographs were assessed at baseline, and 6 months follow up.

**Surgical Intervention:** Plaque control techniques were explained to designated patients, and full mouth SRP was conducted thoroughly. Re-evaluation and documentation of clinical and radiological characteristics were conducted 4 weeks post initial therapy. Participants were randomly selected and classified into three groups. A total of 15 samples of bone defects were randomly allocated to three groups.

**Group I**: For ABG, a full-thickness flap was extracted after local anaesthesia, and recipient sites underwent SRP and debridement. The mandibular symphysis was exposed by a vestibular incision in labial vestibule, & autogenous bone was extracted. In order to accommodate the deformity, the graft was contoured as required. A non-eugenol periodontal dressing was used to protect the donor site and flaps, which were closed with interrupted sutures (3-0 silk). Patients from all three groups were given postoperative instructions and scheduled for a follow up appointment for suture removal post one week. The patients were subsequently contacted for clinical and radiological assessments at 6 months (Figure 1–9).

**Group II:** for ROS, a full-thickness flap was elevated after local anaesthesia and recipient site underwent SRP and debridement. Rotary and manual devices were employed to perform osseous recontouring. In order to accommodate the deformity, the graft was contoured as required. A non-eugenol periodontal dressing was used to protect the donor site and flaps, which were secured with interrupted sutures (3-0 silk) (Figure 10–12).

**Group III**: For OFD, after a full-thickness flap was elevated after local anaesthesia, SRP and debridement were done at the recipient site. Additionally, a full-thickness flap was elevated for debridement of the defect. The margins were secured with a non-eugenol periodontal dressing and interrupted sutures (3-0 silk) (Figures 13,14).

**Clinical Photographs**

**Group I:** Patients receiving autogenous bone graft

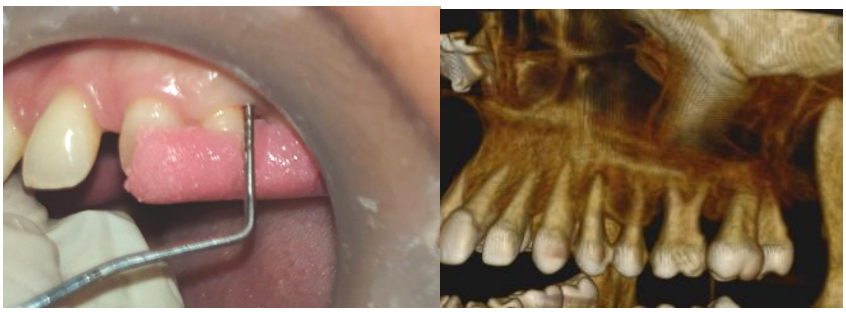


**Figure 1: Probing depth at baseline**

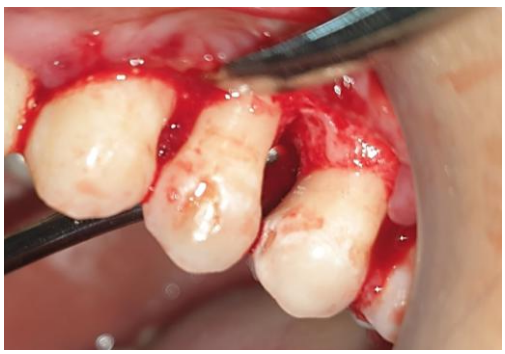


**Figure 2: Exposing the bone defect**

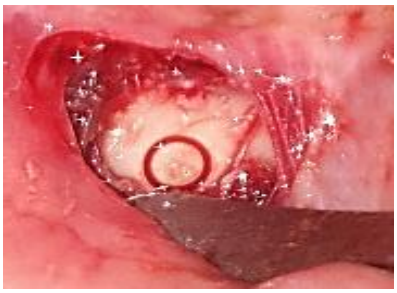


**Figure 3: Trephine drill used**

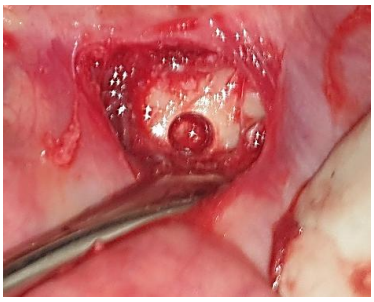


**Figure 4: Post harvesting**

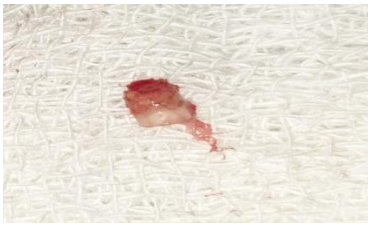


**Figure 5: Autogenous Bone graft harvested**

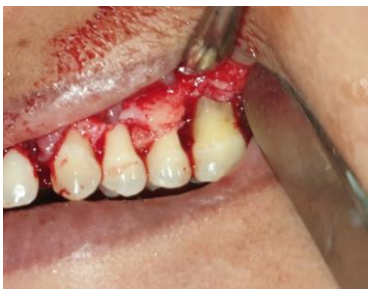


**Figure 6: Bone graft placement in the hemiseptal bone defect**

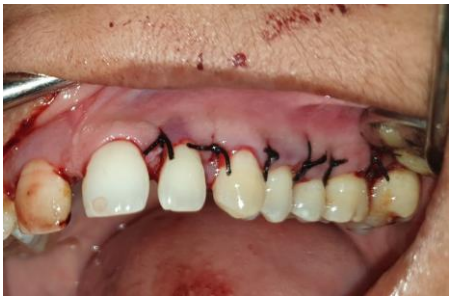
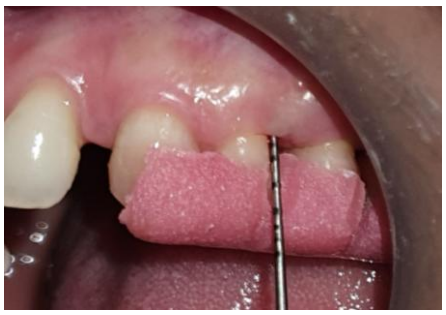


**Figure 7: Sutures placed**



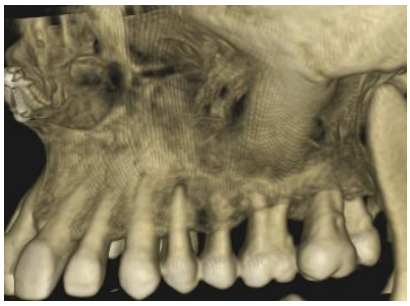


**Figure 8: At 6 months follow up**

**Group II:** Patients receiving resective osseous surgery

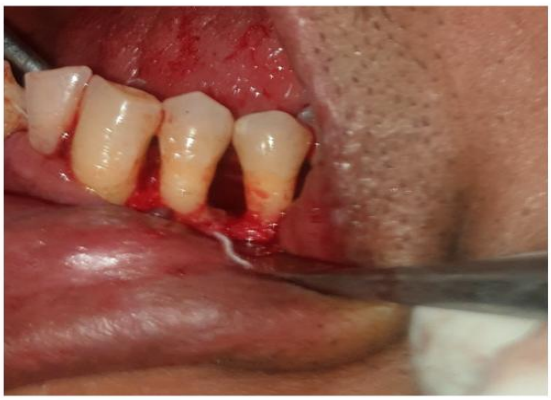


**Figure 10: Raising the flap**

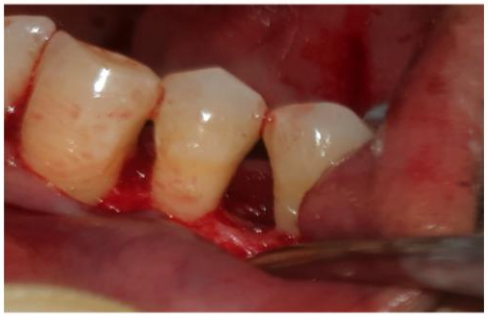


**Figure 11: Exposing the bone defect**

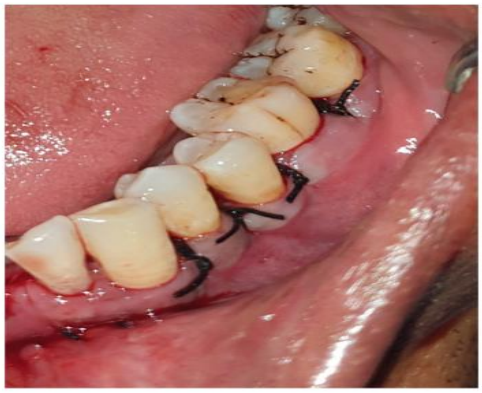


**Figure 12: Placement of sutures**

**Group III:** Open flap debridement

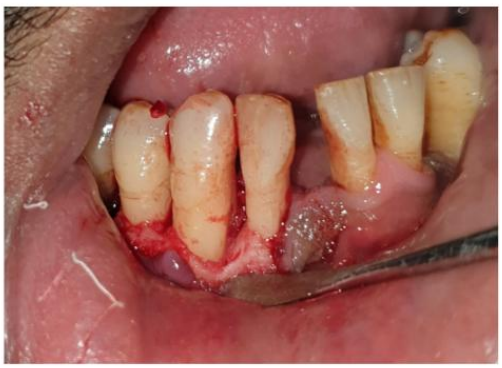


**Figure 13: Raising a full thickness flap for open flap debridement**

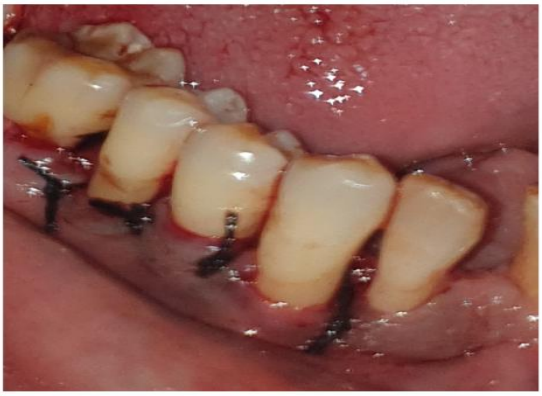


**Figure 14: Placement of sutures**

**Statistical Analysis:** Data was imported and analysed utilising the Statistical Package for Social Sciences (SPSS) for Windows, Version 28.0. IBM Corporation, Armonk, New York. Confidence intervals were established at 95%, and a p-value of < 0.05 was deemed statistically significant. The paired t-test was utilised to examine GI, PPD, RAL, and RDD at baseline and after 6 months for both groups. Repeated measures ANOVA was employed for mean clinical and radiographic data, followed by Tukey's post hoc analysis for intergroup comparisons.

## Results

**Clinical Assessment:** Group I experienced a mean GI score reduction of 0.54 at 6 months postoperatively, Group II experienced a mean GI score reduction of 0.40 and Group III experienced mean GI score reduction of 0.11. Statistically significant results were seen in the mean difference (p = 0.001). Significant differences were seen for GI scores of Groups I, II, and III at baseline and six months postoperatively (p = 0.001). There were no statistically significant differences (p>0.05) seen for Groups I and III.

At 6 months postoperatively, PPD mean score in Group I decreased by 4.0mm, Group II by 3.58 mm and in Group III by 2.75mm. Statistically significant results were observed in the mean difference (p = 0.001). A significant difference was observed between PPD scores of Groups I, II, and III at baseline and six months postoperatively (p= 0.002). There was no statistically significant difference (p>0.05) observed between Groups I & II.

At 6 months postoperatively, the mean RAL score in Group I decreased by

3.41mm, 1.33 mm in Group II, and 2.16 mm in Group III. Statistically significant results were observed in the mean difference (p = 0.001). Significant differences were seen for RAL scores of all 3 groups at baseline and 6 months (p= 0.001). No statistically significant difference (p>0.05) was observed between Group II & Group III.

**Table 1: Comparison of clinical parameters at baseline and 6 months for all three groups**

| Clinical Parameters | Groups | Baseline (Mean±SD) | 6 months (Post-operative) (Mean±SD) | Mean difference | p-value |
|---|---|---|---|---|---|
| **Gingival Index** | Group I | 1.22±0.19 | 0.65±0.33 | 0.54 | 0.001* |
| | Group II | 1.23±0.16 | 0.833±0.19 | 0.40 | 0.001* |
| | Group III | 1.18±0.20 | 1.07±0.19 | 0.11 | 0.005* |
| **Probing Depth** | Group I | 6.91±1.16 | 2.91±0.66 | 4.0 | 0.001* |
| | Group II | 7.16±1.19 | 3.5±0.79 | 3.58 | 0.001* |
| | Group III | 7.08±0.99 | 4.33±0.65 | 2.75 | 0.001* |
| **Relative clinical attachment level** | Group I | 9.66±1.61 | 6.25±1.21 | 3.41 | 0.001* |
| | Group II | 8.66±1.66 | 7.33±1.07 | 1.33 | 0.001* |
| | Group III | 9.41±1.24 | 7.25±1.13 | 2.16 | 0.001* |

*Paired t test; *indicates statistically significant results (p<0.05)*

**Radiographic Assessment:** In Group I, mean score of RDD reduced from 3.44±1.20 to 1.0±0.91, in Group II it reduced from 3.50±1.25 to 2.0±1.62 and in Group III, it reduced from3.0±1.37 to 2.44±1.16 at 6 months post-operatively. Comparison between RDD scores of Groups I, II and III at baseline, and 6 months post-operatively demonstrated significant difference with p= 0.001. Group I showed significantly greater reduction than Group II and III, while Group II also showed significantly greater reduction than Group III.

**Table 2: Comparison of radiographic defect depth at baseline and 6 months for all three groups**

| Radiographic defect depth | Baseline (Mean± SD) | 6 months (Post-operative) (Mean ± SD) | Mean difference | p-value |
|---|---|---|---|---|
| Group I | 3.44±1.20 | 1.0±0.91 | 2.44 | 0.001* |
| Group II | 3.50±1.25 | 2.0±1.62 | 1.5 | 0.001* |
| Group III | 3.0±1.37 | 2.44±1.16 | 0.56 | 0.001* |

*Paired t test; *indicates statistically significant results (p<0.05).*

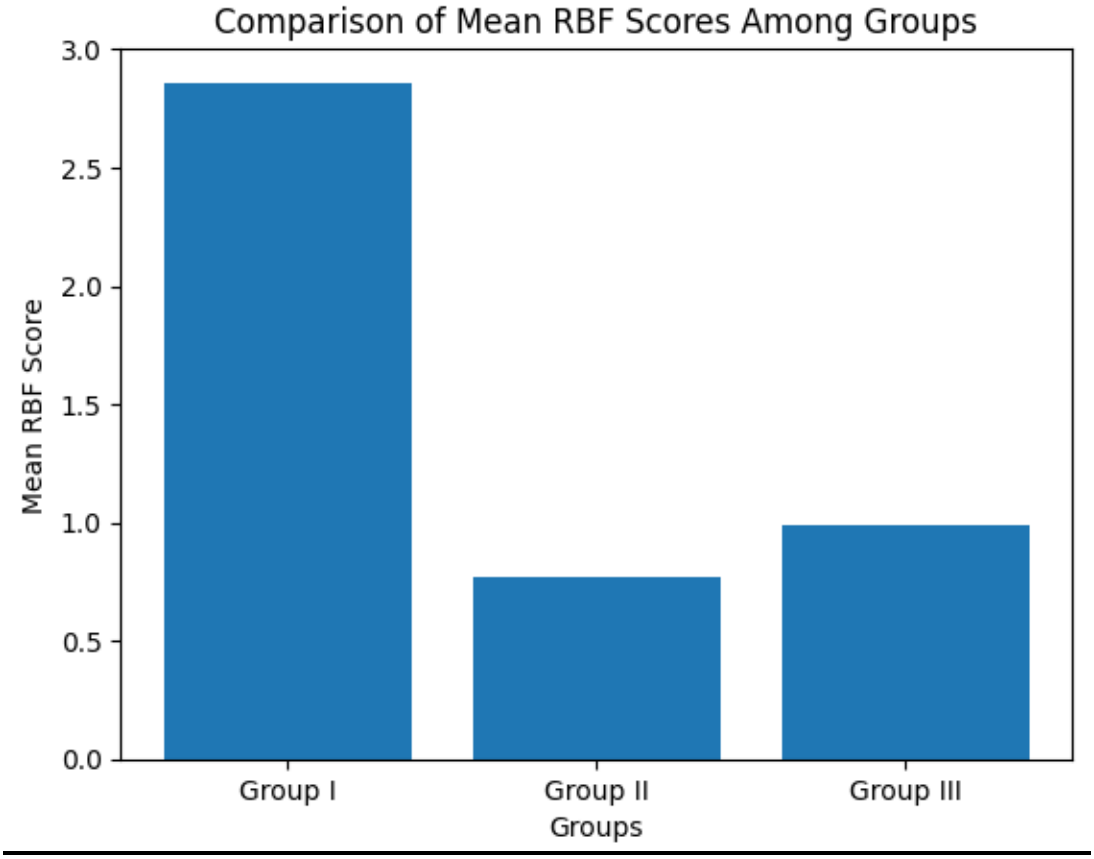



**Figure 1: Radiographic bone fill for all three groups**

In Group I, the mean RBF score was 2.86±1.70, Group II 0.77±0.71, and in Group III, it was 0.99±0.60. Comparison between RBF scores of all 3 Groups at baseline, & 6 months post-operatively showed significant difference with p= 0.001. No significant differences (p>0.05)

were observed for Group II vs Group III (Figure 1).

**Discussion:** The present study aimed to evaluate and compare ABG, ROS, and OFD in the treatment of 05 hemiseptal lesions. Parameters like GI, PPD, RAL, RDD and RBF were evaluated at baseline and six months follow up.

The average gingival index score at baseline decreased for all groups at 6 months postoperatively in our study. A substantial disparity was observed in the intergroup comparison of GI scores among ROS, ABG and OFD, at baseline and six months postoperatively. A substantial disparity was observed in the PPD scores of all three groups at baseline and six months postoperatively. A notable disparity existed in the distribution of mean scores of ABG with ROS and OFD. A comparison of RAL scores for ROS, OFD, and ABG at baseline and six months post-operatively revealed a substantial difference. A notable disparity existed in the distribution of mean scores of ABG with ROS and OFD. No significant difference was seen between ROS and ABG for PD. Based on the aforementioned observations, the null hypothesis of this study, which posited that ABG do not yield superior soft and hard tissue responses compared to ROS and OFD for treating hemiseptal periodontal defects in CP patients, was rejected.

Our results are consistent with research conducted by Thakkalapati et al., Yamamiya et al., Falk et al., and Najafi et al.[25–27] In a 30-year-old female patient with a one-wall intrabony defect associated with tooth #21, Thakkalapati et al. conducted OFD vs application of a mixture of demineralised bone matrix and autologous platelet-rich plasma (PRP). PPD decreased to 0.5 mm at the 6-month follow-up, and the CAL increased by 6.5 mm. There was no movement or haemorrhage during the probing.[25] In a study that involved eight patients, G.A. Najafi et al. employed a collagen membrane in the test group following OFD, while controls received only OFD for treatment of one-walled defects. After six months, the test group demonstrated a mean reduction in PPD of 5.5 mm and a mean RBF of 2.75 mm. The average decrease in PD was 5.7 mm, and the average increase in RBF was 1.5 mm in the control group. The two therapies exhibited a statistically significant difference in the reduction of RDD and RBF.[27] This study illustrates that barrier membranes are superior to access flaps alone and produce enhanced clinical parameters for one-wall intra bony lesions, which is consistent with our findings.

According to the radiographic examination in our study, for ABG, the average RDD score at baseline was 3.44 ± 1.20. It

decreased to 1.0 ± 0.91 six months post-operatively. The mean RDD score for ROS at baseline was3.50 ± 1.25. It reduced to 2.0 ± 1.62 at six months follow up. The mean RDD score for OFD at baseline was3.0 ± 1.37. It decreased to 2.44±1.16 at six months post-operatively. A notable disparity exists in the distribution of mean scores across all three groups. ABG showed significantly greater reduction than ROS and OFD, while ROS also showed significantly greater reduction than OFD.

The mean RBF score for ABG at 6 months follow up was 2.86± 1.70. The ROS score was 0.77 + 0.71, while the mean RBF score for OFD was0.99±0.60. Intergroup analysis of RBF scores across the three groups at baseline & 6 months revealed significant differences. A notable disparity exists in the distribution of mean scores of ABG when comparing ROS and OFD. No substantial difference was seen between ROS and OFD.

The radiographic evaluations that were previously mentioned were consistent with other studies that focused on the treatment of one-walled defects. In H. Falk study, 203 intrabony lesions exceeding 4 mm were consecutively treated in 143 individuals. Of these lesions, 2% were single-walled. The study was an evaluation of GTR therapy. The average PPD of the original intrabony defect was 6.3 ± 1.0 mm, while average RDD was 5.7 ± 1.8 mm. The average PD decreased from 9.0 ±1.0 mm to 3.3 ±1.0 mm. The average CAL gain was 4.8 ± 1.5 mm, which corresponds to 79 ± 13% of the initial RDD. Additionally, 78% of the defects exhibited a CAL increase that exceeded 4 mm. The average RBF was 3.2 ± 1.8 mm. The defect resolution was 4.3 ± 1.9 mm, which is equivalent to 72%, as a result of this and a crestal resorption of 1.1 ± 1.4 mm.[28] Yamamiya et al. investigated the clinical efficacy of human cultured periosteum (HCP) sheets in combination with platelet-rich plasma (PRP) and porous hydroxyapatite (HA) granules in the treatment of 30 human infrabony periodontal defects, including four one-walled defects. They also compared the combined treatment to a mixture of PRP and HA. In comparison to controls, the test group demonstrated a statistically significant increase in CAL (3.9 – 1.6 mm vs 2.7 – 1.3 mm), vertical RAL (83.5% – 31.7% vs 55.0% – 21.9%), and RBF (4.9 – 1.2 mm vs 3.2 – 1.1 mm). The study determined that the treatment utilising a combination of HCP sheets, PRP, and HA resulted in a substantially greater clinical improvement in infrabony periodontal abnormalities than PRP combined with HA alone.[26]

Hemiseptal defects pose considerable obstacles for regeneration therapy due to

their uncontained nature and the restricted supply of regenerative cells to populate the damaged region, resulting from the existence of only one bony wall. Thus, maintaining the wound area and facilitating cellular repopulation for regeneration are considered unfeasible. Preliminary experiments have indicated bone growth in defects with limited regenerative capacity, including craters and hemiseptal periodontal lesions.[29]

Because of their inherent osseoinductive properties, ABG are considered the "gold standard." ABG precisely contoured to match the defect's morphology, will demonstrate non-collapsible properties. [30] The non-contained nature and the absence of a regenerative cell source, which are the consequences of the presence of only 1 bony wall in periodontal hemiseptal defects, may be effectively addressed by these fragments in conjunction with their osseoinductive features and the availability of osteogenic cells.[31]

This pilot study was conducted in accordance with a methodology that the authors had previously published and specifically pertains to the healing of a one-wall intraosseous bone lesion that is more than 4mm in depth.[32] However, numerous studies have demonstrated that the degree of vertical attachment gain or osseous filling is correlated with the overall coronoapical dimension of the bony defects, which encompasses the one-wall component, despite the fact that literature suggests that 2 and 3walled bony defects exhibit superior responses to regenerative therapy over one-wall defects. Stronger attachment gains and enhanced osseous filling are associated with a deeper bony defect that exceeds 4mm.[33]

Our study possesses certain limitations. The sample size is insufficient for generalising the results. Secondly, the duration of the follow-up period may have been extended. A comparison with the gold standard bone graft could have produced additional discoveries. Research on the treatment of one-wall defects is scarce, and our study is the inaugural investigation in this area. Nevertheless, the clinical advantages and the true regenerative mechanisms of the combined approach involving bone grafts, resective procedures, and flap surgeries can be further understood through additional long-term clinical studies that include an expanded sample size, corroborative histological analyses, and sophisticated radio diagnostic evaluations.

**Conclusion:** Within the constraints of the investigation, we can derive the following findings. The mean GI, PD, as well as RAL scores decreased at 6 months post-operatively for all groups, indicating a substantial change. A notable disparity

existed in the distribution of mean PD scores between ABG with ROS and OFD. A notable disparity exists in the distribution of mean radiographic defect depth scores of ABG with ROS and OFD. Consequently, our research shows that ABG operations produce positive outcomes when performed correctly and warrant further investigation in hemiseptal defects by further investigations. Extended clinical studies with bigger cohorts, corroborative histological analyses, and sophisticated radio diagnostic evaluations can improve comprehension of the therapeutic advantages and regenerative mechanisms of diverse periodontal interventions for hemiseptal abnormalities.

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