Comparative Assessment of Autogenous Dentin Graft and Xenograft in Periodontal Regeneration of Intrabony Defects: A Clinical and Radiographic Study

Type of Article- Original Research

Contributors:

1. **Dr. Snehal Sanjayrao Kulkarni,** Postgraduate Student, Department of Periodontology, Aditya Dental College, Beed, Maharashtra, India snehalk792@gmail.com
2. **Dr. Abhijeet Mohkhedkar,** HOD, Department of Periodontology, Aditya Dental College, Beed, Maharashtra, India. mohkhedkar@gmail.com
3. **Dr. Mangesh G. Andhare,** Reader, Department of Periodontology, Aditya Dental College, Beed, Maharashtra, India. mangesh8499@gmail.com
4. **Dr.Sayli Ujgare,** Senior Lecturer, Department of Periodontology, Aditya Dental College, Beed, Maharashtra, India. sayli.ujgare@gmail.com
5. Dr. Gunderao Kulkarni, Senior Lecturer, Department of Periodontology, Aditya Dental College, Beed, Maharashtra, India. drgunderaoperio15@gmail.com
6. **Dr. Manjiri Bokey,** Postgraduate Student, Department of Periodontology, Aditya Dental College, Beed, Maharashtra, India manjiribokey@gmail.com
7. **Dr. Himanshu Srivastava,** Professor, Department of Oral Pathology and Microbiology, Aditya Dental College, Beed, Maharashtra, India himanshu.srivastava97@gmail.com
8. **Dr. Aditi Sarda,** Reader, Department Of conservative Dentistry and Endodontics, Aditya Dental College, Beed, Maharashtra, India drass61@gmail.com
9. **Dr. Mayur Awchar,** Senior Lecturer, Department of Periodontology, Aditya Dental College, Beed, Maharashtra, India. mayurawc3052@gmail.com

Corresponding Author: Dr. Snehal Sanjayrao kulkarni
Postgraduate Student, Department of Periodontology,
Aditya Dental College, Beed, Maharashtra, India.
Snehalk792@gmail.com

ABSTRACT

Background: Periodontal intrabony defects remain a therapeutic challenge, and regenerative outcomes depend heavily on the biological and physical properties of the grafting material employed. Autogenous dentin graft (ADG) has recently emerged as a biocompatible, cost-effective alternative to conventional grafts, owing to its compositional similarity to alveolar bone.

Aim: To clinically and radiographically compare the regenerative efficacy of autogenous dentin graft and xenograft in the management of periodontal intrabony defects.

Materials and Methods: Twenty-four periodontal intrabony defect sites were enrolled in this prospective, single-blinded study and equally allocated to a test group (ADG, n = 12) and a control group (xenograft, n = 12). Clinical parameters —— plaque index (PI), gingival bleeding index (GBI), probing pocket depth (PPD), and clinical attachment level (CAL) —— were recorded at baseline and six months. Radiographic outcomes, including bone fill (BF), bone crest change (BCC), defect resolution (DR), and a relative bone mineral density indicator (RBMD), were assessed using cone-beam computed tomography (CBCT).

Results: Both groups demonstrated statistically significant intragroup improvement in all clinical and radiographic parameters from baseline to six months ($p < 0.05$). Intergroup comparison revealed no significant differences in PPD, CAL, PI, or GBI. Among the radiographic outcomes, bone fill was significantly greater in the ADG group than in the xenograft group (1.61 ± 0.51 mm vs 0.97 ± 0.69 mm; $p = 0.018$). No significant intergroup differences were observed for BCC, DR, or RBMD.

Conclusion: Autogenous dentin graft produced clinical outcomes comparable to xenograft while achieving significantly superior bone fill, supporting its use as a viable, economical, and biologically favourable alternative for periodontal regeneration of intrabony defects.

Keywords: *autogenous dentin graft, xenograft, periodontal regeneration, intrabony defect, cone-beam computed tomography, bone fill*

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INTRODUCTION

Periodontitis is a chronic inflammatory disease of the tooth-supporting structures, initiated by a dysbiotic plaque biofilm. The disease is characterized by progressive destruction of the periodontal ligament and alveolar bone, ultimately leading to periodontal pocket formation, clinical attachment loss, gingival bleeding, and tooth loss if left untreated[1]. According to the 2017 World Workshop Classification, periodontitis remains one of the most prevalent oral diseases worldwide, affecting a substantial proportion of the adult population and posing a significant public health burden[2]

The primary objective of periodontal therapy extends beyond arresting disease progression to achieving true regeneration of lost periodontal tissues. Regenerative periodontal therapy aims to restore the original architecture and function of the periodontium by promoting new alveolar bone, cementum, and periodontal ligament formation. Compared with conventional resective procedures that focus primarily on pocket reduction, regenerative approaches offer the potential for genuine tissue reconstruction and improved long-term outcome[3].

Bone graft materials have become integral to periodontal regenerative therapy because of their capacity to provide a scaffold for new bone formation and to facilitate wound healing. The success of these materials depends on their osteogenic, osteoinductive, and osteoconductive properties, which together influence the biological events underlying periodontal regeneration[4]. Various graft materials —— autografts, allografts, xenografts, and alloplastic substitutes —— have been used in the management of periodontal intrabony defects with varying degrees of clinical success.

In recent years, dentin-derived graft materials have attracted considerable attention as novel biomaterials for regenerative dentistry. Dentin closely resembles alveolar bone in both its inorganic and organic composition. Beyond functioning as an osteoconductive scaffold, dentin contains a collagen-rich matrix and several bioactive molecules that may contribute to bone formation and tissue regeneration[5]. These characteristics have prompted investigation into dentin as an alternative autogenous graft material.

Autogenous dentin graft (ADG), prepared from extracted teeth, represents a promising regenerative biomaterial owing to its biocompatibility, ready availability, and capacity to repurpose tissue that would otherwise be discarded. Dentin also harbours growth factors embedded within its matrix, which may be released during graft preparation and subsequently enhance the regenerative process. The autogenous nature of the material further minimizes the risk of immunological reactions and disease transmission commonly associated with non-autogenous graft materials[5].

Among the currently available grafting materials, xenografts —— particularly anorganic deproteinized bovine bone mineral —— have been extensively used in periodontal regenerative procedures. Xenografts are well recognized for their osteoconductive properties and their ability to maintain space within osseous defects, thereby supporting bone regeneration. Nevertheless, the search for biologically active and cost-effective alternatives has stimulated growing interest in tooth-derived graft materials as potential substitutes for conventional bone grafts.

Although several studies have investigated the regenerative potential of dentin-derived biomaterials in oral and maxillofacial applications, evidence regarding their effectiveness in treating periodontal intrabony defects remains limited. A meaningful research gap therefore exists concerning the systematic clinical application of autogenous dentin grafts in periodontal regeneration, and further studies are required to validate their clinical efficacy, predictability, and safety relative to established grafting materials

The present study was therefore designed to compare the clinical and radiographic effectiveness of autogenous dentin graft and xenograft in the management of periodontal intrabony defects. Clinical outcomes were assessed using probing pocket depth (PPD) and clinical attachment level (CAL), while radiographic outcomes —— bone fill (BF), bone crest change (BCC), defect resolution (DR), and a relative bone mineral density indicator (RBMD) —— were evaluated using cone-beam computed tomography (CBCT). Plaque index (PI) and gingival bleeding index (GBI) were additionally assessed to characterize the periodontal health status of the treated sites before and after therapy.

MATERIALS AND METHODS

Following approval from the Institutional Ethics Committee of Aditya dental College, Beed. (Reference No. ADC/IEC/02/2025), a prospective, single-blinded, longitudinal clinical study was conducted. The investigator and participants were aware of the treatment allocation, whereas the examiner responsible for outcome assessment remained blinded throughout the study.

Sample Size Calculation

Sample size estimation was performed using a two-sided hypothesis test with a significance level of 5% ($\alpha = 0.05$) and an anticipated effect size (Cohen's d) of 1.32. Based on these assumptions, a total of 24 periodontal intrabony defect sites were required to achieve a statistical power of 90%. Accordingly, 12 sites were allocated to the test group and 12 sites to the control group[6]. Individual defect sites, rather than patients, constituted the unit of analysis in the present study.

Study Population

Patients reporting to the Department of Periodontics and Implant Dentistry, Aditya Dental College,Beed. were screened for eligibility. Detailed information regarding the study protocol was provided, and written informed consent was obtained from all participants prior to enrollment.

Inclusion Criteria

- Systemically healthy individuals aged between 25 and 55 years.
- Patients diagnosed with Stage III or Stage IV periodontitis according to the 2017 Classification of Periodontal and Peri-implant Diseases and Conditions.
- Patients who had not received periodontal therapy during the preceding six months.
- Sites exhibiting probing pocket depth (PPD) ≥5 mm following nonsurgical periodontal therapy and presenting with radiographically confirmed two-walled or three-walled intrabony defects.
- Individuals with no history of antibiotic therapy or bone-sparing medication within the previous six months.
- Patients possessing a vital tooth indicated for extraction, which could be utilized for preparation of the autogenous dentin graft (test group only).

Exclusion Criteria

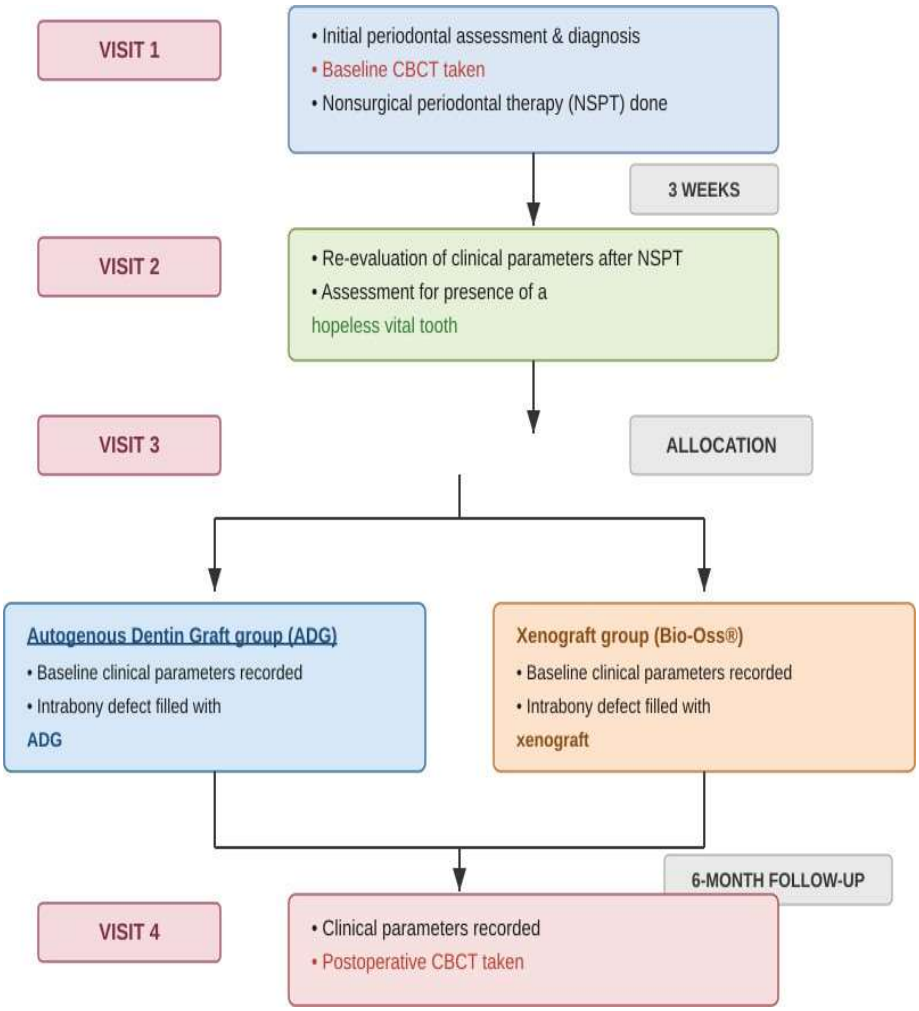
- Individuals with known hypersensitivity to the graft materials used.
- Patients unwilling to participate because of personal or religious considerations.
- Smokers.
- Pregnant or lactating women.
- Patients with systemic conditions that could influence periodontal healing, including diabetes mellitus, cardiovascular disease, or immunocompromised states.
- Individuals for whom periodontal surgical intervention was contraindicated.

Clinical Protocol

Baseline radiographic assessment was performed using cone-beam computed tomography (CBCT) during the screening visit (Visit 1). During the same appointment, a comprehensive periodontal examination and nonsurgical periodontal therapy (NSPT) were completed.

Three weeks after completion of Phase I therapy, patients were re-evaluated (Visit 2) to assess treatment response and identify suitable donor teeth for graft preparation. Defect sites fulfilling the inclusion criteria were subsequently assigned to either the test or control group.

Clinical measurements were recorded on the day of surgery (Visit 3). To ensure reproducibility and minimize measurement variability, probing depth measurements were obtained using a customized acrylic stent that served as a fixed reference point.



Surgical Procedure

Following administration of local anaesthesia using 2% lignocaine with 1:80,000 epinephrine, surgical access was obtained through a modified flap procedure (Kirkland flap). Intrasulcular incisions were placed around the involved teeth and extended to adjacent teeth whenever necessary to facilitate adequate access[7].

A full-thickness mucoperiosteal flap was reflected, and meticulous debridement of granulation tissue and root surfaces was performed using universal and Gracey curettes. Following defect preparation, graft materials were placed according to group allocation:

- **Test Group:** Autogenous Dentin Graft (ADG)
- **Control Group:** Xenograft (Bio-Oss®)

After graft placement, the flaps were repositioned and secured with 3-0 non-resorbable silk sutures. A periodontal dressing was applied to protect the surgical site.

Postoperative Care

All participants received standard postoperative instructions and medications, including antibiotics and analgesics when indicated. Patients were advised regarding oral hygiene maintenance and postoperative precautions.

Periodontal dressings and sutures were removed 7–10 days following surgery. Participants were monitored periodically, and a final evaluation was performed at six months (Visit 4).

Preparation of Xenograft Material

The control group received commercially available anorganic deproteinized bovine bone mineral (Geistlich Bio-Oss®). Small particle granules measuring 0.25–1.0 mm were used to ensure optimal adaptation and defect fill.

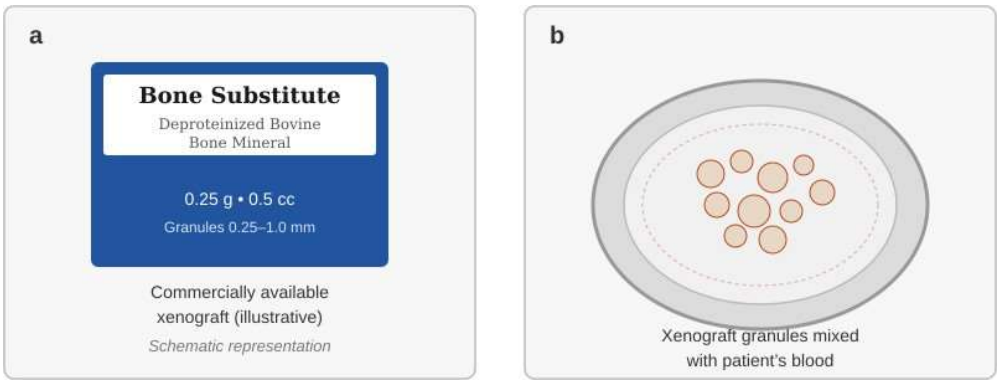


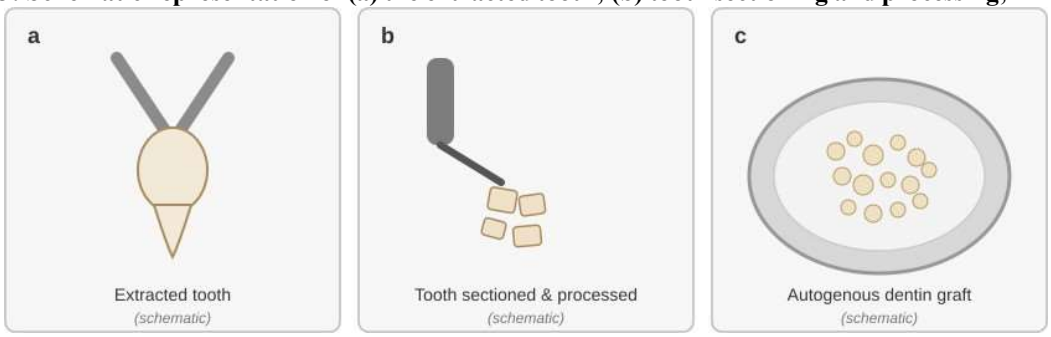
Figure 2: Schematic illustration of (a) the xenograft bone substitute used in the control group; (b) xenograft granules combined with the patient's blood prior to placement. Diagrams are illustrative schematics and do not depict the actual product or surgical photographs.

Preparation of Autogenous Dentin Graft

The autogenous dentin graft was prepared according to the protocol described by Joshi et al.[6].

Hopeless or non-functional teeth indicated for extraction owing to severe periodontal destruction or impaction were removed. Enamel, cementum, and discoloured dentin were eliminated using a tungsten carbide bur. The remaining tooth structure was sectioned and processed using a customized sterile dentin grinder operating at 700 rpm and 1500 watts to obtain dentin particles.

Figure 3: Schematic representation of (a) the extracted tooth; (b) tooth sectioning and processing;



(c) the prepared autogenous dentin graft particles. Diagrams are illustrative schematics and do not depict actual clinical photographs.

The resulting particles were standardized through sequential sieving. Particles larger than 1000 µm were discarded, while excessively fine particles (<250 µm) were eliminated, yielding a particle size range of approximately 0.25–1.0 mm —— corresponding to that of the xenograft material used in the control group.

The dentin particles were then immersed in 1N lactic acid for 20 minutes to achieve sterilization and partial demineralization. This process exposed the collagen matrix and embedded growth factors, thereby enhancing the biological activity of the graft. Following sterilization, the particles were rinsed thoroughly with sterile saline for 60 seconds before clinical application.

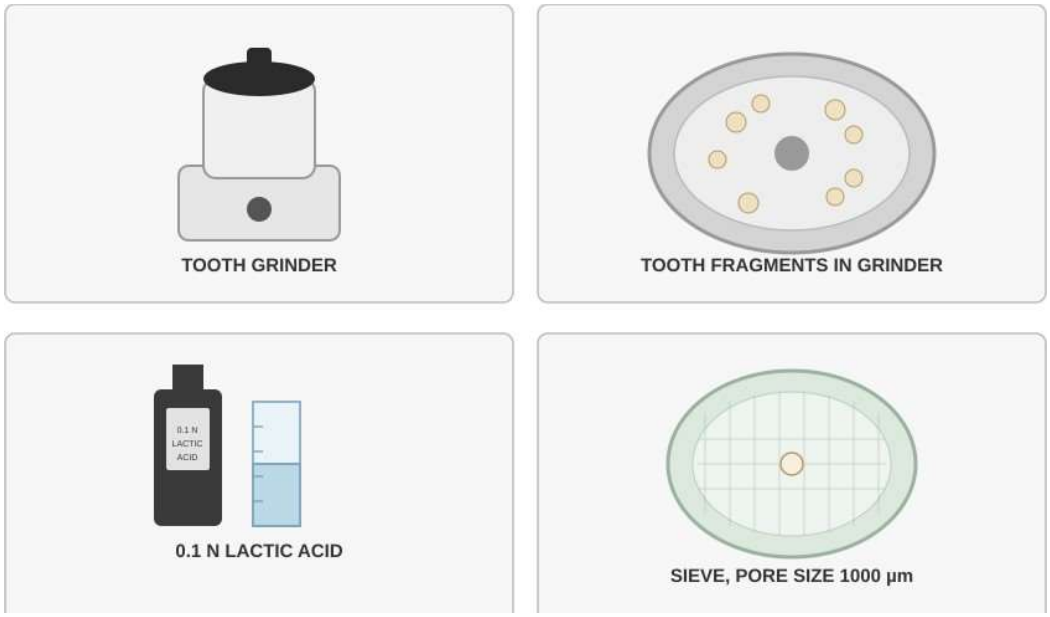


Figure 4: Schematic overview of dentin graft processing equipment: tooth grinder, processed tooth fragments, 0.1N lactic acid demineralization, and sieve (pore size 1000 µm). Diagrams are illustrative schematics.

Clinical Parameters

The following clinical parameters were recorded at baseline (Visit 3) and at six months postoperatively (Visit 4):

- Plaque Index (PI) according to Silness and Löe (1964)
- Gingival Bleeding Index (GBI) according to Ainamo and Bay (1975)
- Probing Pocket Depth (PPD)
- Clinical Attachment Level (CAL)

Radiographic Evaluation

Radiographic assessment was performed using CBCT at baseline (Visit 1) and six months postoperatively (Visit 4). Images were acquired using the Planmeca ProMax 3D system with
Standardized settings of 90 kV, 10 mA, voxel size 400 µm, and an exposure time of 13 seconds. Measurements were analysed using Planmeca Romexis software, version 5.2[8].
For image analysis, sagittal slices with a thickness of 0.1 mm were standardized and aligned parallel to the long axis of the involved tooth to ensure reproducibility[9].
Radiographic landmarks were identified according to the method described by Eickholz et al.[10].

- Cementoenamel Junction (CEJ)
- Alveolar Crest (AC)
- Base of Defect (BD)

The following measurements were calculated:

- CEJ–BD
- CEJ–AC
- Intrabony Defect Depth = (CEJ–BD) – (CEJ–AC)[11]

To compensate for radiographic distortion, a correction factor (CF) based on root length measurements was applied. Subsequently, the following parameters were determined:

- Bone Fill (BF)
- Bone Crest Change (BCC)
- Defect Resolution (DR)[12]
- Relative Bone Mineral Density (RBMD)

RBMD values were expressed in Hounsfield unit equivalents obtained from standardized CBCT images. Although

CBCT does not provide absolute bone mineral density values, relative grey-scale measurements can be used to compare mineralization changes over time.

Statistical Analysis

Data were analysed using appropriate statistical software. Quantitative variables were expressed as mean ± standard deviation. Normality of data distribution was assessed using the Shapiro–Wilk test.

Intragroup comparisons between baseline and six-month measurements were performed using repeated-measures analysis of variance (ANOVA), whereas intergroup comparisons were analysed using the independent-samples t-test. Statistical significance was established at $p < 0.05$.

RESULTS

A total of 24 periodontal intrabony defect sites were included in the study, with 12 sites allocated to the autogenous dentin graft (ADG) group and 12 sites to the xenograft group. All participants completed the six-month follow-up period, and healing was uneventful in both groups. Postoperative complications, graft rejection, or adverse events were observed throughout the study period.

Clinical Parameters

Probing Pocket Depth (PPD)

Both treatment groups demonstrated a reduction in probing pocket depth from baseline to six months. In the ADG group, the mean PPD decreased from 5.59 ± 0.77 mm at baseline to 2.86 ± 0.30 mm at six months. Similarly, the xenograft group exhibited a reduction from 4.88 ± 0.73 mm to 2.61 ± 0.37 mm. Intragroup comparisons showed statistically significant improvement in both groups. However, intergroup comparison did not reveal a statistically significant difference at baseline ($p = 0.130$) or at six months ($p = 0.080$).

Clinical Attachment Level (CAL)

A significant gain in clinical attachment level was observed in both groups over the six-month period. The mean CAL improved from 6.00 ± 0.72 mm to 3.37 ± 0.68 mm in the ADG group and from 5.85 ± 1.11 mm to 3.61 ± 1.04 mm in the xenograft group. No statistically significant differences were found between the groups at baseline ($p = 0.697$) or after six months ($p = 0.513$) (Table 1).

Table 1: Intergroup comparison of probing pocket depth and clinical attachment level at baseline and six months

Parameter	Timeline	Group	n	Mean ± SD (mm)	p value
PPD	Baseline	Test (ADG)	12	5.59 ± 0.77	0.130
		Control (Xenograft)	12	4.88 ± 0.73	
	6 months	Test (ADG)	12	2.86 ± 0.30	0.080
		Control (Xenograft)	12	2.61 ± 0.37	
CAL	Baseline	Test (ADG)	12	6.00 ± 0.72	0.697
		Control (Xenograft)	12	5.85 ± 1.11	
	6 months	Test (ADG)	12	3.37 ± 0.68	0.513
		Control (Xenograft)	12	3.61 ± 1.04	

PPD: Probing pocket depth; CAL: Clinical attachment level; SD: Standard deviation; n: number of sites.

Radiographic Parameters

Radiographic evaluation was performed using cone-beam computed tomography (CBCT) at baseline and six months postoperatively.

Bone Fill (BF)

At six months, the ADG group demonstrated a mean bone fill of 1.61 ± 0.51 mm, whereas the xenograft group showed a mean bone fill of 0.97 ± 0.69 mm. Intergroup comparison revealed a statistically significant difference favouring the ADG group (p = 0.018).

Bone Crest Change (BCC)

The mean bone crest change recorded at six months was 0.63 ± 0.04 mm in the ADG group and 0.59 ± 0.03 mm in the xenograft group. The difference between the groups was not statistically significant (p = 0.182).

Defect Resolution (DR)

The mean defect resolution was 0.86 ± 0.91 mm in the ADG group and 0.77 ± 0.21 mm in the xenograft group after six months. No statistically significant difference was observed between the groups (p = 0.724).

Relative Bone Mineral Density (RBMD)

Both groups demonstrated a marked increase in relative bone mineral density from baseline to six months. In the ADG group, RBMD increased from 125.83 ± 83.50 HU to 694.50 ± 241.57 HU, whereas the xenograft group showed an increase from 103.08 ± 67.67 HU to 568.00 ± 216.46 HU. Intergroup comparison at six months did not reveal a statistically significant difference (p = 0.190) (Tables 2 and 3).

Table 2: Intergroup comparison of bone fill, bone crest change, and defect resolution at six months using cone-beam computed tomography

Parameter	Timeline (months)	Group	Mean ± SD (mm)	p value
Bone fill (CBCT)	6	Test (ADG)	1.61 ± 0.51	**0.018***
		Control (Xenograft)	0.97 ± 0.69	
BCC (CBCT)	6	Test (ADG)	0.63 ± 0.04	0.182
		Control (Xenograft)	0.59 ± 0.03	
DR (CBCT)	6	Test (ADG)	0.86 ± 0.91	0.724
		Control (Xenograft)	0.77 ± 0.21	

CBCT: Cone-beam computed tomography; BCC: Bone crest change; DR: Defect resolution; SD: Standard deviation.
**Statistically significant (p < 0.05).*

Table 3: Intergroup comparison of relative bone mineral density indicator at baseline and six months using cone-beam computed tomography

Parameter	Timeline	Group	Mean ± SD (HU)	p value
RBMD (CBCT)	Baseline	Test (ADG)	125.83 ± 83.50	0.471
		Control (Xenograft)	103.08 ± 67.67	

Parameter	Timeline	Group	Mean ± SD (HU)	p value
	6 months	Test (ADG)	694.50 ± 241.57	0.190
		Control (Xenograft)	568.00 ± 216.46	

RBMD: Relative bone mineral density indicator; CBCT: Cone-beam computed tomography; HU: Hounsfield units; SD: Standard deviation.

Plaque Index and Gingival Bleeding Index

Plaque Index (PI)

The mean plaque index decreased from 1.42 ± 0.25 at baseline to 0.62 ± 0.06 at six months in the ADG group. In the xenograft group, the mean PI decreased from 1.31 ± 0.49 to 0.60 ± 0.09. No statistically significant intergroup differences were observed at baseline (p = 0.495) or at six months (p = 0.552).

Gingival Bleeding Index (GBI)

A reduction in gingival bleeding was observed in both treatment groups. The mean GBI decreased from 83.05 ± 2.12% at baseline to 55.68 ± 6.91% at six months in the ADG group. In the xenograft group, GBI decreased from 82.81 ± 6.03% to 55.22 ± 10.81%. Intergroup comparison showed no statistically significant difference at baseline (p = 0.897) or at six months (p = 0.903).

Overall, both treatment modalities demonstrated significant clinical and radiographic improvements over the six-month follow-up period. Among the evaluated radiographic parameters, bone fill was significantly greater in the autogenous dentin graft group compared with the xenograft group, whereas no significant intergroup differences were observed for the remaining clinical and radiographic outcomes (Table 4).

Table 4: Intergroup comparison of plaque index and gingival bleeding index at baseline and six months

Parameter	Timeline	Group	n	Mean ± SD	p value
PI	Baseline	Test (ADG)	12	1.42 ± 0.25	0.495
		Control (Xenograft)	12	1.31 ± 0.49	
	6 months	Test (ADG)	12	0.62 ± 0.06	0.552
		Control (Xenograft)	12	0.60 ± 0.09	
GBI (%)	Baseline	Test (ADG)	12	83.05 ± 2.12	0.897
		Control (Xenograft)	12	82.81 ± 6.03	
	6 months	Test (ADG)	12	55.68 ± 6.91	0.903
		Control (Xenograft)	12	55.22 ± 10.81	

PI: Plaque index; GBI: Gingival bleeding index; SD: Standard deviation; n: number of sites.

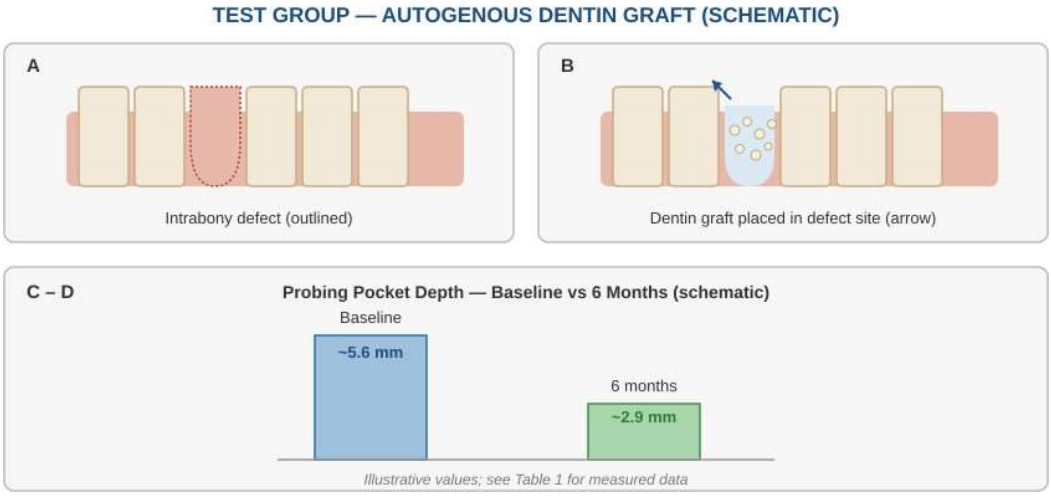


Figure 5: Schematic representation of the test group (autogenous dentin graft): (A) intrabony defect site; (B) graft placement; (C–D) illustrative comparison of probing pocket depth at baseline and six months. Diagrams are schematic and do not depict actual clinical photographs or radiographic images.

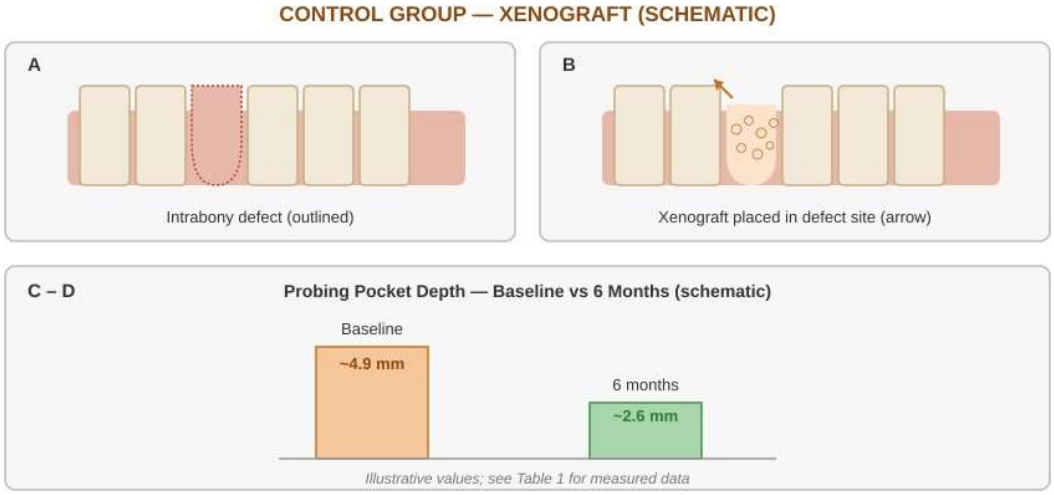


Figure 6: Schematic representation of the control group (xenograft): (A) intrabony defect site; (B) graft placement; (C–D) illustrative comparison of probing pocket depth at baseline and six months. Diagrams are schematic and do not depict actual clinical photographs or radiographic images.

DISCUSSION

Periodontal regeneration remains a primary objective in contemporary periodontal therapy, since successful treatment involves not only controlling disease progression but also restoring the structural and functional integrity of the periodontium[13]. Regenerative procedures utilizing bone graft materials have been widely employed for the management of intrabony defects because they provide a scaffold for new bone formation and facilitate periodontal wound healing[14].Although autogenous bone grafts continue to be regarded as the gold standard for regenerative therapy, their clinical application is often restricted by donor-site morbidity, limited availability, and the need for an additional surgical procedure[14]. These limitations have encouraged the development and evaluation of alternative biomaterials capable of promoting periodontal regeneration with reduced patient morbidity.

Autogenous dentin graft (ADG) has recently emerged as a promising biomaterial because of its close resemblance to alveolar bone in terms of composition and biological properties. Dentin contains both inorganic and organic components, including type I collagen and several growth factors that may contribute to bone formation through osteoconductive and osteoinductive mechanisms[15,16]. Furthermore, the autogenous nature of the graft minimizes the risk of immunological reactions and disease

transmission while providing an economical and readily available source of regenerative material[17,18].

Conversely, xenografts such as deproteinized bovine bone mineral have been extensively used in periodontal regenerative procedures because of their well-documented osteoconductive properties. The porous hydroxyapatite framework of xenografts provides a stable scaffold that supports cellular migration and bone deposition while maintaining defect space during healing[19].

The present study compared the clinical and radiographic outcomes of ADG and xenograft in the treatment of periodontal intrabony defects over a six-month follow-up period. The findings demonstrated significant improvements in clinical and radiographic parameters within both treatment groups, indicating favourable regenerative responses following surgical intervention.

Both treatment modalities resulted in significant reductions in probing pocket depth (PPD) and gains in clinical attachment level (CAL) from baseline to six months. These findings suggest successful periodontal healing and improvement in periodontal support following regenerative therapy. The results obtained in the ADG group are consistent with those reported by Elgendy et al., who demonstrated significant reductions in PPD and improvements in CAL following the use of autogenous dentin nanoparticles for the treatment of periodontal intrabony defects[20].

Similarly, the clinical improvements observed in the xenograft group are in agreement with the findings of Richardson et al., who reported favourable periodontal healing following the application of bovine-derived xenograft materials in osseous periodontal defects[19]. The observed reduction in PPD and gain in CAL may be attributed to resolution of inflammation, reorganization of connective tissue, and maturation of the periodontal wound following regenerative therapy. These observations are supported by the systematic review conducted by Heitz-Mayfield et al., which emphasized the beneficial effects of surgical periodontal therapy on clinical periodontal parameters[20].

Although both groups exhibited significant clinical improvement, no statistically significant differences were observed between ADG and xenograft with respect to PPD reduction or CAL gain. These findings indicate that both biomaterials are capable of achieving comparable short-term clinical outcomes. Similar observations were reported in the systematic review by Gharpure and Bhatavadekar, which demonstrated no significant differences between tooth-derived graft materials and conventional grafting approaches in several clinical studies[3].Radiographic evaluation using CBCT revealed that bone fill was significantly greater in the ADG group than in the xenograft group after six months. This finding suggests that ADG may possess enhanced regenerative potential in periodontal intrabony defects. The greater bone fill observed in the ADG group is consistent with the findings of Elgendy et al., who reported favourable radiographic outcomes following the use of dentin-derived graft materials[15].

The superior bone fill associated with ADG may be explained by its unique biological composition. Dentin contains growth factors such as bone morphogenetic proteins and transforming growth factor-beta that become available following demineralization and may stimulate osteoblastic activity and new bone formation. Kim et al. demonstrated that autogenous dentin graft undergoes gradual resorption and replacement by newly formed bone, thereby contributing to effective regeneration through both osteoconductive and osteoinductive mechanisms[16].

With respect to bone crest change (BCC) and defect resolution (DR), no statistically significant differences were identified between the two treatment groups. Nevertheless, the slight improvement observed in the ADG group corresponds with the findings reported by Joshi et al., who demonstrated favourable bone regeneration following the use of autogenous tooth grafts[6]. The comparable performance of the two graft materials suggests that both are capable of supporting periodontal regeneration within intrabony defects.

Relative bone mineral density (RBMD) increased substantially in both groups over the six-month healing period, indicating progressive mineralization of the regenerated tissue. Although the ADG group demonstrated higher RBMD values than the xenograft group, the difference did not reach statistical significance. Similar observations have been reported by Sánchez-Labrador et al., who demonstrated satisfactory mineralization and bone maturation following the use of autogenous dentin grafts[22].

The absence of significant differences in several radiographic parameters between ADG and xenograft is consistent with the systematic review and meta-analysis conducted by Li et al., which concluded that autogenous demineralized dentin matrix exhibits osteogenic effectiveness comparable to that of Bio-Oss® and other conventional graft materials[23]. Likewise, Zhang et al. reported that the regenerative performance

of tooth-derived graft materials is largely comparable to that of established bone substitutes due to their favourable osteoconductive characteristics[24].

Plaque index (PI) and gingival bleeding index (GBI) scores decreased significantly in both groups during the study period. The reduction in these parameters is likely attributable to successful nonsurgical periodontal therapy, surgical debridement, and reinforcement of oral hygiene measures. Similar findings were reported by Elgendy et al., who observed significant improvements in plaque control and gingival health following regenerative treatment using dentin-derived graft materials[25].

An important advantage of ADG is its autologous origin, which eliminates concerns related to immunogenicity and disease transmission while utilizing extracted teeth that would otherwise be discarded. In addition, ADG offers a cost-effective alternative to commercially available graft materials and aligns with the growing interest in biologically derived regenerative biomaterials.

The favourable clinical and radiographic outcomes observed in the present study further support its potential application in periodontal regenerative therapy.

Nevertheless, certain limitations should be considered when interpreting the findings. The relatively small sample size and short follow-up duration may limit the generalizability of the results. Furthermore, radiographic outcomes alone cannot confirm true periodontal regeneration, and histologic evaluation would be required to verify the formation of new cementum, periodontal ligament, and alveolar bone. Future multicentre randomized controlled trials with larger sample sizes and extended follow-up periods are therefore necessary to validate the long-term effectiveness and predictability of autogenous dentin grafts.

Overall, the results of the present study suggest that autogenous dentin graft is a safe and effective regenerative biomaterial that produces clinical outcomes comparable to xenograft while demonstrating superior bone fill in periodontal intrabony defects. These findings contribute to the growing body of evidence supporting the use of tooth-derived graft materials in periodontal regenerative procedures[3].

CONCLUSION

Within the limitations of this study, autogenous dentin graft and xenograft both produced significant clinical and radiographic improvement in the treatment of periodontal intrabony defects over six months. Autogenous dentin graft demonstrated clinical outcomes comparable to xenograft, with the added advantage of significantly superior bone fill. Given its biocompatibility, low cost, and elimination of donor-site morbidity associated with autogenous bone harvesting, autogenous dentin graft represents a promising and practical regenerative biomaterial for periodontal intrabony defects, warranting further validation through larger, multicentre, long-term trials.

REFERENCES

1. Papapanou PN, Sanz M, Buduneli N, Dietrich T, Feres M, Fine DH, et al. Periodontitis: consensus report of workgroup 2 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. J Periodontol. 2018;89(Suppl 1):S173–82.
2. Germen M, Baser U, Lacin CC, Fıratlı E, İşsever H, Yalcin F. Periodontitis prevalence, severity, and risk factors: a comparison of the AAP/CDC case definition and the EFP/AAP classification. Int J Environ Res Public Health. 2021;18:3459.
3. Gharpure AS, Bhatavadekar NB. Clinical efficacy of tooth-bone graft: a systematic review and risk of bias analysis of randomized control trials and observational studies. Implant Dent. 2018;27:119–34.
4. American Academy of Periodontology. Position paper: periodontal regeneration. J Periodontol. 2005;76:1601–22.
5. Tabatabaei FS, Tatari S, Samadi R, Modarreszadeh K. Different methods of dentin processing for application in bone tissue engineering: a systematic review. J Biomed Mater Res A. 2016;104:2616–27.
6. Joshi CP, Dani NH, Khedkar SU. Alveolar ridge preservation using autogenous tooth graft versus beta-tricalcium phosphate alloplastic: a randomized, controlled, prospective, clinical pilot study. J Indian Soc Periodontol. 2016;20:429–34.
7. Mahajan A, Kedige S. Periodontal bone regeneration in intrabony defects using osteoconductive bone graft versus combination of osteoconductive and osteostimulative bone graft: a comparative study. Dent Res J (Isfahan). 2015;12:25–30.
8. Banodkar AB, Gaikwad RP, Gunjikar TU, Lobo TA. Evaluation of accuracy of cone-beam computed tomography for measurement of periodontal defects: a clinical study. J Indian Soc Periodontol. 2015;19:285–9.
9. Pang KM, Um IW, Kim YK, Woo JM, Kim SM, Lee JH. Autogenous demineralized dentin matrix from extracted tooth for the

augmentation of alveolar bone defect: a prospective randomized clinical trial in comparison with anorganic bovine bone. Clin Oral Implants Res. 2017;28:809–15.
10. Eickholz P, Kim TS, Benn DK, Staehle HJ. Validity of radiographic measurement of interproximal bone loss. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1998;85:99–106.
11. Chung YM, Lee JY, Jeong SN. Comparative study of two collagen membranes for guided tissue regeneration therapy in periodontal intrabony defects: a randomized clinical trial. J Periodontal Implant Sci. 2014;44:194–200.
12. Trombelli L, Heitz-Mayfield LJ, Needleman I, Moles D, Scabbia A. A systematic review of graft materials and biological agents for periodontal intraosseous defects. J Clin Periodontol. 2002;29(Suppl 3):117–35.
13. Needleman I, Tucker R, Giedrys-Leeper E, Worthington H. A systematic review of guided tissue regeneration for periodontal infrabony defects. J Periodontal Res. 2002;37:380–8.
14. Nasr HF, Aichelmann-Reidy ME, Yukna RA. Bone and bone substitutes. Periodontol 2000. 1999;19:74–86.
15. Elgendy EA, Elgendy AM, ElBorady OM. Clinical and radiographic assessment of autogenous dentin nanoparticles in treatment of stage III periodontitis: a split-mouth clinical study. J Pak Med Assoc. 2023;73(Suppl 4):S310–6.
16. Pai A, Gurpur P, Dayakar MM, Mundoor S, Seedhar AS. Dentine graft. Int J Res Eng Sci Manag. 2021;4:24–6.
17. Finkelman RD, Mohan S, Jennings JC, Taylor AK, Jepsen S, Baylink DJ. Quantitation of growth factors IGF-I, SGF/IGF-II, and TGF-beta in human dentin. J Bone Miner Res. 1990;5:717–23.
18. Grawish ME, Grawish LM, Grawish HM, Grawish MM, Holiel AA, Sultan N, et al. Demineralized dentin matrix for dental and alveolar bone tissues regeneration: an innovative scope review. Tissue Eng Regen Med. 2022;19:687–701.
19. Richardson CR, Mellonig JT, Brunsvold MA, McDonnell HT, Cochran DL. Clinical evaluation of Bio-Oss: a bovine-derived xenograft for the treatment of periodontal osseous defects in humans. J Clin Periodontol. 1999;26:421–8.
20. Heitz-Mayfield LJ, Trombelli L, Heitz F, Needleman I, Moles D. A systematic review of the effect of surgical debridement versus non-surgical debridement for the treatment of chronic periodontitis. J Clin Periodontol. 2002;29(Suppl 3):92–102.
21. Kim YK, Kim SG, Byeon JH, Lee HJ, Um IU, Lim SC, et al. Development of a novel bone grafting material using autogenous teeth. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2010;109:496–503.
22. Sánchez-Labrador L, Martín-Ares M, Ortega-Aranegui R, López-Quiles J, Martínez-González JM. Autogenous dentin graft in bone defects after lower third molar extraction: a split-mouth clinical trial. Materials (Basel). 2020;13:3090.
23. Li Y, Zhou W, Li P, Luo Q, Li A, Zhang X. Comparison of the osteogenic effectiveness of an autogenous demineralised dentin matrix and Bio-Oss® in bone augmentation: a systematic review and meta-analysis. Br J Oral Maxillofac Surg. 2022;60:868–76.
24. Zhang S, Li X, Qi Y, Ma X, Qiao S, Cai H, et al. Comparison of autogenous tooth materials and other bone grafts. Tissue Eng Regen Med. 2021;18:327–41.