Autogenous Dentin Graft with Autologous Pulp Cells in Vertical Defect Management

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ABSTRACT

Background Vertical alveolar bone defects pose a considerable challenge in periodontal regeneration due to their complex architecture, reduced vascularity, and limited inherent healing capacity. Conventional grafting materials often lack biological activity or require additional donor sites. Autogenous dentin grafts, owing to their compositional similarity to bone, along with dental pulp stem cells (DPSCs), which possess osteogenic and regenerative potential, offer a promising, biologically driven, and patient-specific therapeutic alternative.

Description A vertical intrabony defect associated with tooth #36 was treated using a particulate autogenous dentin graft combined with dental pulp stem cells obtained from an extracted supraerupted third molar (#38). The extracted tooth was processed chairside into particulate graft material, preserving its organic and inorganic components. Dental pulp tissue was harvested and utilized as a source of stem cells to enhance regenerative outcomes. The graft-stem cell complex was placed within the defect following thorough debridement. Clinical and radiographic evaluation at six months demonstrated significant bone fill, reduction in probing depth, gain in clinical attachment, and satisfactory stability of the treated site without any adverse outcomes.

Practical Implications This case series underscores the clinical feasibility and effectiveness of utilizing autogenous dentin in conjunction with dental pulp stem cells as a minimally invasive, cost-effective, and biologically active approach for managing vertical bone defects. This strategy eliminates the need for secondary donor sites and highlights its potential as a viable regenerative modality in contemporary periodontology.

Keywords: Autogenous dentin; Dental pulp stem cells; Vertical bone defect; Periodontal regeneration; Supraerupted molar; Bone grafting.

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Introduction

The management of vertical periodontal defects continues to represent a significant therapeutic challenge due to the complex architecture of these defects and the inherent difficulty in achieving predictable regeneration of lost alveolar bone [1]. Conventional regenerative approaches, including autografts, allografts, and xenografts, have been widely employed; however, these modalities are associated with certain limitations such as donor site morbidity, risk of disease transmission, variable resorption rates, and inconsistent clinical outcomes [2–4].

In recent years, increasing emphasis has been placed on biologically driven regenerative strategies utilizing autologous materials. Among these, autogenous dentin has emerged as a promising graft material due to its close structural and chemical resemblance to alveolar bone, including the presence of hydroxyapatite, collagen matrix, and inherent growth factors. These properties enable dentin to function as an

osteoconductive scaffold with potential osteoinductive capabilities, thereby supporting new bone formation and periodontal regeneration [5–7].

Additionally, dental pulp tissue represents a rich and accessible source of mesenchymal stem cells, known as dental pulp stem cells (DPSCs), which exhibit high proliferative capacity and the ability to differentiate into osteogenic lineages. The synergistic use of dentin as a scaffold and DPSCs as a cellular component may enhance regenerative outcomes by promoting both structural support and biological activity at the defect site [8–10].

Notably, supraerupted third molars—frequently indicated for extraction due to orthodontic, prosthetic, or occlusal considerations—serve as a convenient and minimally invasive source of both dentin and pulp tissue. Their utilization in regenerative procedures eliminates the need for secondary donor sites and aligns with the principles of autologous, cost-effective, and patient-specific therapy [11,12].

Therefore, this case series aims to evaluate the clinical and radiographic outcomes of managing vertical intrabony defects using a combination of autogenous dentin graft and dental pulp stem cells derived from extracted third molars. This approach highlights an innovative and biologically based strategy for periodontal regeneration

Materials and Methods

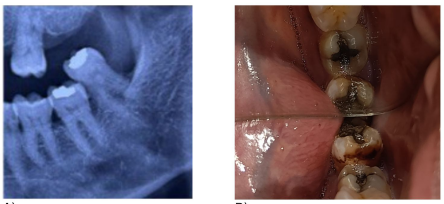
This study was designed as a prospective case series to evaluate the clinical and radiographic outcomes of managing vertical periodontal defects using an autologous dentin-based biomaterial functioning as a carrier for dental pulp-derived stem cells. Systemically healthy patients presenting with probing depths ≥6 mm associated with radiographically confirmed vertical intrabony defects in posterior teeth were included. A key criterion for selection was the presence of a non-functional, supraerupted, or non-restorable third molar indicated for extraction, which served as a source of both scaffold material and cellular components. Patients with systemic conditions affecting healing, tobacco use, pregnancy, or inadequate oral hygiene were excluded. All participants underwent initial periodontal therapy, including scaling and root planing, followed by reevaluation after 4–6 weeks to ensure adequate plaque control and reduction of inflammation prior to surgical intervention.

Under aseptic conditions and local anesthesia, the indicated third molar was atraumatically extracted and immediately processed chairside. The extracted tooth was thoroughly debrided to remove soft tissue remnants and contaminants, and the dentin was mechanically ground into particulate form while preserving its organic and inorganic components. This processed dentin, rich in collagen matrix and hydroxyapatite, served as an osteoconductive scaffold with inherent bioactive potential. Simultaneously, dental pulp tissue was aseptically extirpated from the extracted tooth and mechanically processed to obtain a cell-rich fraction containing dental pulp-derived stem cells. Without ex vivo expansion, the pulp tissue was directly incorporated into the dentin particulate to form an autologous dentin–pulp composite, designed to function as a biologically active construct facilitating localized delivery of regenerative cells and signaling molecules.

At the recipient site, a full-thickness mucoperiosteal flap was elevated to access the defect, followed by meticulous degranulation and root surface debridement. The prepared dentin–pulp construct was then delivered into the vertical defect, ensuring intimate adaptation to the surrounding bony walls to promote cellular integration and scaffold stability. The flap was repositioned and secured using interrupted sutures to achieve primary closure and maintain a stable healing environment. Postoperatively, patients were prescribed systemic antibiotics and analgesics and instructed to use chlorhexidine mouth rinse for chemical plaque control, while avoiding mechanical disruption of the surgical site during the initial healing phase.

Clinical parameters, including probing depth, clinical attachment level, bleeding on probing, tooth mobility, and gingival condition, were recorded at baseline, 3 months, and 12 months using standardized methods. Radiographic evaluation was performed to assess bone fill and defect resolution, reflecting the effectiveness of the cell-loaded biomaterial construct in promoting periodontal regeneration. Given the descriptive nature of the case series, outcomes were assessed qualitatively based on improvements in clinical parameters and radiographic evidence of regeneration over time.

All patients provided informed consent prior to treatment, and the study was conducted in accordance with accepted ethical standards for clinical research.



A) B)

Figure 1 (A–B)
(A) Preoperative intraoral view s
(B) Radiograph showing vertical bone defect adjacent to 36

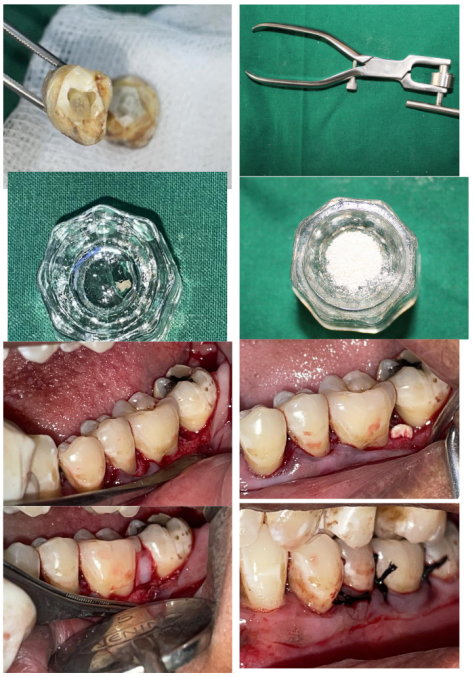


Fig 2 - (A) Extracted tooth 38 with access to pulp chamber
(B) Harvested pulp tissue suspended in saline C)Dentin particles post-decontamination
D)Full-thickness flap elevated at site 36 E) Placement of dentin–pulp composite graft into vertical defect F)
Collagen membrane (Fix-Gide®) placed over graft G) Primary closure with 4-0 silk sutures

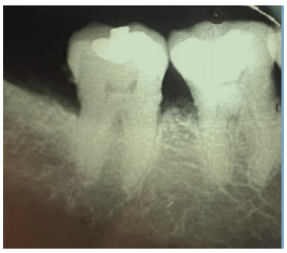


Fig 3:(B) Radiographic bone fill and crest continuity at 3 months

Autogenous Pulp Extraction Protocol

Tooth #38 Extraction (Under Local Anesthesia)
↓
Mechanical Cleaning of Extracted Tooth
↓
Section Crown to Expose Pulp Chamber
↓
Harvest Dental Pulp Tissue
↓
Mince & Suspend Pulp in Sterile Saline

Autogenous Dentin Extraction Protocol

Grind Root Dentin into 300–1200 µm Particles
↓
Decontaminate Dentin:
→ Soak in 0.5M NaOH + 20% Ethanol (10 mins)
→ Rinse Thoroughly with Sterile Saline
↓
Prepare Recipient Site (#36):
→ Raise Full-Thickness Flap
→ Debridement & Root Planing
↓
Mix:
→ Autogenous Dentin Particles
+ Pulp Cell Suspension
↓
Place Graft into Vertical Defect
↓
Cover with Resorbable Collagen Membrane
↓
Achieve Primary Closure with 4-0 Silk Sutures

Postoperative Protocol

Following the surgical intervention, patients were placed on a standardized postoperative regimen to ensure optimal healing and minimize the risk of infection. Amoxicillin 500 mg was prescribed three times daily for five days as antimicrobial prophylaxis. For pain management, a combination of aceclofenac 100 mg and paracetamol 325 mg was advised on an as-needed basis, depending on the patient's level of discomfort. To maintain plaque control during the early healing phase, patients were instructed to use a 0.12% chlorhexidine mouth rinse twice daily for two weeks. They were specifically advised to avoid mechanical plaque control measures in the treated area during this period to prevent disruption of the surgical site and the stability of the placed graft.

In addition, patients were given detailed postoperative instructions, including adherence to a soft diet, avoidance of chewing on the treated side, and refraining from vigorous rinsing or spitting in the immediate postoperative period. Maintenance of overall oral hygiene in non-operated areas was emphasized. Sutures were removed after ten days, at which point initial soft tissue healing was assessed.

A structured follow-up protocol was implemented, with clinical evaluations scheduled at one week, one month, and three months postoperatively. These visits included assessment of soft tissue healing, presence or absence of inflammation, and patient compliance. Radiographic evaluation was performed at appropriate intervals to assess bone fill and integration of the graft material. This systematic postoperative care protocol was designed to support uneventful healing and to monitor the regenerative outcomes associated with the autologous dentin–pulp construct

Outcome Results

At the three-month follow-up, a marked clinical improvement was observed at the treated site. The probing depth was significantly reduced from an initial 7 mm to 3 mm, accompanied by the absence of bleeding on probing, indicating effective resolution of inflammation. The clinical attachment level remained stable, suggesting successful periodontal reattachment and functional integrity of the treated site. Radiographic evaluation at this stage demonstrated appreciable bone fill within the defect, along with early re-establishment of alveolar crest continuity (Fig. 10), indicating favorable integration of the graft and initiation of regenerative processes.

At the twelve-month follow-up, the clinical outcomes remained stable and well-maintained. The treated site exhibited sustained reduction in probing depth with no recurrence of periodontal pocketing. There was no evidence of bleeding on probing, and the gingival tissues appeared healthy, with maintained clinical attachment levels. Radiographically, the defect site showed continued bone maturation and preservation of the regenerated architecture, with no signs of bone loss or defect recurrence. Healing progressed uneventfully throughout the observation period, with no incidence of postoperative complications such as infection, graft rejection, or adverse tissue reactions. These findings suggest that the autologous dentin–pulp construct provided a stable and biologically favorable environment for periodontal regeneration, supporting both early healing and long-term tissue stability

Discussion

The present case series demonstrates the favorable clinical and radiographic outcomes achieved using an autologous dentin–pulp construct derived from supraerupted third molars for the management of vertical periodontal defects. The observed regenerative success can be attributed to the combined biological and structural properties of dentin and dental pulp-derived stem cells, functioning synergistically to enhance periodontal healing. Dentin, by virtue of its compositional similarity to bone, serves as an effective osteoconductive scaffold while also exhibiting osteoinductive potential due to the presence of bioactive molecules embedded within its matrix. Previous studies have reported high success rates with dentin as a grafting material in periodontal regeneration, supporting its role as a viable autologous alternative to conventional grafts (5,9,16–18).

The process of dentin preparation, particularly demineralization, has been shown to facilitate the release of growth factors such as bone morphogenetic proteins, thereby enhancing osteogenic differentiation and new bone formation (14,16,19). In the present approach, the use of freshly prepared dentin likely contributed to the establishment of a favorable microenvironment for regeneration. Furthermore, dental pulp tissue represents a rich source of mesenchymal stem cells with significant osteogenic and angiogenic potential. These dental pulp-derived stem cells (DPSCs) not only differentiate into osteoblast-like cells but also secrete angiogenic factors that promote neovascularization, thereby improving graft integration and overall regenerative outcomes (9,20).

An important advantage of this technique lies in the utilization of freshly harvested pulp tissue without the need for ex vivo culture expansion. This preserves cellular viability and bioactivity while simplifying the clinical protocol and reducing both cost and procedural complexity. In addition, the use of a supraerupted third molar as the source of both scaffold and cellular components eliminates the need for a secondary donor site, thereby minimizing patient morbidity and optimizing the use of otherwise discarded biological material (11).

From a tissue engineering perspective, the dentin–pulp construct can be considered a naturally derived, autologous delivery system that integrates scaffold, cells, and signaling molecules within a single biological unit. This triad is essential for predictable regeneration and may explain the favorable clinical outcomes observed in this case series, including significant probing depth reduction, gain in clinical attachment, and radiographic bone fill with sustained stability over time. These findings are consistent with emerging evidence highlighting the synergistic potential of dentin matrices combined with stem cell-based approaches for hard tissue regeneration.

However, despite these promising results, the limitations inherent to a case series design must be acknowledged. The absence of a control group, small sample size, and limited follow-up period

restrict the generalizability of the findings. Therefore, further well-designed randomized controlled clinical trials with larger sample sizes and long-term evaluation are necessary to validate the efficacy of this approach and to establish standardized clinical protocols

Conclusion

Within the limitations of this case series, the use of an autologous dentin–pulp construct derived from supraerupted third molars appears to be a promising and biologically active approach for the management of vertical periodontal defects. Across the treated cases, this patient-specific strategy demonstrated favorable clinical, radiographic, and functional outcomes over a 12-month follow-up period, including reduction in probing depth, gain in clinical attachment, and substantial bone fill with stable periodontal conditions.

This approach effectively utilizes a non-functional third molar as a dual source of scaffold and cellular components, thereby transforming biological waste into a valuable regenerative resource. The autogenous dentin matrix provides an osteoconductive and osteoinductive framework, while the incorporated pulp-derived mesenchymal stem cells enhance osteogenic potential and vascularization, contributing to predictable and stable periodontal regeneration. Additionally, this technique eliminates the need for a secondary donor site, reduces patient morbidity, and offers a cost-effective and minimally invasive alternative to conventional grafting materials.

Despite these encouraging findings, the results should be interpreted with caution due to the limited sample size and absence of a control group. Further well-designed randomized controlled clinical trials with larger sample sizes and long-term follow-up are necessary to validate the reproducibility, predictability, and clinical applicability of this technique. Standardization of dentin and pulp processing protocols will also be essential for its widespread clinical adoption.

In conclusion, autogenous dentin–pulp grafting represents a biologically sound and clinically effective modality for vertical bone regeneration and holds significant potential for advancing regenerative therapies in periodontology

Patient Consent

Written informed consent was obtained from the patient for publication of this case report and all associated clinical images.

Declaration of Interest Statement

The authors declare no conflict of interest related to this case report.

References

1. Caton JG, Armitage G, Berglundh T, et al. A new classification scheme for periodontal and peri-implant diseases and conditions. J Periodontol. 2018;89(Suppl 1):S1–S8.
2. Aghaloo TL, Moy PK. Which hard tissue augmentation techniques are the most successful in furnishing bony support for implant placement? Int J Oral Maxillofac Implants. 2007;22(Suppl):49–70.
3. Retzepi M, Donos N. Guided bone regeneration: biological principle and therapeutic applications. Clin Oral Implants Res. 2010;21(6):567–576.
4. Iocca O, Farcomeni A, Puggioni A, et al. Implant survival rate after placement in sites regenerated with bone grafts: systematic review. J Clin Periodontol. 2017;44(2):147–157.
5. 5Kim YK, Lee J, Um IW, et al. Tooth-derived bone graft material. J Korean Assoc Oral Maxillofac Surg. 2013;39(3):103–111.
6. Murata M. Autogenous demineralized dentin matrix for maxillary sinus augmentation in humans: the first clinical case report. Bone Graft Substitutes. 2012;165–178.
7. Um IW, Kim YK, Kim KW, et al. Bone healing with autogenous tooth bone grafts: a case series. Implant Dent. 2014;23(5): 639–644.
8. Gronthos S, Mankani M, Brahim J, et al. Postnatal human dental pulp stem cells (DPSCs) in vitro and in vivo. Proc Natl Acad Sci USA. 2000;97(25):13625–13630.
9. d'Aquino R, Graziano A, Sampaolesi M, et al. Human postnatal dental pulp cells co-differentiate into osteoblasts and endotheliocytes. Bone. 2007;40(3):684–693.
10. Seo BM, Miura M, Gronthos S, et al. Investigation of multipotent postnatal stem cells from human dental pulp. Lancet. 2004;364(9429):149–155.

11. Sonoda S, Yamaza T, Akiyama K, et al. Characterization of the supraerupted molars in orthodontic patients. Orthod Waves. 2013;72(3):87–93.
12. Tonetti MS, Greenwell H, Kornman KS. Staging and grading of periodontitis: framework and proposal. J Periodontol. 2018;89(Suppl 1):S159–S172.
13. Murata M, Akazawa T, Mitsugi M, et al. Autograft of dentin materials for bone regeneration. Adv Dent Res. 2018;29(1): 48–52.
14. Minamizato T, Kinoshita K, Kokubo S, et al. Demineralized dentin matrix as a scaffold for bone regeneration. Biomaterials. 2010;31(20):5114–5123.
15. Gomes MF, Luvizuto ER, Okamoto R, et al. Dentin graft biomaterial: histological analysis in critical-size defects. J Clin Exp Dent. 2017;9(11):e1294–e1300.
16. Lee JH, Kim ES, Kim SM, et al. Autogenous tooth bone graft block for sinus augmentation with simultaneous implant placement: a case series. J Korean Assoc Oral Maxillofac Surg. 2013;39(5):221–228.
17. Iezzi G, Degidi M, Piattelli A. Comparative histological evaluation of human bone grafts treated by different demineralization processes. Implant Dent. 2010;19(1):29–37.
18. Kim YK, Kim SG, Um IW, et al. Tooth-derived bone graft material. J Korean Assoc Oral Maxillofac Surg. 2013;39(3):103–111.
19. Urist MR. Bone formation by autoinduction. Science. 1965;150(3698):893–899.
20. Wang J, Liu X, Jin X, et al. Osteogenic and angiogenic potentials of the dental pulp stem cells for bone tissue engineering: A promising strategy for bone regeneration. Stem Cell Res Ther. 2020;11(1):56.