

MINI-REVIEW

Autogenous dentin as a graft material for alveolar ridge preservation in dentistry: Definition and clinical application

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Abstract

Adequate bone volume is essential for implant placement, and in many cases, can only be achieved through bone grafting. However, impaction of lower third molars can cause bone lysis in the distal alveolar area of the second molar. Hence, this review evaluates the effectiveness of autogenous dentin in alveolar preservation and bone augmentation in implant surgery, as well as its role in preventing the development of bone defects and subsequent periodontal pocket formation after lower third molar extraction. A bibliographic review was conducted across electronic databases, including PubMed/MEDLINE and the Cochrane Library Plus. Multiple studies concluded that autogenous dentin is suitable for bone regeneration. Autogenous dentin enhances bone regeneration in the extraction socket, facilitates bone volume augmentation in implant surgery, and prevents periodontal pocket formation distal to the second molar following lower third molar extraction.

Keywords: Autogenous dentin; Lower third molar; Tooth transformer; Socket preservation; Maxillary sinus augmentation; Dental implants

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1. Introduction

The use of dental implants to replace missing teeth has increased substantially; however, in many cases, insufficient bone availability necessitates bone grafting. Although autogenous bone is considered the gold standard for bone regeneration, it has several disadvantages, including limited availability and donor-site morbidity.

Impaction of lower third molars can cause bone lysis in the distal alveolar region of the adjacent second molar. In addition, the surgical extraction procedure itself may result in periodontal complications, such as distal bone loss at the second molar, periodontal pocket formation, and potential damage to the adjacent tooth.^{1,2}

Many authors recommend the use of regenerative techniques as a complementary treatment to minimize these complications. Studies have demonstrated that bone substitutes combined with resorbable membranes are effective for post-extraction defect healing compared with extraction without grafting, resulting in improved bone height.³

In the search for biomaterials with properties comparable to bone, dentin has

recently emerged as a potential regenerative option. It exhibits favorable physical and chemical properties, such as density, roughness, homogeneity, and a calcium–phosphate composition similar to that of human bone.⁴ Dentin is composed of approximately 70% inorganic content, which provides osteoconductive properties, 20% organic matrix—predominantly type I collagen network (18%) along with non-collagenous proteins (2%) involved in bone calcification and growth factor activity—and 10% fluid.^{4,5} This composition underlies its potential osteoinductive capacity. However, dentin lacks osteogenic properties, and its clinical availability is limited by the condition of the extracted teeth.⁶

2. Methodology

A narrative literature review was conducted to evaluate the clinical applications and effectiveness of autogenous dentin as a graft material for alveolar ridge preservation and bone augmentation in implant dentistry. An electronic search was performed in the PubMed/MEDLINE and Cochrane Library databases. The search strategy included combinations of the following keywords: “autogenous dentin,” “tooth transformer,” “socket preservation,” “dental implants,” and “third molar extraction.” Boolean operators (AND, OR) were used to refine the search.

Articles published in English were considered, with no strict restriction on publication date, in order to include both foundational and recent studies. The inclusion criteria comprised clinical trials, systematic reviews, and relevant *in vivo* studies evaluating the use of autogenous dentin in bone regeneration, implant surgery, or post-extraction alveolar preservation. The exclusion criteria included studies unrelated to dentistry, *in vitro* studies lacking clinical relevance, case reports with insufficient data, and articles not available in full text.

The selection process involved screening titles and abstracts, followed by full-text analysis of eligible studies.

3. Obtention of autogenous dentin

New technologies have been developed to obtain autogenous dentin, such as the Tooth Transformer® (Imbident, Spain) and the Smart Dentin Grinder® (KometaBio, United States). These devices produce an easy-to-use and cost-effective autogenous graft from extracted teeth. They promote bone regeneration, osteoinduction, and osteoconduction due to the presence of morphogenetic proteins and growth factors in dentin.

These devices sterilize, demineralize, and fragment the tooth into granules of an appropriate size (400–800 µm). Tooth fragments are placed in a grinder equipped with special blades that process the tooth. The container is made

of thermoplastic material, while the blades are composed of surgical stainless steel. Different solutions are applied to demineralize the particles, disinfect, and rinse the final product. A basket is used to collect the granules at the end of the procedure.

The material obtained with these devices can be used for alveolar ridge preservation techniques. When used in combination with implant placement, a healing period of approximately four months is required.⁷

For a successful application, case selection is essential. The patient must present a third molar or another tooth scheduled for extraction. Teeth with previous endodontic treatment or extensive restorations are excluded. All soft tissues adhering to the tooth are removed, and a fissure bur is used to divide the tooth into fragments of approximately 4–5 mm, which are then air-dried. The fragments are placed in the grinder (Figure 1) and inserted into the Tooth Transformer.

The disposable component kit comprises a tray and a cartridge containing the solutions used to clean and disinfect the tooth. The tray and liquid cartridge are inserted with the perforable side facing upward, and the perforations are made with a punch. After approximately five minutes, the grinding process is complete, and the device can be opened to check the granule size, which should range from 0.40 to 0.80 mm.

The disinfection process lasts 20–30 min, after which the graft material can be collected from the tray and placed into the socket with minimal compaction to allow blood vessel ingrowth (Figure 2).

4. Uses of autogenous dentin

Autogenous dentin is primarily used to preserve alveolar bone after tooth extraction. This is particularly important to prevent bone loss and allow future implant placement. In third molar extractions, it helps prevent the formation of a distal bone defect at the second molar. Autogenous dentin is also used to augment bone before or during implant placement and in maxillary sinus elevation procedures.^{8–11}

5. Disadvantages of autogenous dentin

When a graft is required for implant surgery, autogenous dentin can only be used if the patient requires the extraction of one or more teeth or has an impacted third molar that must be removed. In large defects or maxillary sinus elevation procedures, the amount of available dentin may be insufficient.

If the technique is not well standardized, surgical time may increase, as the tooth must be prepared, including cleaning, cutting, and sterilization. A learning curve is



Figure 1. Dental fragments in the grinder



Figure 2. Graft material

required to ensure that the procedure does not become excessively prolonged.

The graft may undergo long-term resorption; however, better results have been reported when autogenous dentin was combined with platelet-rich fibrin and collagen membranes.^{12,13}

There are still insufficient long-term studies to determine the survival of implants placed using autogenous dentin as a graft material.¹⁴ However, greater alveolar ridge augmentation has been achieved when autogenous dentin was used for socket preservation.¹⁵

6. Discussion

The structure of teeth closely resembles that of bone, both physically and biochemically, and can be used efficiently as a graft material due to its osteoinductive and osteoconductive properties. Autogenous tooth-derived bone grafts are mainly used in sinus and ridge augmentation procedures and for socket preservation before implant placement.⁵

Systematic reviews by Gual-Vaqués *et al.*⁶ and Ramanauskaite *et al.*¹⁶ have highlighted the formation of new bone when autogenous dentin was used. According to Inchingolo *et al.*⁸, histological analysis showed new bone

formation ranging from 42% to 56% within 4–6 months after grafting, with favorable vascularization and biological integration.

Minetti *et al.*⁹ studied bone formation with and without a collagen membrane. Their results demonstrated significant new bone formation in close contact with dentin particles, confirming the osteoconductive behavior of the material. The use of a collagen membrane enhanced graft stability and limited soft tissue invasion, although bone regeneration was also observed without membrane application. These findings reinforce the role of autogenous dentin as a reliable alternative to conventional bone substitutes for ridge augmentation procedures before implant placement. Similarly, Sun *et al.*¹⁰ reported that dentin exhibits osteoconductive and, in some cases, osteoinductive properties due to the release of growth factors and bone morphogenetic proteins during dentin demineralization.

The use of autogenous dentin reduces the periodontal defect that typically remains distal to the second molar after surgical extraction of the lower third molar.^{17,18} This technique is increasingly applied in implant dentistry, where bone availability is often limited, such as in the maxillary sinus area.¹⁹ It is also used for alveolar ridge preservation, maintaining the vertical and horizontal dimensions of the post-extraction socket.²⁰

7. Conclusion

Autogenous dentin is an excellent material for alveolar ridge preservation, as it is obtained directly from the patient. Unlike autogenous bone, it is more readily available and does not involve donor-site morbidity. However, further studies are required to better understand the long-term outcomes associated with this biomaterial.

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Conflict of interest

The authors declare that there are no conflicts of interest.

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Ethics approval and consent to participate

Not applicable.

Consent for publication

The patients provided informed consent for the use of their images in this publication.

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