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Regeneration of Intrabony Defects Using Autogenous Dentin Graft - A Case Report

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Abstract

Periodontitis is an inflammatory disease of supporting tissues of the teeth caused by specific microorganisms, or group of specific microorganisms, resulting in progressive destruction of the periodontal ligament and alveolar bone with pocket formation, recession or both.[1] The combination of various regenerative biologic agents and techniques has recently attracted the interest of researchers in the field of reconstructive periodontal surgical therapy. [2]

A 45-year-old patient presented with a probing pocket depth of 7 mm and 8 mm mesial and distal to the right mandibular 2nd premolar respectively. The radiograph revealed an intrabony defect depth of 6.32 mm and 6.57 mm on mesial and distal aspect of the the tooth respectively. The defect was treated by open flap debridement and grafting with autogenous dentin graft along with chorion as a barrier membrane. On 6 months follow-up favourable results were seen.

Keywords: Autogenous dentin graft, Chorion membrane, Intrabony defects.

Introduction

The most common form of regenerative periodontal therapy in practice is the use of bone grafts. Bone grafting materials function as structural scaffolds and matrices for attachment and proliferation of anchorage-dependent osteoblast.[3] Intrabony defects have been treated by many techniques for regeneration of bone for better prognosis. One of the oldest biomaterials used for scaffolds is the fetal membrane. The fetal membrane was first used for the transplantation of skin in 1910. It is useful in the management of burns, creation of surgical dressings, as well as reconstruction of oral cavity, bladder and vagina tympanoplasty and arthroplasty.[4]

It has gained importance because of its ability to reduce scarring and inflammation,enhance wound healing, and serve as a scaffold for cell proliferation and differentiation as a result of its antimicrobial properties. In addition, the chorionic membrane (CM) a fetal membrane is a biomaterial that can be easily obtained, processed and transported.[5]

It has been stated that teeth can be used as graft material that is gradually replaced by bone. Autogenous mineralized dentin grafted immediately after extraction is considered as a gold standard for socket preservation, bone augmentation in sinuses & bone defects.[6]

Case Report

A 45-year-old male patient reported with a chief complaint of food impaction in the right lower back tooth region. On clinical examination, there was a periodontal pocket of 8 mm on the distal aspect and 7 mm on mesial aspect of 45. Radiographic examination revealed an intrabony defect mesial and distal to 45. Informed consent for the surgical procedure was obtained from the patient. The treatment plan comprised of phase 1 therapy followed by surgical therapy after 4 weeks comprising of open flap debridement and grafting with autogenous dentin graft and chorion membrane was performed. As 48 was impacted this tooth has been used to prepare autogenous dentin graft using smart dentin grinder. (SDG) (Figure.1)

Figure.1 Smart dentin grinder

The clinical parameters like gingival index (Loe and Silness, 1963) were recorded at baseline, 3 and 6 months while the probing depth, CAL were recorded to the nearest millimeter with a University of North Carolina (UNC)-15 probe at baseline, 3 and 6 months. All the radiographs were analysed using a metal ball, standardized by using long cone paralleling technique and film holders (RINN XCPTM, DENTSPLY). RVG was used to obtain digital radiographs. Intra bony defect (IBD) depth on the radiograph was obtained by measuring the vertical distance from cemento enamel junction of the tooth to the base of the defect by using special software [University of Texas Health Science Centre at San Antonio (UTHSCSA) Image Tool (Figure.2). The IBD depth was evaluated at baseline, 3 months and 6 months.

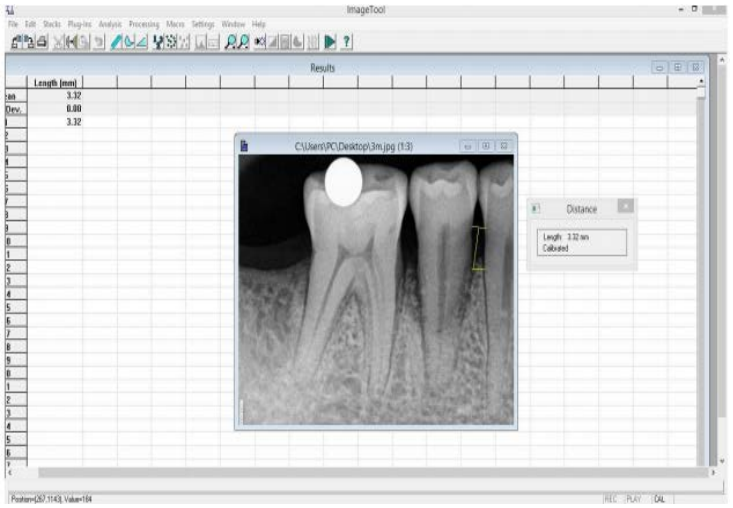

Figure.2: University of Texas Health Science Centre at San Antonio (UTHSCSA) Image Tool

After anesthetizing the area with 2% lignocaine with adrenaline (1: 80000) solution 48 was extracted and used to obtain autogenous dentin graft by using SDG as per the manufacturer's instructions. Chair side autogenous dentin graft was obtained within 15 – 20 min from the time of extraction. A sulcular incision was given using BP blade no.15 (Figure. 3) and a full thickness mucoperiosteal flap was elevated (Kirkland Flap)(Figure.4)

Figure.3 Sulcular incision

Figure.4 Flap reflection

Thorough debridement was performed using area-specific curettes (Hu-Friedy, USA) and the anatomy of the intrabony defect was clinically confirmed and the defect was filled with autogenous dentin graft (Figure.5) with chorion membrane (Figure.6)

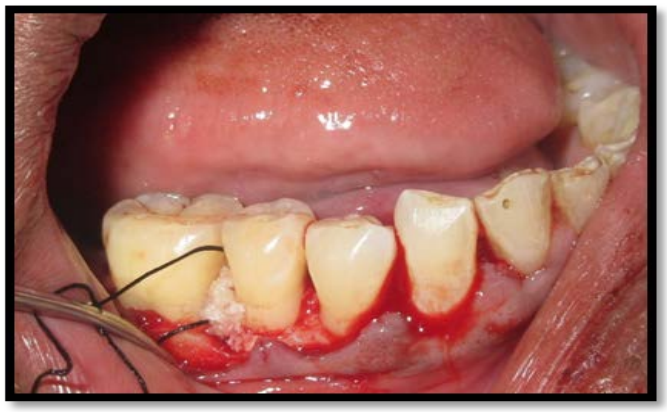

Figure.5 Autogenous dentin graft placed

Figure.6 Chorion membrane placed

The buccal and lingual flaps were approximated using a 3-0 non absorbable silk suture(Fig. 7) and periodontal dressing was given.

Figure.7 Sutures placed

All patients received systemic antibiotic therapy (Cap. Amoxicillin 500 mg thrice daily, Cap. Metrogyl 400 mg thrice daily) for 5 days and analgesics (Tab. Voveran 50 mg twice daily) for 3 days to prevent post-operative pain and edema. Post operative instructions were given to the patient. 0.2% chlorhexidine mouth rinse was advised twice daily. Healing of soft tissues was visualized and patient was asked for any symptoms regarding discomfort, pain and swelling. The patient was recalled after 1 week for suture removal.

At baseline, gingival index score was 1.9, 3 months postsurgery, the gingival index score reduced to 1.2 and 1 at the end of 6 months . A good oral hygiene was maintained throughout the follow-up period. The probing pocket depth reduced from 8 mm and 7 mm at baseline to 3 mm and 2 mm on distal and mesial side of 45 respectively at 6 months. The intrabony defect depth has reduced from 6.32 and 6.57 to 1.36 and 1.43 mm on mesial and distal side of 45 respectively at 6 months. (Figure .8, 9, 10)

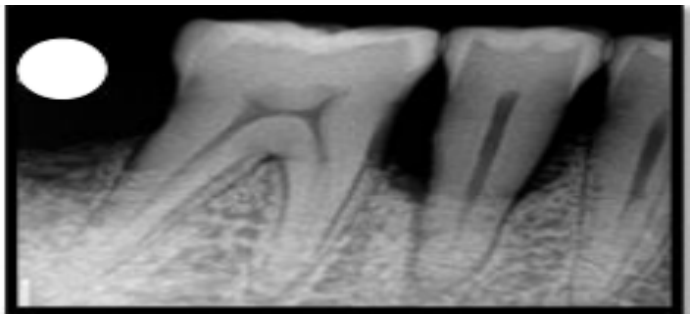

Figure .8 Radiovisiography at baseline

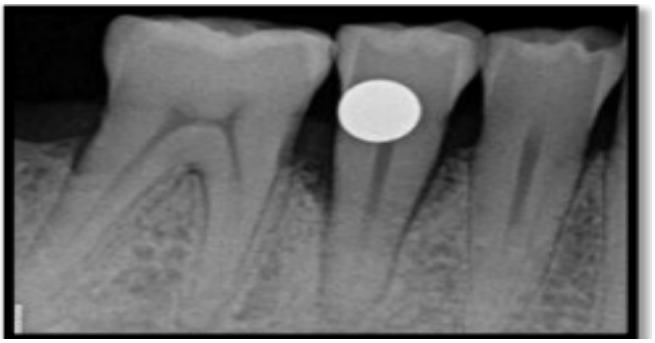

Figure.9 Radiovisiography at 3 months

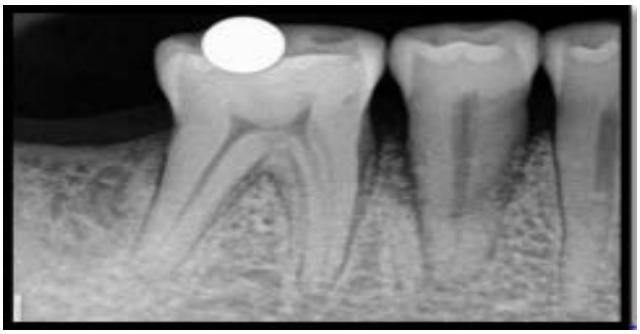

Figure.10 Radiovisiography at 6 months

Discussion

This case report evaluated the efficacy of autogenous dentin graft with chorion as a barrier membrane in treatment of of an intra-osseous defect. At baseline, the defect depth was 6.32mm and 6.57 mm on mesial and distal aspect of 45. The radiographic defect fill was approximately 5mm at 6 months in both the sites

Conventional surgical approaches, such as open flap debridement (OFD), improve periodontal clinical parameters primarily by formation of a long junctional epithelium.[7,8] Whereas regenerative therapy allows reconstitution of component tissues and function through regeneration of the attachment apparatus, namely formation of new bone, cementum, and periodontal ligament (PDL) on a previously diseased root surface.[9]The placental allografts possess antibacterial and antimicrobial properties being tissues with immunoprivilege and are thus quite different from cadaveric allograft, xenograft, and alloplast barrier membranes used in periodontal therapy. They reduce inflammation and provide a matrix highly rich in protein and there by facilitate migration of cells at the area of defect .[10]

A study done by Kher et al.[11] included sixteen systemically healthy patients with 20 periodontal infrabony defects. Each patient had at least ≥5 mm clinical probing pocket depth (PPD), depth of intrabony component ≥3 mm .Baseline measurements included plaque index, papillary bleeding index, PPD, gingival recession, clinical attachment level and radiographic defect depth (DD). Test group was treated with collagen membrane plus DFDBA and the control group with a bioresorbable collagen membrane only. The test group showed better results in the treatment of infrabony defects characterized by unfavorable architecture. Similar to this our case report showed a gain in PPD and IBD.

Autogenous tooth bone graft material (AutoBT) was first developed in 2008 and has been used mainly for guided bone regeneration to supplement dental implants.[12] Normally all extracted teeth are being considered as clinical waste and are being simply discarded. Recently, bone graft materials using permanent teeth have come into light, and clinical and histological outcomes of this material have been confirmed in dental procedures by various studies.[13,14]

The tooth is increasingly attracting the attention as a material for alveolar bone regeneration. It is composed of an organic matrix and an inorganic reinforcing phase of hydroxyapatite. Radial arrays of dense type I collagen fibrils, which account for 90% of the organic matrix, and non collagenous acidic proteins play an important role in the process of calcification.[15] Materials based on collagen, particularly type I collagen, have attracted attention because of their ability to improve the cellular responses of osteogenic lineages, thus ensuring better bone regeneration.[16]

It can be stated that dentin has 65% inorganic and 35% organic substances similar to that of alveolar bone. Tooth contains inorganic components of calcium phosphate lineage and organic components such as collagen. Tooth minerals consist of five biological calcium phosphates: hydroxyapatite, tricalcium phosphate (TCP), octacalcium phosphate (OCP), amorphous calcium phosphate (ACP), and dicalcium phosphate dehydrate. Interacting reciprocally, these calcium phosphates are capable of remodeling the existing bone when grafted. Dentin and cementum contain various other growth factors besides Bone Morphogenic Proteins (BMPs) such as insulin-like growth factor (IGF), plateletderived growth factor (PDGF), fibroblast growth factor (FGF) and transforming growth factor (TGF)-β. [17]

Organic parts of dentin include type I collagens and various growth factors such as bone morphogenic proteins (BMPs). Type I collagen occupies about 90% of the organic parts of tissues, with the rest non-collagenous proteins (NCP), biopolymers, lipid, citrate, lactate, etc. NCPs include phosphophoryn, sialoprotein, glycoprotein, proteoglycan, osteopontin (OPN), osteocalcin, dentin matrix protein-1, osterix, and Cbfa1 (Runx2), Dentin sialoprotien (DSP). These proteins are known to trigger the bone resorption and generation processes.[18] Phosphophoryn in particular, bound to type I collagen, contributes to the mineralization process; it is of the largest amounts among NCPs. Previous studies discovered through the immunohistochemical study that OPN and DSP manifested 6-8 weeks after grafting the tooth graft material on alveolar bone defects in Wistar rats.[12] OPN is known to trigger osteogenesis through the early differentiation of the osteoblasts but also leads to bone resorption by allowing adherence of osteoclasts to the bone surface. DSP has a significant role in dentin calcification. [19]

Based on the potentials of osteoconduction, osteoinduction and osteogenesis through growth factors in tooth and similar histogenesis between tooth and bone, a novel bone graft material has been developed utilizing the inorganic and organic components of an extracted tooth. Tooth dentin depending on its demineralisation has been categorized into three groups as undemineralized dentin (UDD),partially demineralized dentin matrix (PDDM) and demineralized dentin matrix (DDM). [20]

]Kim et al.[21,22] has achieved bone regeneration using mineralized as well as demineralised dentin in implant therapy . Tooth demineralisation takes longer time.[23,24] When it is exposed to acid in the process ofdemineralisation it has been seen that demineralisation process affects the non collagenous proteins in the dentin.[25]

Thus in the present case ADG obtained from SDG was not demineralised, not subjected to any acid treatment and was immediately used in defects without delaying the time and interfering with the action of NCP's.

A study [20] concluded that mixture of particles with variable sizes may have better results when compared with even particle sizes. Hence 300-1200 µm was used in the present case. The scanning electron microscopy (SEM) picture in a recent article showed wide open and clean tubules after 10minutes of cleanser treatment with SDG procedure and it was bacteria-free particulate dentin.

Gao et al.[26] reported that enamel has growth factors such as insulin like growth factor (IGF) II, BMP2, and transforming growth factor (TGF) beta like bone. According to Saygin et al. [27] cementum and its mother cell have TGF beta, IGFI, and platelet derived growth factor. In other words, the enamel and cementum of tooth have many growth factors that help bone formation.

Conclusion

Within the limits of this study, it can be concluded that the use ADG with chorion membrane had shown improvements in clinical as well as radiographic parameters. These results present a valid promise for further long term studies to evaluate the attainable effects of autogenous dentin graft as a regenerative material for the treatment of periodontal osseous defects.

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