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Management of grade II furcation defect using bone graft and PRF- A case report

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Abstract

Furcation defects are critical sites for regeneration in periodontitis patients due of their complicated structure. For the treatment of furcation, various current surgical procedures and the use of biomaterials have been proposed in the literature. PRF has been shown to be useful in a variety of regenerative soft tissue and bone procedures, including facial plastic surgery and as an osteoconductive filling substance in sinus lift procedures, as well as periodontal tissue regeneration in intrabony defect (IBD) treatment and mandibular degree II furcation defect resolution. There have been studies that evaluated the effect of OCP coating on titanium alloy (Ti6Al4V) implants or bone regeneration on synthetic OCP in order to apply these advantages of OCP to medical devices, but most of them were basic experimental studies on OCP materials, and research compared with dental bone graft materials is insufficient. As a result, Ti-oss®, a DBBM surface-treated with newly developed OCP with platelet rich fibrin, was used in this case report to evaluate its efficacy in curing furcation defects. This case report suggests that the combined treatment approach with PRF and tioss was effective in treating the furcation defect.

Keywords: Furcation, Platelet Rich Fibrin, Bone Graft

Introduction

Periodontal treatment's major goal is to prevent periodontal disease progression while also regenerating lost periodontal tissue. Furcation defects are critical sites for regeneration in periodontitis patients due of their complicated structure. For the treatment of furcation, various current surgical procedures and the use of biomaterials have been proposed in the literature. [1,2] The degree of furcation involvement is a major risk factor for tooth loss. These areas may be surgically treated using a range of reconstructive periodontal surgery procedures and materials. Guided tissue regeneration (GTR) refers to methods that try to repair damaged periodontal tissues by using barrier materials to promote bone regrowth and new connective tissue attachment.In this sense, the most commonly used materials are bone substitutes (autologous, allogenic, xenogenic, or synthetic by origin) alone or in combination with membranes (either resorbable or non-resorbable). Xenografts are regenerative and can be used as a biocompatible grafting material. The use of these materials in periodontal regeneration is common and well described in the literature. Since then, several membranes have been added to give space between the defect and the root surface, guide cell growth, and allow periodontal ligament cells, osteoblasts, and pericytes to repopulate the generated gap. However, the use of membranes necessitates extra considerations such as a more intrusive flap, subsequent surgery to remove the membrane (in the case of non-resorbable membranes), and the possibility of membrane exposure, which may jeopardise the results. Given these concerns, the actual inclination is to prefer minimally invasive surgical techniques and to explore for alternatives. Even while these regenerative materials are still employed today, the introduction of biomimetic agents such as enamel matrix derivatives, bone morphogenetic proteins, and platelet concentrates opens up new avenues for better periodontal therapy outcomes. PRF has been shown to be useful in a variety of regenerative soft tissue and bone procedures, including facial plastic surgery and as an osteoconductive filling substance in sinus lift procedures, as well as periodontal tissue regeneration in intrabony defect (IBD) treatment and mandibular degree II furcation defect resolution. Various treatments have been utilised to treat furcation deficiencies, including bovine-derived xenografts, demineralized freeze-dried bone allografts, autografts, barrier membranes, and membranes and bone grafts in combination. Aside from the regeneration modalities that are still in use today, biomimetic drugs such as bone morphogenetic proteins and platelet-derived growth factors enamel matrix derivatives, and platelet rich plasma have given better results in furcation resolution PRF has been shown to be useful in a variety of regenerative soft tissue and bone procedures, including facial plastic surgery and as an osteoconductive filling substance in sinus lift procedures, as well as periodontal tissue regeneration in intrabony defect (IBD) treatment and mandibular degree II furcation defect resolution. Choukroun et al. created platelet-rich fibrin (PRF), a second generation platelet concentrate commonly utilised to promote soft and hard tissue healing[3.] Although PRF has been employed in a variety of techniques, including ridge augmentation, bone transplant and Guided Tissue Regeneration Membrane are the most commonly used to treat the furcation defect. However, relatively few studies have been undertaken to assess the effectiveness of PRF in the therapy of furcation problems. Among biodegradable materials, OCP has gained popularity as a material that can supplement the properties of traditional bone graft materials. OCP is made up of biological apatite crystals similar to those found in bones and teeth, and it has a physical property that can be transformed into HA by dissolving in ionic and pH concentrations similar to those found in human plasma. These properties encourage osteoblast differentiation and the production of new bone. Previous research found that OCP coating and OCP-based materials selectively adsorb serum components to OCP at the start of transplanting in the rat calvarial defect model, and that its bone formation ability is comparable to autogenous bone due to its strong bone conductivity. There have been studies that evaluated the effect of OCP coating on titanium alloy (Ti6Al4V) implants or bone regeneration on synthetic OCP in order to apply these advantages of OCP to medical devices, but most of them were basic experimental studies on OCP materials, and research compared with dental bone graft materials is insufficient. As a result, Ti-oss®, a DBBM surface-treated with newly developed OCP with platelet rich fibrin, was used in this case report to evaluate its efficacy in curing furcation defects.[4,5,6,7,8,9.]

Case Presentation

A 56- year-old female reported to the department of periodontics with chief complaint of pain and swelling associated with pus discharge in the lower right back tooth region of her mouth since 3 weeks. Patient was healthy with no relevant medical history.History of presenting illness confirmed incessant and throbbing pain in said region that occasionally got worsened during mastication and sleep. On clinical examination revealed grossly decayed tooth with periodontal abscess.(figure 1)Probing pocket depth was 8mm and grade 2 furcation involvement. however, vitality testing of 46 yielded no response.In radiographic examination, intraoral peri apical radiographs confirmed Class II furcation involvement with the evident vertical bone loss.(figure 2)Based on the clinical assessment and investigations, a systematic treatment planning was framed to achieve total rehabilitation step-by-step. Abscess drainage was done and prescribed antibiotics for the patient scaling root planning done followed by maintenance therapy.After that patient referred to department of endodontics for the management of carious lesion.Root canal treatment in rt 46 was done and patient referred back to the department of periodontics.

Surgical Treatment

Four to six weeks after scaling and root planing and just prior to the surgical procedure, each subject was re-examined and baseline data were recorded. After local anesthesia (2% lignocaine, 1:200000), a sulcular incision was given on the buccal and lingual aspect of one tooth distal and mesial to the involved tooth. Full thickness mucoperiosteal flap was then elevated by blunt dissection using a periosteal elevator.The granulation tissue was removed in the furcation defect and thorough debridement was carried out with curettes and an ultrasonic scaler, to ensure a clean site for incorporation of the bone graft material and membrane. The appropriate amount of the bone graft was taken in a container and transferred to a sterilized dappendish, to which a few drops of saline were added. The contents were then mixed with the blunt instrument and transferred to the defect with a plastic filling instrument and condensed. PRF membrane was placed to cover the site and the osseous graft.(figure 3)

Result

The post-operative follow-up revealed normal healing. Patients were recalled for routine periodontal maintenance therapy and reported no symptoms and easy access of cleaning. Periodontal examination and radiographs were taken at one month and 6-months after surgery.(figure 4a,4b)These examinations revealed significant improvement of periodontal probing depth, clinical attachment loss, and FI defects. Compared to the pre-surgical examination, radiographic changes were observed with evident gain of bone height, and the furcation areas were filled with bone showing lamina dura lining the intra-radicular areas.

Discussion

In this case, we showed significant closure of the furcation defects, reduction in PD, and gain in clinical attachment at the 6 month postoperative follow-up. Radiographically, fill of the bony defects increased in bone intensity, and continuous interradicular lamina dura lining the root furca, were observed. These changes might have been a result of true periodontal regeneration by means of new attachment, or a long junctional epithelium between the newly regenerated tissues and the root surface. These results are consistent with other clinical and radiological findings using PRF in the treatment of a mandibular grade II furcation in the study done by Min-Hua Shen et al in 2008[10].

PRF is made up of a fibrin matrix that contains concentrated leukocytes, platelets, and circulating stem cells. They produce and gradually release a variety of growth factors, including TGF-1 (transforming growth factor-1), PDGF-BB (platelet-derived growth factor-BB), VEGF (vascular endothelial growth factor), and thrombospondin-1, among others. 6 These factors can accelerate wound healing and periodontal regeneration by promoting cell migration, osteogenic differentiation, and angiogenesis. 8 PRF has been shown to be a successful treatment technique in the regenerative repair of intrabony defects in patients with chronic periodontitis. Furthermore, the PRF membrane formed a natural barrier to prevent epithelial cell downgrowth while not interfering with soft tissue repair for 1-2 weeks. 8 As a result, by properly utilising these PRF qualities, we may be able to accomplish improved tissue regeneration and wound healing. [11]

Xenografts are regenerative and can be used as a biocompatible grafting material. The use of these materials in periodontal regeneration is common and well described in the literature. The properties of calcium phosphate ceramic materials may alter the process of bone development in the case of xenograft materials such as Ti-oss® and graft materials mixed with calcium phosphate ceramic materials such as synthetic HA or-tricalcium phosphate (β -TCP). The synthetic HA is a generally chemically stable material that dissolves and remains in the bone defect location for an extended period of time. β -TCP, on the other hand, generates an osteoclastic cellular phagocytotic response after chemical breakdown due to its ability to dissolve at physiological pH when grafted on bone. Biodegradation happens chemically or by osteoclasts under these physiological conditions, and fresh space is produced. This area serves as a scaffold for the formation of osteoblast colonies, which is ultimately advantageous for bone regeneration. [12] β -TCP has been shown to induce the expression of α2 integrin subunit genes as well as the activation of the mitogen-activated protein kinase (MAPK)/extracellular related kinase (ERK) signalling pathway[13].

The OCP coating on the Ti-oss® surface is thought to represent a forerunner of biological apatite crystals of dentin, enamel, and bone. [14] In addition of chemical degradation, osteoclast-like cells biodegrade in the physiological environment. Many research that have performed X-ray diffraction analysis on the OCP grafted on bone and subcutaneous tissue have found that the OCP eventually converts into the hydroxyapatite phase..

In the physiological environment, the OCP crystal consumes calcium ions while simultaneously releasing inorganic phosphate ions, and it is known that fluoride ions induce hydrolysis even in very minute levels in physiological fluids]. OCP and OCP hydrolysate aid in the adsorption of circulating serum proteins such as a2HS-glycoproteins in a physiological environment. Protein adsorption in bone metabolism, in particular apoprotein, is known to enhance bone regeneration [15]

It has been determined whether the addition of material to the PRF is connected with improved VCAL findings.

Several investigations have demonstrated an overall improvement in most clinical indicators, which is attributed to a synergistic effect of the BG material and the extra PRF. However, depending on the substance utilised, the outcomes may vary. [16,17]

The major goal of treating furcation abnormalities is to avoid additional loss of periodontal tissue while also allowing the patient to successfully maintain the region, which is best accomplished by regeneration of lost tissue. At the 6-month postoperative follow-up, we observed substantial closure of the furcation defect in this case report. Radiographically, there was enhanced bone intensity in the fill of the bony defects, as well as continuous interradicular lamina dura lining the root furca. These modifications could be the consequence of real periodontal regeneration via new attachment, or of a lengthy junctional epithelium between newly regenerated tissues and the root surface.

Conclusion

This case report suggests that the combined treatment approach with PRF and tioss was effective in treating the furcation defect.

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Legend Figures

Figure 1 -Pre-operative intraoral photograph, buccal view of furcation defect showing deep pocket and grade II furcation involvement

Figure 2 -Pre-operative periapical photograph

Figure 3: Surgical Phase

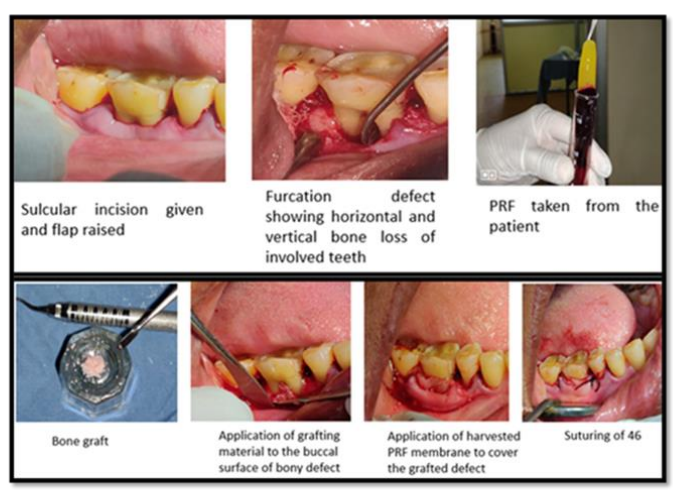

Figure 4: Periapical radiograph showing the status of bone defects [a]1 month [b]and 6-month post-operatively