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OSTEOPROMOTIVE AND OSTEOINDUCTIVE BONE GRAFT USING MODIFIED MINIMAL INVASIVE SURGERY

Periodontology

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ABSTRACT

Bone regeneration is a well orchestrated physiological process of bone formation which mimics the normal cascade of bone formation following fracture, involving the continuous bone remodelling throughout adult life. Currently, there is a surfeit availability of bone regeneration materials to augment the impaired or the insufficient bone by the use of autogenous, autologous, xenografts, alloplastic, osteoprogenitor cells and distraction osteogenesis. Improved bone regeneration therapies are in advent like gene therapy, tissue engineering and the systemic enhancement of bone repair. The periodontal regeneration associated with minimal invasive therapy preserves the dentition and supporting structures with minimal soft tissue trauma and the removal of granulation tissue from periodontal defects using a much smaller surgical incision than that used in standard bone graft techniques. The potential efficacy of Platelet rich fibrin (PRF), Decalcified freeze dried bone allograft (DFDBA) along with Modified Minimal invasive periodontal surgery (MIPS) has proved to be beneficial in bone regeneration.

KEYWORDS:

Bone graft, osteopromotive, osteoconductive, periodontal regeneration, biomimetic, minimal invasive surgery

Introduction:

Bone replacement grafts are used to promote bone formation and periodontal regeneration. Bone grafting materials function, in part, as structural scaffolds and matrices for attachment and proliferation of anchorage-dependent osteoblasts. A wide range of bone grafting materials, including bone grafts and bone graft substitutes, have been applied and evaluated clinically, including autografts, allografts, xenografts, and alloplasts . Osteoblasts are anchorage-dependent cells that are highly responsive to the surface characteristics of osteoconductive scaffolds. Efforts to enhance the effectiveness of graft materials have focused on the use of biomimetic engineering and biologic agents. The potential of biologic mediators is to improve wound healing and enhance the clinical benefits of bone replacement grafts.2 Platelet rich fibrin (PRF), collected by centrifugation of autogenous serum, provides a source of highly concentrated platelets, which produce growth factors that are critical for normal healing.3 PRF, a osteopromotive material when admixed with a bone graft, facilitates graft placement and containment. PRF has been shown to provide beneficial effects, as reflected in gains in clinical attachment level, when used as an adjunct to periodontal regenerative therapy.[1] Conventional surgical approaches, such as open flap debridement, provide critical access to evaluate and detoxify root surfaces as well as establish improved periodontal form and architecture; however, these surgical techniques offer only limited potential in restoring or reconstituting component periodontal tissues.[1] With the advent of various surgical techniques, recent trends in dentistry promote the use of modified minimally invasive procedure. The modified minimally invasive surgery (M-MIST) is a variant to minimal invasive surgical technique (MIST). It was described by Cortellini et al 2009. In M-MIST the incisions are made in the sulcus around the facial surfaces only and the lingual side of the papilla remains intact. The granulation tissue is dissected from the defect using a blade and a curette. This technique also incorporates the concept of space provision for regeneration. The present case response to the use of modified minimally invasive surgery along with platelet rich fibrin and bone graft (DFDBA) in treatment of intrabony defect.

Case Report

A 23-year old female patient with a chief complaint of dull radiating pain and tooth mobility in the mandibular left anterior tooth region reported to the Outpatient Department of Periodontology and Oral Implantology, Himachal Dental College, Sundernagar, H.P. The medical history did not reveal any systemic condition and did not interfere with the normal physiologic healing. On clinical examination gingival inflammation and dull pain on percussion was observed on tooth 33. Periodontal examination revealed a periodontal pocket on mesio-buccal aspect of tooth 33, 10 mm as measured with UNC 15 probe. On radiographic examination vertical bone loss was observed mesial to tooth 33.

The initial phase of treatment comprised of complete oral hygiene and motivation of the patient to perform oral hygiene measures. This was followed by full mouth scaling with ultrasonic and manual instruments followed by root canal treatment. Trauma from occlusion was relieved. The patient was recalled and reevaluated four weeks after non surgical periodontal therapy. The patient was then scheduled for surgical therapy. The clinical parameters assessed before the surgical therapy at 3 weeks included Plaque index, Gingival index, Probing pocket depth, Clinical attachment level.

Platelet rich fibrin (PRF) preparation:

The PRF was prepared following the protocol developed by Choukroun et al. Just before surgery, intravenous blood (by venipuncturing of the antecubital vein) was collected in three 10-mL sterile tubes without anticoagulant and immediately centrifuged in a centrifugation machine at 3,000 revolutions (400 g) per minute for 10 minutes. Blood centrifugation immediately after collection allows the composition of a structured fibrin clot in the middle of the tube, just between the red corpuscles at the bottom and acellular plasma (platelet-poor plasma) at the top. PRF was easily separated from red corpuscles base (preserving a small red blood cell layer) using sterile tweezers and scissors just after removal of platelet-poor plasma and then transferred onto a sterile compress. A stable fibrin membrane was obtained by squeezing serum out of the PRF clot.

Surgical phase:

Facial skin all around the oral cavity was scrubbed with Povidine Iodine solution and the patient was made to rinse with 0.2% Chlorhexidine Digluconate mouthrinse for one minute prior to the surgery. The patient was anesthetized using 2% Lidocaine with Adrenaline concentration of 1:80000. Crevicular incision was given using Bard Parker no 15 blade on the buccal surface in the area of surgery involved leaving the opposite side intact. The full thickness mucoperiosteal flap was reflected using a periosteal elevator. The defect was thoroughly debrided and root surface was then planed and the flap trimmed to remove granulation tissue tags and minimize bleeding followed by irrigation.

After debridement of the defect Platelet Rich Fibrin (PRF) was mixed with Decalcified Freeze Dried Bone Allograft (DFDBA) homogenously in a sterile dappen dish. It was then then filled into the intrabony defect upto the level of the bony walls. The over or the underfilling of the graft material could hinder the flap closure, thereby hampering healing and loss of graft material. The mucoperiosteal flap was then replaced and wound closure was achieved using 4-0 resorbable sutures associated with placement of periodontal dressing. Following surgery the patient was asked not to chew from the surgical site during first postoperative day. The patient was recalled after 14 days for removal of periodontal dressing and suture. Systemic antibiotic amoxicillin 500 mg, thrice daily for 5 days and analgesic

ibuprofen 400 mg, thrice daily for 3 days. The patient was instructed to rinse 0.2% chlorhexidine mouth wash for 7 days. The patient was re-evaluated after 6 months.

Fig1. Pre-Op IOPAR

Fig2. Endodontically treated 33

Fig3. PRF prepared

Fig4. DFDBA

Fig5. Buccal Pedical Flap raised Fig6. Placement of PRF and DFDBA

Fig7. Suture placement Fig8. 6 monthly IOPAR

Results:

Healing after surgery was uneventful and the patient experienced no untoward reaction. At the initial 10 day postoperative visit, the surgical site exhibited excellent early soft tissue healing and minimal inflammation. At the end of 3 week postoperative visit, continued excellent healing was noted. At 6 months, PD and CAL measurements were retaken with the same UNC 15 probe. At six months, Probing depth improved by 6 mm (Pre-surgical PD: 9mm; Post surgical PD:3mm) and CAL improved by 5 mm. There was no bleeding on probing and the site no longer caused pain or sensitivity to the patient. Intraoral periapical radiograph with long cone paralleling technique revealed bone fill of intrabony defect at 6 months.

Discussion:

A modified minimally invasive procedure, the single-flap approach (SFA), specifically indicated when the defect extension is prevalent on the buccal or oral side. The basic principle of the SFA is the elevation of a flap to access the defect only on one side (buccal or oral), leaving the opposite side intact. This technique was developed to optimize primary closure as well as to minimize the surgical trauma in the reconstructive procedures of periodontal intraosseous defects.[5] The three major objectives of M-MIST: i). Minimize the interdental tissue tendency to collapse, ii). Enhance the wound/soft tissue stability, and iii). Reduce patient morbidity.

Periodontal regeneration aims to regenerate the supporting periodontal tissues by new attachment. The goal is to regenerate the lost periodontal support. The use of bone grafts and polypeptide growth factors are very beneficial in regenerating the periodontal structures.[6] PRF is a new generation platelet concentrate with ease of preparation and handling.[7] As the patient's blood is utilized, the risk of human-human disease transmission is virtually eliminated, making it safer treatment method.[8] The use of bone grafts for reconstructing osseous defects produced by periodontal disease dates back to **Hegedus in 1923** and was reviewed by **(Nabers & O' Leary in 1965)**.[9] It was also stated by **Creeper et al 2009**[10] that PRP stimulates osteoblasts that are critical for bone regeneration. The potential influence of the PRP might be masked from the significantly high additive effect of the other regenerative material like bioactive glass **(Camelo et al 1998)**[11]. The use of PRP in combination with biomaterial improve the surgical handling of biomaterial and widen their field of application in bone surgery **(Le Guennehec et al. 2004)**[12]. Bone regeneration was observed in accordance to the study by **Shukla 2011**.[13] Combination of minimal invasive surgical technique with second generation platelet fibrin and allograft has been beneficial in regeneration of bone in intrabony defect.

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