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Case Report

Treatment of periodontal osseous defect with bio-oss xenograft and biodegradable IGF fibers: A case report

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ABSTRACT

Introduction: Osseous defect caused due to periodontitis needed to be repaired or regenerated to avoid tooth loss. Bio-oss is made up of 10% porcine collagen and can induce osteoblastic differentiation due to its volumetric stability and out standing osteoconductive properties. Application of growth factors in regenerative procedures have helped to maintain the scaffold and induce several cellular processes. The biodegradable fibers incorporated with IGF growth factor has strong effect on PDL fibroblasts, mitogenesis, and protein synthesis which promotes osteogenesis and cementogenesis.

Case Report: A patient having grade II furcation and intrabony defect was treated and evaluated after 12 months with biodegradable fibers infused with insulin like growth factor and bio oss xeno graft irt 36. Treated site responded well to the use of the bovine bone mineral with good tissue response and an improvement and there was an overall mean probing pocket reduction in the deepest site of osseous defects. The clinical parameters assessed are plaque index, bleeding on brobing, pocket probing depth, clinical attachment level, glickman's furcation index and RVG at baseline, 6 and 12 months post operatively. Both the bone grafts resulted in better regeneration when compared to base line and 12 months.

Conclusion: Bio oss (bovine bone mineral) and biodegradable fibres infused with insulin like growth factor materials are of considerable promise for regeneration with better clinical and radiographic outcomes.

1. Introduction

Periodontitis, a chronic inflammatory disease of the periodontium results in progressive loss of connective tissue attachment and supporting alveolar bone due to inflammatory cell infiltrate and microbial influx. The reducing bone height not only alters the morphologic features of bone leading to an array of osseous defects or deformities, but also leads to masticatory dysfunction. These periodontal osseous defects need to be treated since the contour and behavior of gingiva is conditioned by the architecture of the underlying supporting alveolar bone. These deformities of the alveolar bone unless corrected may interfere with the eradication of the pockets and make the maintenance difficult, thereby leading to recurrence of the diseases.[1,2]

The current goal of periodontal therapy is the reconstruction of the bone and periodontal ligamentous attachment that have been destroyed by the disease. Several studies have shown that conventional periodontal therapeutic procedures do not result in regeneration of the supporting tissues, to a predictable degree.[1]

Advancements in periodontal regenerative therapies have encouraged clinicians to seek the therapeutic goal of achieving periodontal regeneration that aims reconstruction of the tooth supporting structures which has been lost due to periodontal disease. Over the years, numerous strategies have been implemented to surgically reconstruct intra-bony

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periodontal defects. In recent years, emphasis on the use of growth factors for periodontal healing is gaining great momentum. In addition, recombinant growth factors have also been made available for use in tissue engineering as a result of recent developments in molecular biology.[3]

The bone substitute based upon the inorganic component of bone, a natural derived porous bone mineral of bovine origin called Bio-Oss^{TM}. This material is manufactured in Wolhusen and marketed by Geistlich Biomaterials, a Swiss company, which has been widely used in periodontics and oral and maxillofacial surgery as a grafting material. It is a promisable bone graft as it is biocompatible and supports bone formation. The morphology, porosity, internal surface, crystalline structure, and chemical composition of this bone graft are reported to be similar to that of human bone. In experimental studies, Bio-Oss^{TM} was found to resorb slowly and integrate in natural remodeling process.[4]

Growth factors have a positive impact on periodontal regeneration and they include Platelet Derived Growth Factor; Insulin (PDGF) Insulin like growth factor-1 (IGF-1); Fibroblast growth factor (FGF); Transforming growth factor-β; TGF-β. These growth factors, either alone or in combination have been tested for periodontal regeneration in various animal experiments. Insulin-like growth factor 1 (IGF-1) is a potent mitogenic protein which has enhanced capability of osteogenic differentiation of periodontal ligament (PDL) fibroblasts. However, it remains unclear whether IGF-1 can stimulate the osteogenic differentiation and osteogenesis of human periodontal ligament stem cells (PDLSCs).[5,6]

In vew of all the above factors the present study has been taken up with the following aims and objectives:

1. To evaluate biodegradable fibres infused with Insulin like growth factor and Bio-Oss^{TM} a bovine-derived xenograft in the repair of human osseous defects resulting from moderate to advanced periodontal disease.
2. To determine the amount of reduction from baseline osseous defect depth parameters and amount of bone fill subsequent to grafting.
3. To determine whether the use of this graft would improve the periodontal status of the involved teeth, such as reduction in probing pocket depths, gain in clinical attachment after twelve months.

2. Case Report

A 20 year old male patient came to the department of periodontics with the chief complaint of pain in his left lower back teeth region since 2 months. On clinical examination, there was severe plaque and calculus formation with periodontal pocket and clinical attachment loss of 12 mm in 36 tooth region (using UNC probe). Later patient was subjected to thorough supragingival and subgingival scaling, followed by scaling and root planning. Patient was recalled after 1 week for evaluation. RVG was taken at 36 region, which showed intrabony and furcation defect.

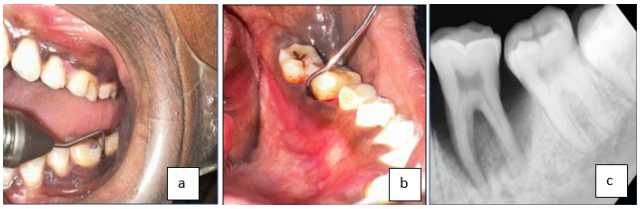

Figure 1: a: Pre-operative probing depth irt 36; **b:** Assessing furcation defect with Naber's probe irt 36; **c:** Baseline RVG irt 36

Patient is explained about the surgical procedure regarding its pros and cons and an informed consent was taken.

2.1. *Surgical procedure*

Before performing the surgery, blood investigations (clotting time, bleeding time, % of haemoglobin, random blood sugar level) were performed and all the values were within the physiological limits. After obtaining the proper local anesthesia on left side of oral cavity, proper bone sounding was performed using UNC 15 probe. Crevicular incisions were given from 35 tooth region to 38 tooth region. Muco periosteal flap was carefully reflected. Thorough debridement followed by saline betadine irrigation was done. Under proper isolation, Biodegradable IGF fibre was placed in intrabony defect while bio oss bone graft was placed at furcation defect site irt 36. 3' 0 black silk sutures were placed to cover the surgical site and periodontal pack is placed. Post operative instructions were given with Amoxixillin 500 mg thrice daily for 5 days, ketorolac twice daily for 5 days. Patient was recalled after 14 days for suture removal. Patient turned up at 6 months and twelve months after suture removal.

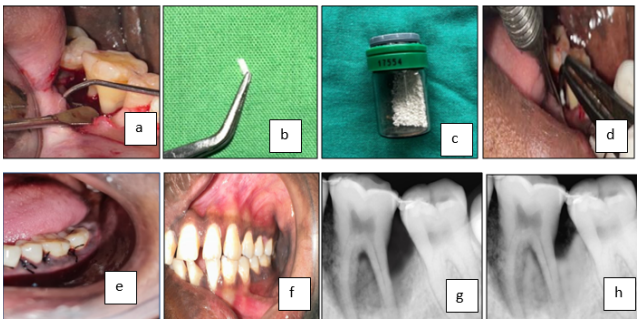

Figure 2: Surgical procedure: **a:** Flap elevation; **b:** Biodegradable IGF fibre; **c:** Bio oss bone graft; **d:** 3'0 black silk sutures placed; **f:** After suture removal; **g:** 3 months post-operative RVG; **h:** 12 months post-operative RVG.

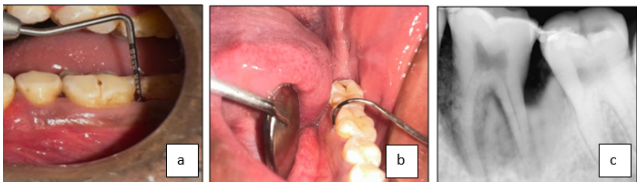

Figure 3: 12 months follow up; **a:** PPD reduced to 4mm with UNC probe; **b:** Furcation defect assessed with Naber's probe; **c:** 12 months post operative RVG irt 36.

3. Discussion

Present case report is a detailed description of surgical procedure used for treating osseous defect with biodegradable IGF fibres at intrabony defect and bio oss xeno graft at furcation of 36 tooth region. There are no complications in healing of surgical sites, no scar formation and pocket depth reduced to 4mm at 12 months follow up. There was no bleeding on probing and patient was fully satisfied with the treatment outcome.

Recently, through many studies, clinicians came to conclusion that, combination of transplanted biomaterials containing appropriately selected and primed cells, along with mix of growth factors, signaling molecules and ECM components, the growth and specialization of the host cells can be facilitated to achieve periodontal regeneration, a process termed as tissue engineering.[7]

The main goal of regenerative therapy is regeneration of periodontal hard and soft-tissues, including formation of a new attachment apparatus, which would result in the closure of the furcation.Regeneration with new attachment apparatus, cementum, connective tissue and bone in intrabony defects grafted with Colocast® has been reported previously.[3]

IGF I used in the present study is a polypeptide hormone with vital biological actions in alveolar bone. Osteoblasts are the primary cells of bone formation, which are important to replace old, damaged bone with new bone formation. When IGF receptors bind to the surface of osteoblasts, events of phosphorylation takes place in the extracellular matrix, the phosphorous or nitric oxide enters cytoplasm to translocate into nucleus of osteoblasts under IGF 1R tyrokinase enzyme. Here the nucleus of osteoblasts replicates as sequencing is replicated through transcription and eventually the cell differentiation and proliferation takes place to form new bone.[8]

Therefore, several biomaterials have been developed in an attempt to reduce the use of or even replace the autogenous bone graft in reconstructive surgeries. Among these, Bio-Oss—a deproteinized bovine bone—has been used in dentistry for bone augmentation procedures due to its osteoconductive properties.[9]

Bio oss used as barrier membrane and as a bone graft in intrabony defects led to new bone formation was more extensive to the bone wall on histologic examination. When autologous PDLSCs along with bio oss material is used, newly formed periodontal tissues, bone and cementum were observed on the denuded root surfaces of the furcation area.[10] Rh-IGF-I+rh-VEGF treated sites resulted in greater improvement in PPD reduction, CAL gain as well as in osseous fill with effective regeneration of lost periodontal structures.[11]

4. Conclusion

The management of class II furcation involvement and intrabony defects presents a unique clinical problem due to the complexity in anatomy at the furcation area. However, the results observed in the present case showed that the use of bio oss xenograft in grade II furcation defect and biodegradble IGF fibres have shown proper healing with better clinical and radiographic outcomes. Hence, both Bio-oss xenograft and biodegradable IGF fibers can be used to treat periodontal defects as they were proven to show regeneration of the periodontal tissues which is a dynamic process involving cell-to-cell and cell–extracellular matrix interactions involving several signalling pathways.

5. Source of Funding

None.

6. Conflict of Interest

None.

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