Optimizing implant placement with guided bone regeneration - A case report

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ABSTRACT

Guided bone regeneration (GBR) has made the placement of implants possible in sites that were not a part of the original implant protocol, expanding the treatment options to meet patients' esthetic and masticatory needs. In this report, implant placement with simultaneous guided bone regeneration was performed to manage the exposed implant threads. Consequently, stabilization of implant in the optimal position was feasible without any complications.

INTRODUCTION

Single-tooth replacement by means of an implant-supported restoration has become a viable and accepted treatment modality.1 Anterior sites are most likely linked to esthetic expectations and often present a considerable challenge to clinicians because various local risk factors have the potential to compromise the predictability of the results.2, 3

To attain success in use of osseointegrated implants for the treatment of complete and partial edentulism, a sufficient quantity of bone is needed. Unfavorable local conditions of the alveolar ridge, due to atrophy, periodontal disease, and trauma, may lead to insufficient bone volume, which may potentially compromise the long-term survival of implants, or render the implant placement incorrect from a functional and esthetic viewpoint.4

Guided bone regeneration has enabled the clinician to place implants in sites with insufficient bone with predictability in results when marginal dehiscences and/or buccolingual fenestrations are encountered.5, 6

This case report describes an esthetic placement of implant in maxillary left central incisor region in a two-stage protocol in conjunction with bone expan-

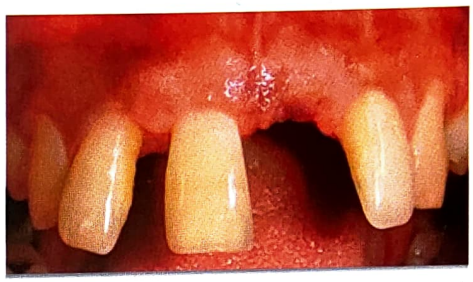
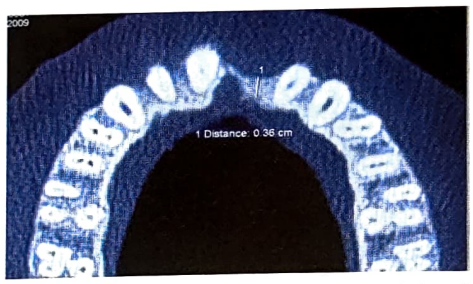


Fig 1 - Preoperative view. a) clinical, b) radiographic



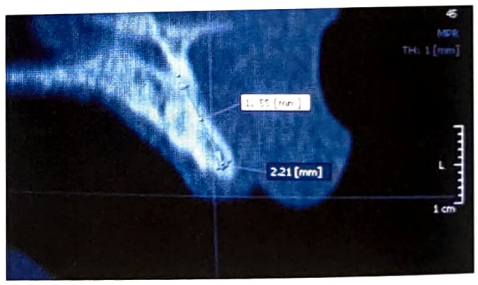


Fig 2 Computed tomography scans. a) axial view, b) saggital view

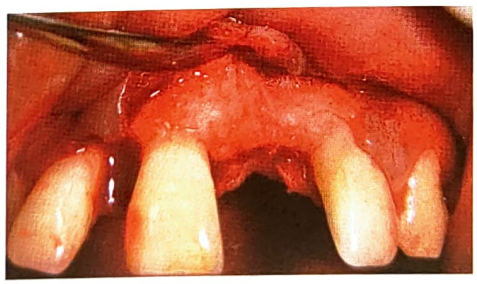


Fig 3 Full-thickness mucoperiosteal flap with two releasing incisions

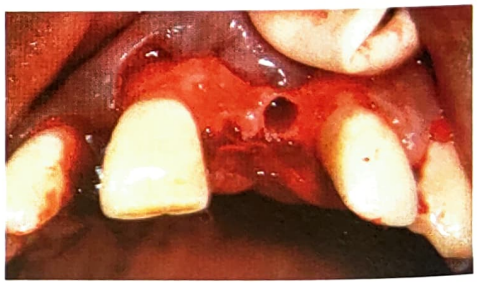


Fig 4 Final osteotomy after expansion

sion and guided bone regeneration.

CASE REPORT

A 35 year old male patient presented to the Department of Periodontics and Oral Implantology, Maulana Azad Institute of Dental Sciences, New Delhi, India with chief complaint of missing upper anterior tooth. The patient did not have any medical problems and was not under any medications. On clinical examination, tooth # 9 was found to be missing with inadequate bucco-lingual width **(Figure 1a)**. Radiovisiograph (RVG) was taken to assess the site initially **(Figure 1b)**. Since the patient rejected a removable prosthesis for psychological reasons, a computerized tomography was taken after to evaluate the osseous morphology for implant installation. The amount and density of existent bone was equivalent to Division B and consistent with D3 respectively. The maximum available bone in bucco-lingual width and length was 3.68mm and 12.55mm respectively **(Figure 2a** and **2b)**. It revealed sufficient bone height but limited bone width. The patient was given a detailed explanation concerning the present state, alternative treatment plans, procedure and informed consent was obtained from the patient. Treatment with placement of dental implant with simultaneous bone expansion was planned and explained to the patient.

Immediately before the procedure, the patient rinsed for 1 minute with a 0.12% chlorhexidine digluconate solution (Periogard® oral rinse, Colgate Oral Pharmaceuticals Inc.). Following injection of 2% Lignocaine HCl with adrenaline 1:80,000 local anaesthetic, a mid-crestal incision was made with mesial and distal vertical releasing incisions. Full thickness mucoperiosteal flap was elevated and the surgical area was evaluated **(Figure 3)**. Consequently, round drill was used to mark the position for osteotomy followed by 2.0mm diameter drill. Ridge expansion with osteotomes was performed for implant

Fig 5 Threads exposed after implant placement

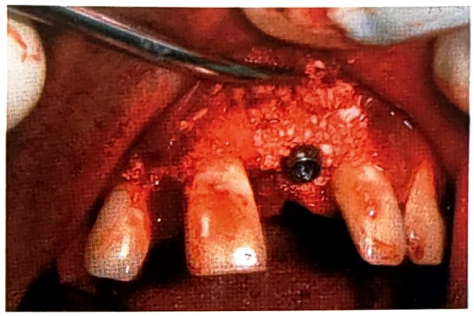


Fig 6 Bovine bone particles applied soaked in blood

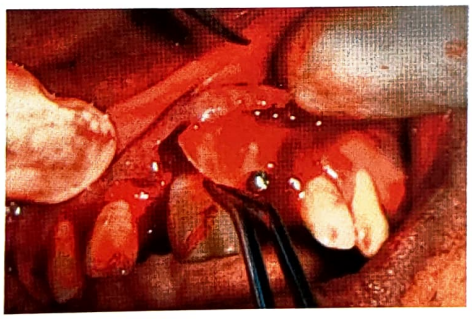


Fig 7 Membrane adapted around the neck of the implant, extending onto intact bone beyond the borders of the defect

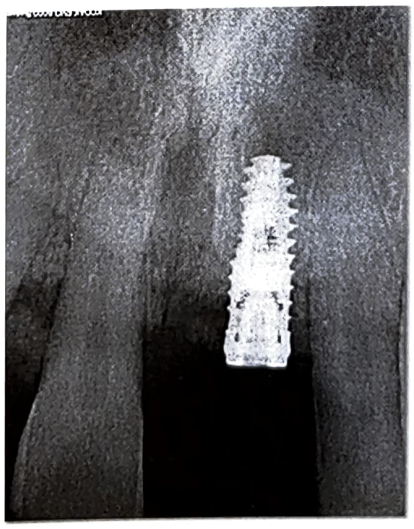


Fig 8 Immediate postoperative radiograph

installation of 3.4 × 11 mm (Dentsply Friadent, XIVE®) **(Figure 4)**. With optimal implant positioning and existing horizontal resorption of the host bone in the area, approximately 4-5 threads were exposed on the buccal surface of the implant **(Figure 5)**.

0.5 cc of bovine origin alloplastic material containing hydroxyapatite with collagen (Bio-Oss®, Geistlich Biomaterials) soaked in blood was used to augment the deficient ridge and cover the exposed threads of the implant **(Figure 6)**. A 25x25mm of collagen membrane (Bio-Gide®, Geistlich Biomaterials) was placed over the graft to assist in bone graft containment and to eliminate connective tissue and epithelial invagination into the surgical site **(Figure 7)**.

Reapproximation of the flaps with tension free primary closure was established utilizing 5-0 polyglactin 910 sutures (Coated Vicryl, Ethicon, Johnson and Johnson Medical Inc).Radiograph was taken to assess the implant position **(Figure 8)**. Postoperatively, 500 mg amoxicillin and 400 mg ibuprofen t.i.d. were given for 7 days. The patient was instructed to rinse the mouth twice daily for 1 month with 0.12% chlorhexidine digluconate solution (Periogard® oral rinse,Colgate Oral Pharmaceuticals Inc.). The sutures were removed after 14 days. Patient was recalled once a week for the first month and then once a month until the second-stage surgery. Healing was uneventful and the implant was uncovered at 6 months using Er,Cr:YSGG Laser(Waterlase® C100) **(Figure 9)**. Gingiva former of 3mm height was placed to improve the emergence profile. The gingival tissue was allowed to heal for an additional 1 month. A prefabricated, preparable prosthetic abutment (Dentsply Friadent ® Esthetic Base) was inserted and the implant restored with porcelain fused to metal crown (Figure 10).

DISCUSSION

Implants placed into deficient alveolar ridges, lead to bone defects around them. These bone defects have been classified as dehiscence, infrabony and fenestration defects. Inadequate amounts of bone at the time of implantation have been associated with decreased success rates.7 Hence, considerable efforts have been made to develop techniques and materials to increase the host bone volume, and thus to obtain a larger area of bone-to implant contact.

In conjunction with the placement of the implant, GBR procedures have resulted in successful coverage of the previously exposed implant surfaces with bone. Such regeneration of bone in conjunction with the placement of dental implants has become an accepted and successful clinical procedure.8

This concept is based on the hypothesis that the non desirable tissue cells are prevented from entering the wound area, thereby giving preference for repopulation of the defect to those particular cells which have the capacity to regenerate the desired type of tissue.9 The tool used to generate this is a cell occlusive membrane, which can be manufactured from different natural or synthetic polymers.

Biodegradable membranes made of collagen have become the standard of care in many clinical situations. They fulfil most of the requirements of being an ideal material for GBR.10 They must maintain their structural integrity during early wound healing. The resorption time of the collagen membrane used in present clinical situation is 24 weeks 10, sufficient to inhibit the epithelial migration in the early wound healing stage. Its collagen structure remains preserved in histologic analysis in monkeys even after 6 months in situ. 11 Histologic evaluation demonstrates nearly complete continuous layer of lamellar bone with osteoblastic activity in the collagen membrane-treated group as compared to only fibrous connective tissue in the no treatment control group.12

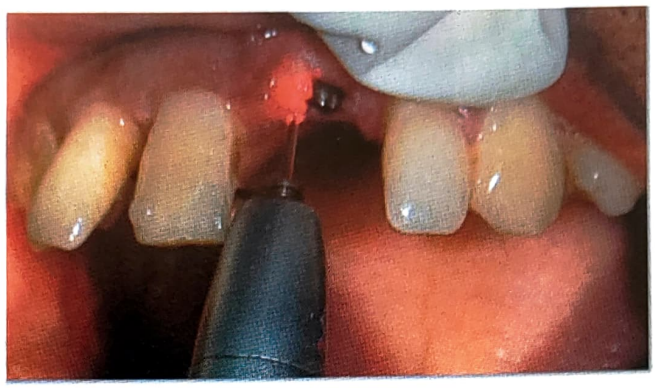


Fig 9 Implant exposure after 6 months with Er,Cr:YSGG Laser

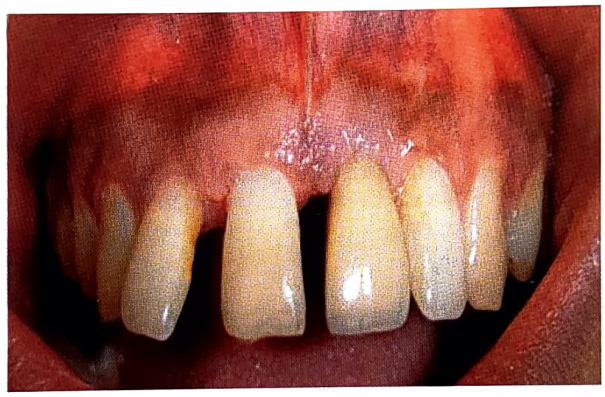


Fig 10 Final prosthesis

Previous studies have suggested that the commercially available bioresorbable membranes are not capable of maintaining sufficient space for bone regeneration unless the defect morphology is very favorable. They have demonstrated that bone formation is unsatisfactory in the absence of membrane supporting materials.13, 14 In the present case, bovine bone mineral containing hydroxyapatite was applied to support the bioresorbable collagen membrane. This material has been widely studied.15, 16 Excellent osteoconductive properties of the bovine bone with an osteoconductivity index of more than 2.5 have been demonstrated.17 Autogenous bone grafts and bone replacement grafts, such as DFDBA alone, 18 and a composite graft of DFDBA/FDBA, 19 have also been used as membrane supporting materials with varied results. Although the autogenous bone graft is the gold standard and provides the most predictable osteogenic result, a second surgical site is needed to harvest the graft material, which discourages patients from the GBR procedure. Thus hydroxyapatite was the material of choice in this case.

The clinical outcome of this case clearly demonstrated a positive effect of bone regeneration on implant success. Several factors could have influenced the quantity of bone formation in a GBR technique. The space-maintaining capability and duration of the barrier membrane are the most important ones.

Without the assistance of present day augmentation materials, endosseous implants would be limited to only those patients that present with alveolar ridges with adequate bone volume. The predictability of guided bone regeneration techniques has increased the number of implant candidates and has facilitated prosthetically driven restorations.

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