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Management of Residual Bone Defects after Cyst Enucleation: Clinical Role of Bone Grafts in the Maxillofacial Skeleton

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ABSTRACT

Residual bone defects following cyst enucleation in the maxillofacial skeleton remain a significant clinical challenge, particularly when large osseous cavities persist as unhealed scars. Small defects may heal spontaneously, but extensive lesions compromise ridge morphology, aesthetics, and implant rehabilitation. This case report presents the management of a 36-year-old male with a persistent anterior maxillary defect five years after enucleation of a dentigerous cyst. Radiographic evaluation revealed a residual defect measuring 12.94 × 17.42 mm, unsuitable for implant placement. Reconstruction was achieved using particulate bone graft blended with platelet-rich fibrin (PRF), stabilized with a titanium mesh, and covered with a guided tissue regeneration (GTR) collagen membrane. This multimodal approach provided stability, enhanced biologic activity, and created a favorable environment for bone regeneration, enabling future implant placement. The case underscores the limitations of spontaneous healing in large cystic cavities and highlights the importance of grafting strategies combined with biologic adjuncts and barrier membranes. Such interventions transform compromised sites into rehabilitated regions, ensuring predictable functional and aesthetic outcomes.

Keywords: Odontogenic cyst; Dentigerous cyst; Residual bone defect; Bone graft; Platelet-rich fibrin (PRF); Guided tissue regeneration (GTR); Titanium mesh; Maxillofacial surgery; Ridge augmentation; Implant rehabilitation

INTRODUCTION

Odontogenic cysts are frequent lesions of the maxillofacial skeleton, with dentigerous cysts being among the most common. Enucleation is the treatment of choice, but large cysts often leave behind significant osseous cavities. While small defects may heal spontaneously, larger ones can persist as unhealed scars, compromising aesthetics, function, and the possibility of implant rehabilitation. Bone grafts, platelet-rich fibrin (PRF), and guided tissue regeneration

(GTR) membranes have been widely studied as adjuncts to promote bone healing. Several reports confirm that grafting accelerates bone fill and reduces the risk of persistent defects compared to spontaneous healing alone [1-3].

CASE PRESENTATION

A 36-year-old male reported to our department with a history of a persistent defect in the anterior maxilla. The patient became aware of the defect during radiological investigations performed as part of his plan to undergo dental implant therapy. He expressed concern about the inadequate bone volume in the region, which had prevented him from pursuing prosthetic rehabilitation. He had undergone enucleation of a dentigerous cyst five years earlier, during which the left maxillary canine and lateral incisor were extracted as they were intimately involved with the lesion. Although the surgery had successfully removed the cyst, the patient noticed that the area never fully healed.

On clinical examination, the anterior maxilla showed a depression in the alveolar ridge with loss of contour. Radiographic evaluation confirmed the presence of a residual bony defect measuring approximately 12.94mm x 17.42mm above the canine region.

The defect was characterized by a thin cortical lining and inadequate bone volume, making it unsuitable for implant placement. The persistence of this defect over several years highlighted the limitations of spontaneous bone healing in large cystic cavities.

The procedure was carried out under local anesthesia in an outpatient surgical setting. After appropriate antisepsis and draping, a midcrestal incision was made over the edentulous ridge with small buccal releasing incisions to provide adequate access. A full-thickness mucoperiosteal flap was carefully elevated to expose the defect margins. The residual fibrous tissue lining the defect was excised, and the bony walls were freshened with gentle decortication and microperforations to stimulate bleeding and enhance graft integration.

Before graft placement, venous blood was drawn and processed to prepare platelet-rich fibrin (PRF). PRF membranes and plugs were kept ready to be mixed with the graft material and layered over the defect.

The bone graft, consisting of particulate material blended with PRF fragments, was gently packed into the defect to restore volume and ensure intimate contact with the bleeding bone walls.

A titanium mesh measuring 2.5 × 2.5 cm was contoured to replicate the natural alveolar ridge form and secured with screws into healthy surrounding bone, providing stability and maintaining the desired contour.Over the mesh, PRF membranes were laid to enhance biologic activity, and a guided tissue regeneration (GTR) collagen membrane was adapted to cover the entire grafted site. This barrier prevented soft tissue invasion and protected the healing environment. The flap was advanced with periosteal releasing incisions to achieve tension-free closure, and sutures were placed to ensure a watertight seal.

Postoperatively, the patient was advised on a soft diet, oral hygiene with chlorhexidine rinses, and routine pain control and infection-prevention medications. Follow-up visits were scheduled at one week, one month, and then at regular intervals to monitor healing. The graft was expected to consolidate over 4 to 6 months, after which re-entry and implant placement would be planned.

This comprehensive strategy created a stable environment for bone regeneration. The patient was informed that graft consolidation would require several months, after which implant placement could be considered to restore the missing

teeth. The case underscores the importance of bone grafting in the management of large cystic defects. While smaller lesions may heal spontaneously, extensive defects often remain as unhealed scars, compromising both aesthetics and function. In such situations, grafting combined with biological adjuncts and barrier membranes provides predictable outcomes and paves the way for successful prosthetic rehabilitation.

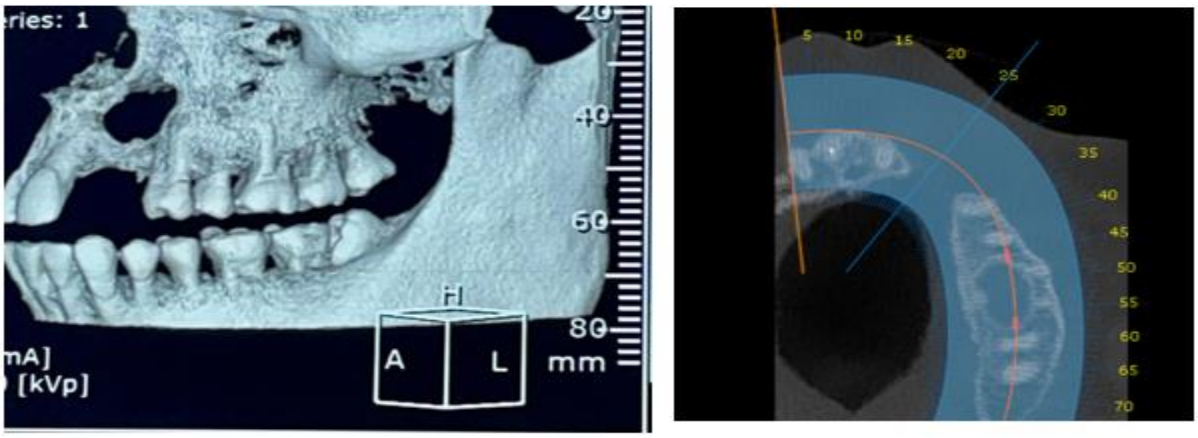

Figure 1: CBCT images showing the defect in 3d imaging and axial section.

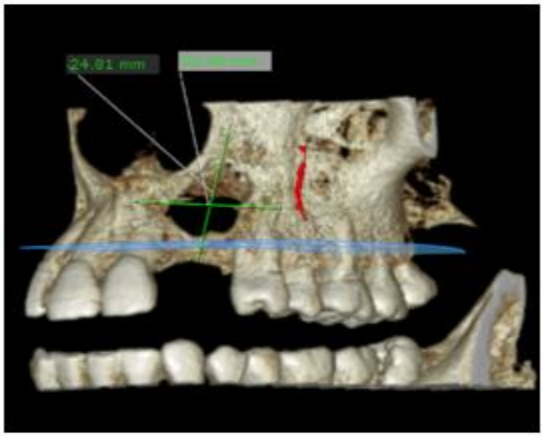

Figure 2: Pre-op planning was done where the mesh size and gtr membrane chosen were 2.5 x 2.5cm

Figure 3: CBCT image showing the defect size.

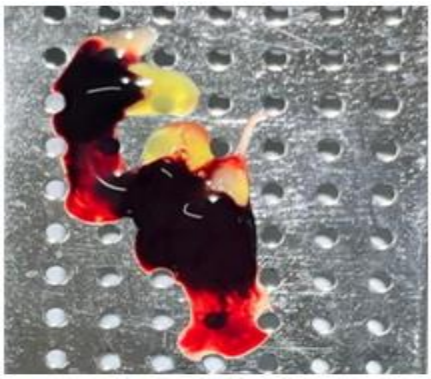

Figure 4: PRF membranes obtained

Figure 5: Intra-operative picture showing a through-and-through bone defect

A **B** **C**

D

Figure 6A: PRF plugs obtained; **6B:** PRF mixed with bone graft; **6C:** The PRF enriched bone graft was carefully packed into the defect to restore ridge volume. **6D:** Post operative picture after closure

DISCUSSION

Spontaneous bone healing following cyst enucleation has been well documented in the literature; however, its predictability is influenced by several factors, including the size of the defect, the patient's age, and the surgical technique employed. Small cystic cavities generally demonstrate satisfactory healing within 6-12 months, whereas larger maxillary defects-particularly those involving the canine region-may remain unhealed for extended periods, sometimes persisting for years [4]. Such residual defects or scars not only compromise the aesthetic contour of the anterior maxilla but also pose significant challenges for prosthetic rehabilitation.

Bone grafting has therefore become an essential adjunct in the management of these cases. Grafts provide a scaffold for osteoconduction, facilitating new bone formation, while autogenous grafts additionally contribute osteogenic cells and growth factors that enhance regeneration. Alloplastic and xenograft materials have also been successfully utilized in cystic cavities, often in combination with biologic adjuncts such as platelet-rich fibrin (PRF) or platelet-rich plasma (PRP), which improve vascularization and accelerate healing [2][5]. Guided bone regeneration (GBR) membranes further support this process by preventing soft tissue ingrowth into the defect, thereby maintaining space for bone fill and ensuring predictable outcomes [6].

Comparative studies consistently demonstrate superior results with grafting compared to spontaneous healing. Radiographic analyses confirm that bone fill is faster, denser, and more uniform when grafts are employed [1]. Case reports highlight that untreated defects may persist as unhealed scars for years, necessitating secondary interventions to restore ridge volume and function [3,4]. In the present case, the combined use of bone graft, PRF, titanium mesh, and a GBR membrane provided a stable environment for bone regeneration, ultimately enabling future implant placement in a region that had remained deficient for five years.

Additional reports emphasize the synergistic role of PRF and PRP in accelerating healing, particularly when blended with graft materials [7]. Volumetric and radiographic studies further confirm that while spontaneous healing is possible, it is often slower and less predictable, whereas grafting significantly improves both the quality and speed of bone regeneration [8,9]. Collectively, these findings underscore the importance of grafting strategies in the management of large maxillofacial cystic defects, ensuring functional rehabilitation and long-term aesthetic success.

CONCLUSION

Unhealed scars following cyst enucleation remain a considerable clinical challenge, particularly when the defect involves the maxilla and extends across aesthetically critical regions such as the canine and lateral incisor area. These residual defects compromise ridge morphology, reduce bone volume, and hinder the possibility of implant placement or prosthetic rehabilitation. While spontaneous healing may occur in smaller lesions, larger defects often persist for years without adequate regeneration, underscoring the need for surgical intervention.

Bone grafting has emerged as a cornerstone in the management of such cases. By providing an osteoconductive scaffold, grafts restore lost volume and create a favourable environment for new bone formation. When combined with biological adjuncts such as platelet-rich fibrin (PRF), which delivers concentrated growth factors to stimulate angiogenesis and osteogenesis, and guided bone regeneration (GBR) membranes, which protect the graft from soft tissue invasion, the predictability of healing is significantly enhanced. This multimodal approach not only addresses

the structural deficit but also ensures that the reconstructed site can support implant placement, thereby restoring both function and aesthetics.

The presented case illustrates the effectiveness of this strategy: a long-standing unhealed scar was successfully managed with bone grafting, PRF, titanium mesh stabilization, and GBR membrane coverage, creating a stable environment for regeneration. Such interventions transform a compromised site into one suitable for definitive rehabilitation. Nevertheless, long-term radiographic monitoring remains indispensable to confirm complete healing, evaluate graft integration, and rule out recurrence of pathology.

In summary, bone grafts combined with biologic and mechanical adjuncts represent a reliable solution for unhealed maxillary defects after cyst enucleation. They not only overcome the limitations of spontaneous healing but also pave the way for implant-based rehabilitation, ensuring durable functional outcomes and aesthetic satisfaction for the patient.

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