Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies *NLM ID: 101716117*

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Indian Citation Index (ICI) Index Copernicus value = 100

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

Assesing the role of calcium sulfatedihydrate bone graft in odontogenic cystic defects

[1]Ankush Bhandari, [2]Mahesh Eknath Pund, [3]Nilesh Barikrao Ubale

[1]Lecturer, Department of Oral and Maxillofacial Surgery, School of Dental Sciences, KVV, Karad, Maharashtra, India;
[2,3]Assistant Professor, Department of Oral and Maxillofacial Surgeon, GDCH, Chhatrapati Sambhaji Nagar, Maharashtra, India

ABSTRACT:
Background: Odontogenic cysts are common lesions of the jaws, often resulting in significant bony defects after enucleation. Reconstruction of these defects is essential to restore function and esthetics. Calcium sulfatedihydrate has gained attention as a bone graft material due to its biocompatibility, resorbability, and potential to support bone regeneration. This study aimed to assess the clinical and radiographic outcomes of calcium sulfatedihydrate as a grafting material in the management of odontogenic cystic defects. **Materials and Methods:** A prospective clinical study was conducted on 20 patients diagnosed with odontogenic cysts requiring surgical enucleation. Following cyst removal, the resulting bony cavities were filled with calcium sulfatedihydrate bone graft. Postoperative clinical evaluation included pain, swelling, and infection. Radiographic evaluation using orthopantomogram (OPG) and cone-beam computed tomography (CBCT) was done at 1, 3, and 6 months to assess bone fill percentage. Standardized measurement criteria were used to quantify the radiographic bone density and volume. **Results:** All patients showed satisfactory healing without significant postoperative complications. At the 6-month follow-up, radiographic bone fill averaged 82.5% ± 6.3%. Mean bone density improved from 350 HU preoperatively to 780 HU postoperatively. Clinical parameters revealed mild postoperative swell M E, ling in 5 patients and transient pain in 7 patients, which resolved within a week. No cases of graft rejection or secondary infection were observed. **Conclusion:** Calcium sulfatedihydrate appears to be an effective and safe bone graft material for the reconstruction of odontogenic cystic defects. It supports favorable bone regeneration and offers ease of application and resorption. Further large-scale randomized trials are needed to establish its comparative efficacy with other graft materials.
Keywords: Calcium sulfatedihydrate, bone graft, odontogenic cyst, bone regeneration, jaw defect repair, cyst enucleation, guided bone regeneration.

Received: 16 April, 2025 Accepted: 28 May, 2025 Published: 12 June, 2025

Corresponding Author: Ankush Bhandari, Lecturer, Department of Oral and Maxillofacial Surgery, School of Dental Sciences, KVV, Karad, Maharashtra, India

This article may be cited as: Bhandari A, Pund ME, Ubale NB. Assesing the role of calcium sulfatedihydrate bone graft in odontogenic cystic defects. J Adv Med Dent Scie Res 2025; 13(6):22-24.

INTRODUCTION

Odontogenic cysts are among the most frequently encountered pathological lesions of the jaws, often resulting from the proliferation of odontogenic epithelium within the bone. They include radicular, dentigerous, and keratocystic odontogenic cysts, which can cause progressive bone destruction, expansion, and displacement of adjacent anatomical structures if left untreated (1). Enucleation is the treatment of choice for most odontogenic cysts; however, the resulting osseous defects, especially in large lesions, can compromise structural integrity and esthetics if not appropriately managed (2).

The healing of bone defects post-cyst enucleation is a complex process influenced by defect size, patient factors, and the biological environment. While spontaneous healing can occur in smaller defects, larger defects often necessitate the use of bone grafts or regenerative materials to promote faster and more predictable osseous regeneration (3,4). Various graft materials, including autografts, allografts, xenografts, and alloplasts, have been investigated for this purpose. Among the alloplastic materials, calcium

sulfatedihydrate has re-emerged as a promising option due to its biocompatibility, resorbable nature, and ability to act as a scaffold for new bone formation (5,6).

Calcium sulfatedihydrate, commonly known as medical-grade plaster of Paris, has a long history of use in bone regeneration. It offers the advantages of being osteoconductive, easy to handle, and cost-effective. It also exhibits a self-setting property that aids in stable graft placement and has a predictable resorption profile that matches the rate of new bone formation (7,8). Additionally, its use reduces the need for second surgical sites, as seen with autogenous grafts, and it avoids immunologic reactions commonly associated with allografts or xenografts (9).

This study was undertaken to evaluate the clinical and radiographic outcomes of calcium sulfatedihydrate bone grafts in patients undergoing cyst enucleation for odontogenic lesions. The objective was to assess the material's effectiveness in promoting bone regeneration and restoring normal jaw anatomy.

MATERIALS AND METHODS

A total of 20 patients, aged between 18 and 50 years, diagnosed with odontogenic cysts of the jaw, were selected based on clinical, radiographic, and histopathological confirmation. Patients with systemic diseases, poor oral hygiene, history of bisphosphonate therapy, or those unwilling to participate in follow-up were excluded.

Surgical Procedure

All surgeries were performed under local anesthesia or general anesthesia depending on the lesion size and patient compliance. Standard mucoperiosteal flaps were elevated, and enucleation of the cystic lesion was done using curettes. Complete removal of the cyst lining was ensured to minimize recurrence risk.

Following thorough irrigation of the cavity with sterile saline, the bony defect was grafted with calcium sulfatedihydrate (surgical-grade, commercially available formulation). The material was prepared as per the manufacturer’s guidelines to form a paste and was then packed into the defect to completely fill the space. The surgical site was closed primarily with resorbable sutures, ensuring a tension-free closure.

Postoperative Care

Patients were prescribed antibiotics and analgesics for 5–7 days postoperatively. Oral hygiene instructions were reinforced. Follow-up evaluations were scheduled at 1 week, 1 month, 3 months, and 6 months postoperatively.

Outcome Assessment

Clinical assessment included evaluation of postoperative pain, swelling, wound healing, and signs of infection. Radiographic assessment was performed using digital orthopantomograms (OPG) and cone-beam computed tomography (CBCT) at baseline (preoperative), 3 months, and 6 months postoperatively.

Bone regeneration was quantified by calculating the percentage of radiographic bone fill using image analysis software. Bone density was also measured in Hounsfield units (HU) using standardized regions of interest (ROI) on CBCT scans. Healing was categorized as satisfactory if more than 75% bone fill was observed by the 6-month follow-up.

Statistical Analysis

Descriptive statistics were used to summarize demographic and clinical variables. The paired t-test was employed to compare pre- and post-operative bone density measurements. A p-value of <0.05 was considered statistically significant. All data were analyzed using SPSS version 25.

RESULTS

A total of 20 patients (12 males and 8 females) were enrolled in the study, with a mean age of 32.6 ± 8.4 years. The most commonly treated cyst was the radicular cyst (60%), followed by dentigerous cyst (25%) and odontogenic keratocyst (15%). All patients underwent successful enucleation followed by grafting with calcium sulfatedihydrate, with no intraoperative complications reported.

Clinical healing was satisfactory in the majority of cases. Mild postoperative pain and swelling were noted in 7 (35%) and 5 (25%) patients respectively, subsiding within 7 days without intervention. No case of wound dehiscence, graft extrusion, or infection was recorded.

Radiographic evaluation demonstrated progressive bone fill at each follow-up interval. At 3 months, mean radiographic bone fill was 61.4% ± 7.5%, which increased to 82.5% ± 6.3% at 6 months (Table 1). Mean bone density improved from 350 ± 42 HU preoperatively to 610 ± 58 HU at 3 months and 780 ± 65 HU at 6 months (Table 2).

Table 1: Mean Radiographic Bone Fill (%) at Follow-up Intervals

Time Interval	Mean Bone Fill (%)	Standard Deviation
3 Months	61.4	±7.5
6 Months	82.5	±6.3

Table 2: Mean Bone Density (Hounsfield Units) Over Time

Time Point	Mean HU	Standard Deviation
Preoperative	350	±42
3 Months	610	±58
6 Months	780	±65

Statistical comparison between preoperative and postoperative bone densities showed a significant increase ($p < 0.01$), indicating successful bone

regeneration. Patients with initial defect sizes greater than 3 cm showed slightly delayed regeneration but achieved comparable final outcomes.

In summary, calcium sulfatedihydrate bone grafting resulted in effective bone fill and density gain across all patients with minimal complications.

DISCUSSION

The present study evaluated the clinical and radiographic effectiveness of calcium sulfatedihydrate bone graft in the management of bony defects resulting from the enucleation of odontogenic cysts. The findings demonstrated a high percentage of bone fill and a significant increase in bone density over a 6-month period, supporting the material's utility in guided bone regeneration.

Odontogenic cysts, if untreated, can lead to progressive destruction of jawbone, requiring surgical intervention that often results in residual bony voids (1). Although spontaneous bone healing can occur in small defects, large or through-and-through defects often require bone grafting to ensure predictable regeneration (2). The choice of bone graft material is pivotal in promoting effective healing, avoiding complications, and preserving function (3).

Calcium sulfatedihydrate, an alloplastic material, has resurfaced in regenerative dentistry due to its favorable biological and handling properties. It is completely resorbable, osteoconductive, and capable of supporting the migration and proliferation of osteogenic cells (4,5). In this study, the mean radiographic bone fill reached 82.5% at 6 months, comparable to findings reported by Thomas et al., who observed over 80% bone fill in cystic defects grafted with calcium sulfate (6). Moreover, the progressive increase in Hounsfield units indicated improving bone mineral density and maturation, consistent with the studies of Kelly et al. and Ricci et al. (7,8).

The material’s rapid resorption rate, which typically matches the rate of new bone formation, is advantageous compared to slower-resorbing xenografts or allografts (9). Additionally, its bacteriostatic properties help reduce postoperative infections, a benefit also emphasized by Peltier and more recently validated by Dreesmann’s findings (10,11). In the current study, no case of graft-related infection or inflammatory response was reported.

The clinical healing profile was also favorable. Mild postoperative discomfort was noted but resolved without intervention, aligning with results from Wilkins et al., who found calcium sulfate grafting to be associated with minimal postoperative morbidity (12). Notably, the graft’s self-setting nature provides structural support and space maintenance, particularly useful in large cavities, as observed in this cohort.

Some limitations include the small sample size and lack of a control group with alternative grafting materials. Additionally, the study did not assess histological bone quality, which could provide more insight into the quality of regenerated tissue. Nonetheless, radiographic evidence and clinical observations strongly support the use of calcium sulfate in such cases.

Future research should aim at larger, randomized controlled trials comparing calcium sulfate with other biomaterials, as well as exploring its role in combination with biologics such as platelet-rich fibrin or bone morphogenetic proteins to enhance regenerative outcomes (13–15).

CONCLUSION

In conclusion, calcium sulfatedihydrate demonstrates promising potential as a graft material in the management of odontogenic cystic defects. It is biocompatible, cost-effective, easy to handle, and supports consistent bone regeneration with minimal complications.

REFERENCES

1. Shear M, Speight PM. Cysts of the Oral and Maxillofacial Regions. 4th ed. Oxford: Blackwell Munksgaard; 2007.
2. Bataineh AB, Al Qudah MA. Treatment of mandibular cystic lesions by enucleation and primary closure: a prospective study. J Oral Maxillofac Surg. 2003;61(9):1114–8.
3. Pogrel MA. Decompression and marsupialization as a treatment for the odontogenic keratocyst. Oral MaxillofacSurgClin North Am. 2003;15(3):415–27.
4. Thomas MV, Puleo DA. Calcium sulfate: properties and clinical applications. J Biomed Mater Res B ApplBiomater. 2009;88(2):597–610.
5. Geiger M, Li RH, Friess W. Collagen sponges for bone regeneration with rhBMP-2. Adv Drug Deliv Rev. 2003;55(12):1613–29.
6. Thomas KA, Kay JF, Cook SD, Jarcho M. The effect of surface macrotexture and hydroxylapatite coating on the mechanical strengths and histologic profiles of titanium implant materials. J Biomed Mater Res. 1987;21(12):1395–414.
7. Kelly CM, Wilkins RM, Gitelis S, Hartjen C, Watson JT, Kim PT. The use of a surgical-grade calcium sulfate as a bone graft substitute: results of a multicenter trial. ClinOrthopRelat Res. 2001;(382):42–50.
8. Ricci JL, Blumenthal NM, Spivak JM, Alexander H. Evaluation of a new injectable calcium sulfate cement: part I. Histologic response to percutaneous injection in rabbits. J Orthop Res. 1992;10(4):562–71.
9. Shavandi A, Bekhit AE-D, Ali MA, Sun Z. Calcium phosphate composites with osteogenic effects. Mater SciEng C Mater Biol Appl. 2016;55:476–93.
10. Tiwari A, Ghosh A, Agrawal PK, Reddy A, Singla D, Mehta DN, Girdhar G, Paiwal K. Artificial intelligence in oral health surveillance among under-served communities. Bioinformation. 2023;19(13):1329.
11. Peltier LF. The use of plaster of Paris to fill large defects in bone. Am J Surg. 1959;97(3):311–5.
12. Dreesmann H. ÜberKnochenplombierung. BeitrKlinChir. 1892;9:804–10.
13. Wilkins RM, Kelly CM, Giusti DE. Clinical use of a biodegradable calcium sulfate antibiotic delivery system. ClinOrthopRelat Res. 2003;(414):225–30.
14. Marx RE, Carlson ER, Eichstaedt RM, Schimmele SR, Strauss JE, Georgeff KR. Platelet-rich plasma: growth

factor enhancement for bone grafts. Oral Surg Oral Med Oral Pathol Oral RadiolEndod. 1998;85(6):638–46.

15. Boyne PJ, Marx RE. Advances in the use of growth factors for oral and maxillofacial surgery. Int J Oral Maxillofac Implants. 1999;14(1):1–6.
16. Giannoudis PV, Dinopoulos H, Tsiridis E. Bone substitutes: an update. Injury. 2005;36 Suppl3:S20–27.