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Clinical application of calcium sulfate for the augmentation of extraction socket with an oro-antral communication

Calcium sulfate (CS), the so-called gypsum, is a mineral consisting of calcium sulfate dehydrate ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$). When gypsum is heated to 110°C , it loses water in a process known as calcination. The final product is calcium sulfate hemihydrate which is known as Plaster of Paris.¹ It has been successfully used for several decades as a bone filler alone or as a carrier with biologically active components applied for socket preservation, ridge augmentation, and sinus lift procedures.^{2,3} In this study, the authors first reported a patient who received the CS as the sole grafting material for augmenting alveolar ridge dimension of the socket with an oro-antral communication over a 2.5-year follow-up period.

A 36-year-old healthy female patient suffered from pain and pus discharge from tooth 16 edentulous area. Periapical radiography found a residual root fragment in the previous extraction socket (Fig. 1A). Cone beam computed tomography (CBCT) also revealed the maxillary sinusitis with Schneiderian membrane thickening, a root fragment beneath the thickened Schneiderian membrane, and the suspicion of membrane perforation in the coronal view (Fig. 1B). The retained root was removed under local anesthesia, and an oro-antral communication was noted (Fig. 1C). Then, two oblique vertical releasing incisions were made and the full thickness flaps were elevated to visualize the site and to allow mobilization of the flaps to cover the tooth socket. After curettage of the granulation tissues around the extraction socket, medical grade calcium sulfate (sterilized in dry-heat oven 170°C for 2 h) mixed with normal saline was shaped and placed into the tooth socket for the repair of perforation area and the augmentation of the tooth socket (Fig. 1D and E). The flaps

were repositioned and sutured over the tooth socket to achieve the maximal closure of the flap margins (Fig. 1F). The healing process was uneventful. Approximately 3.5 months after the CS placement, the intra-oral photograph revealed the complete closure of the socket of tooth 16 (Fig. 1G). Moreover, a well-defined sinus border was also demonstrated by the CBCT scan (Fig. 1H). This patient did not have any other symptoms during the regular follow-ups. Finally, 2.5 years after the surgery, the operation site healed completely with the healthy edentulous area (Fig. 1I) and the CBCT examination showed a compact sinus border (Fig. 1J).

Usually, platelet-rich fibrin or collagen membrane were used as the biomaterials for the repair of sinus membrane perforation.⁴ To the best of our knowledge, this is the first report regarding the use of CS for covering an oro-antral communication. The CS has been recognized as a highly biocompatible bone graft material due to a minimal inflammatory response subsequent to implantation.⁵ The advantages of the CS include the low curing temperature, rapid setting, biocompatibility, biodegradability, resorbable, and well tolerated by tissues.⁵ Compared to other comparable graft materials, these characteristics appear to make CS an alternative to other grafting materials. In conclusion, CS was successful proved to be used for not only socket preservation but also the repair of an oro-antral communication. It also showed the satisfactory healing of sinus membrane perforation and positively influenced the socket perseveration. As a short case report, its clinical value is somewhat debatable at this stage. Further case series or controlled clinical trials are necessary to determine the benefits of the CS in such situation.

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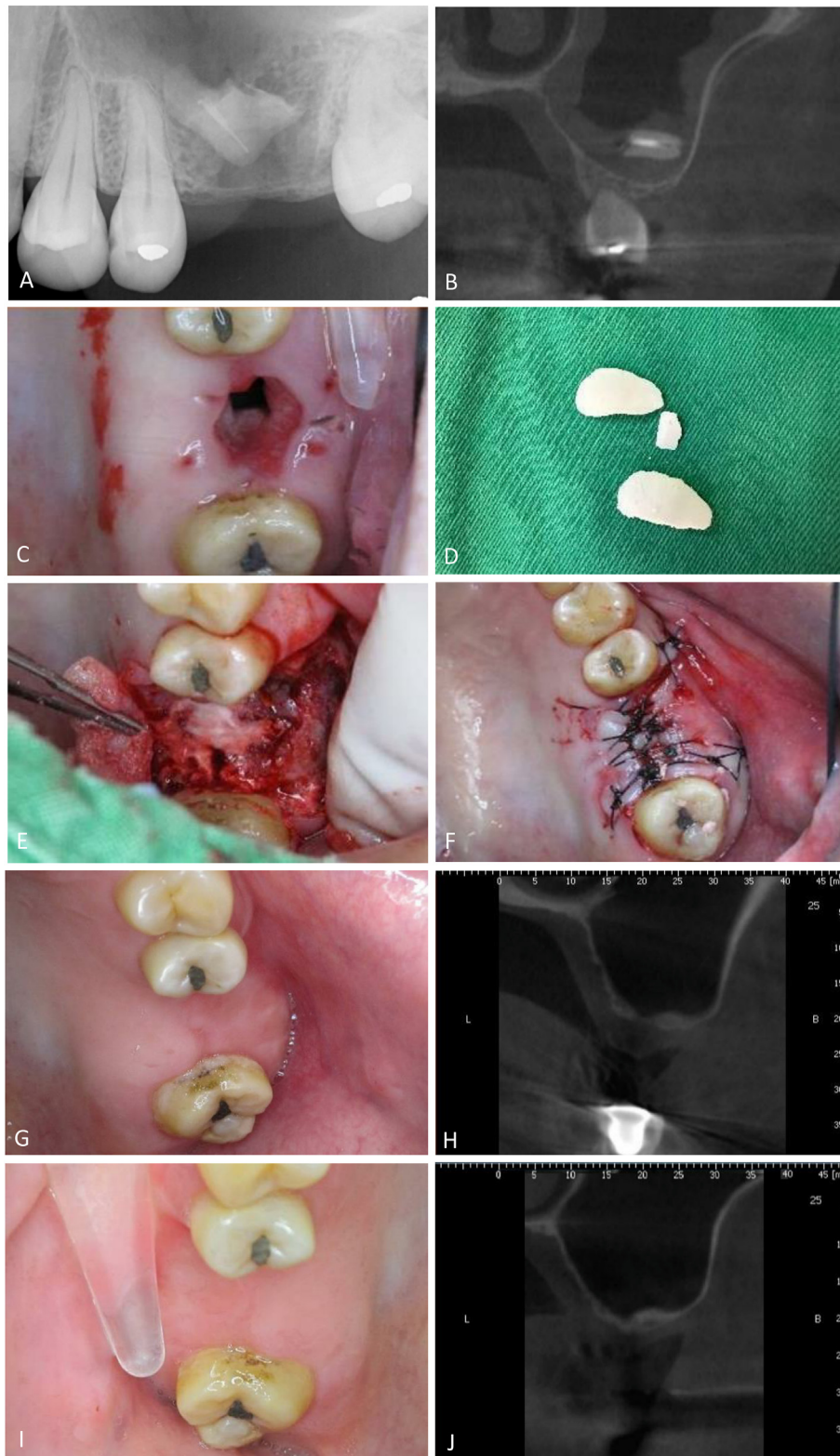


Figure 1 Periapical and cone beam computed tomography (CBCT) images and clinical photographs of our case. (A) Initial periapical radiograph exhibited a retained root fragment of tooth 16 in the extraction socket. (B) Coronal view of CBCT revealed a residual root adjacent to the thickened Schneiderian membrane. (C) Sinus membrane perforation was noted after the removal of the retained root fragment. (D) Medical grade calcium sulfate (CS) was sterilized, shaped, and prepared to place into soft and hard tissue defects. (E) The flaps were released and reflected for the alveolar ridge augmentation using the CS. (F) Clinical photograph indicated the maximal closure after the CS placement. (G) After 3.5 months, an intra-oral photograph revealed the complete closure of the socket of tooth 16. (H) Moreover, the CBCT scan showed a well-defined sinus border. (I) Finally, 2.5 years after the surgery, the operation site healed completely with the healthy edentulous area. (J) In addition, the CBCT examination showed a compact sinus border.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

References

1. Anusavice KJ. Gypsum products. In: Anusavice KJ, ed. *Phillips' science of dental materials*. St. Louis, MO: Saunders, 2003: 255–81.
2. Fu YC, Wang YH, Chen CH, Wang CK, Wang GJ, Ho ML. Combination of calcium sulfate and simvastatin-controlled release microspheres enhances bone repair in critical-sized rat calvarial bone defects. *Int J Nanomed* 2015;10:7231–40.
3. Huang KH, Chen CY, Chang CY, Chen YW, Lin CP. The synergistic effects of quercetin-containing 3D-printed mesoporous calcium silicate/calcium sulfate/poly-ε-caprolactone scaffolds for the promotion of osteogenesis in mesenchymal stem cells. *J Formos Med Assoc* 2021;120:1627–34.
4. Huang IJ, Yu HC, Chang YC. Schneiderian membrane repair with platelet-rich fibrin during maxillary sinus augmentation with simultaneous implant placement. *J Formos Med Assoc* 2016;115: 820–1.
5. Yahav A, Kurtzman GM, Katzap M, Dudek D, Baranes D. Bone regeneration: properties and clinical applications of biphasic calcium sulfate. *Dent Clin* 2020;64:453–72.

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