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Immediate dental implantation after transcrestal sinus elevation by osseodensification in a severe atrophic alveolar ridge - Case report

Alveolar ridge atrophy as well as sinus floor pneumatization following the tooth extraction in the posterior maxilla usually challenge the dental implant placement. Many transcrestal sinus floor elevation methods such as osteotomes, balloon elevation, hydraulic pressure, and piezosurgery are simpler and less complications than the lateral approach for the increase of bone height.[1] However, these techniques cannot improve the bone density resulting in a delay of the tooth implantation. Osseodensification was first introduced by Huwais with special designed burs (Densah® burs, Versah, Jackson, MI, USA) to avoid subtractive bone drilling in the implant preparation site.[2] Osseodensification can create a layer of compact bone around the implant preparation bony surface to enhance bone density.[2] Usually, osseodensification for the transcrestal sinus floor elevation is suitable for the residual bone height (RBH) ranging from 2 to 7 mm.[3,4] However, a recent review suggested when the RBH $\leq$ 2–3 mm might be a risk factor for sinus membrane perforations by using osseodensification burs.[2] In this report, we presented a 1.5-year follow-up of osseodensification in a severely-resorbed edentulous ridge with a stable osseointegration of the implant placed in the grafted sinus with the maintained crestal bone and sinus graft height.

A 37-year-old male suffered from the tooth #16 missing with severe alveolar ridge atrophy for more than 10 years. Cone-beam computed tomography (CBCT) was conducted to assess the treatment options. An image scan revealed about 1–2 mm RBH (Fig. 1A) and 7 mm bone width from the buccal to palatal aspect. With the patient's informed consent, osseodensification was operated according to the standard protocols III (the minimum 2–3 mm RBH with the minimum 7 mm alveolar width) with a minor modification.[2] Briefly, a full thickness flap was raised after the mid-crestal incision. Avoiding to use pilot drill instead of 2 mm narrowest densifying bur (VT1525, 2.0), this approach could control bone compaction and facilitated the sinus floor elevation without the initial cutting action (Fig. 1B). The densification was step by step with the 2, 3, and 4 mm Densah burs. The sinus membrane was visible and intact in all densifying stages with gentle pumping motions applied to increment up to maximum 3 mm for the prevention from the membrane penetration. Finally, the freeze-dried bone allografts (Corticocancellous, Maxxeus, Kettering, Ohio, USA) were propelling to lift the sinus membrane (Fig. 1C). The sagittal view of CBCT scan demonstrated the sinus membrane elevation up to about 10 mm without perforation (Fig. 1D). An implant (4 mm diameter $\times$ 8.5 mm length, TPlus, MegaGen Implant Co., Ltd, Seoul, Korea) was inserted into the osteotomy sites simultaneously with an adequate torque of 40 N/cm and secured with the primary closure (Fig. 1E and F). CBCT scan confirmed the integrity of the sinus membrane and the proper implant placement (Fig. 1G). The prosthesis was delivered 6 months postoperatively with a uneventful wound healing and the periapical radiograph was documented (Fig. 1H). Clinical image and CBCT examination were performed after the crown placement (Fig. 1I and J). Six months later, a second periapical radiograph was evaluated (Fig. 1K). After the final crown restoration for 1.5 years, the clinical photograph revealed the healthy soft tissue appearance (Fig. 1L) and the CBCT demonstrated the stable osseointegration of the implant (Fig. 1M).

This case report showed that osseodensification could increase the primary stability, bone mineral density, and immediate implant placement in the severe posterior maxillary atrophy with RBH only 1–2 mm after 1.5-year follow-up. Recently, a systematic review demonstrated that the advantages of osseodensification were the increase of bone density, primary stability of the implant, and bone-

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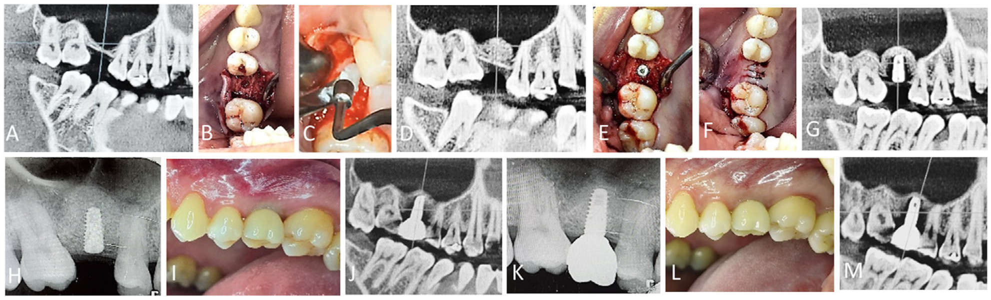

Figure 1 Sinus floor elevation by osseodensification with the simultaneous implant placement. (A) Cone-beam computed tomography (CBCT) depicting sinus pneumatization with 1–2 mm alveolar ridge height. (B) Clinical occlusal view of osteotomy preparation with the adequate alveolar ridge width of 7 mm. (C) Clinical occlusal view of the final implant osteotomy for propelling bone graft. (D) No evidence of membrane perforation demonstrated by the sagittal view of CBCT scan. (E and F) Clinical procedure of implant placement, wound closure, and suturing. (G) CBCT verification for the sinus augmentation with the allograft noted by the extent of the Schneidarian membrane lift, the graft, and the placed implant. (H) Periapical radiograph verification prior to implant uncover at 6 months post-surgery showing the sinus graft with implant integration. (I and J) Clinical occlusal view and the sagittal view of CBCT scan after restoration delivery. (K) Periapical radiograph verification for the 6-month follow-up after the final prosthesis placement. (L) The 1.5-year follow-up: Clinical buccal view showing the peri-implant tissue health. (M) CBCT scan verification for a stable osseointegration of the implant placed with the maintained crestal bone and sinus graft height.

implant contact.[5] Taken together, the bone grafts, densification, and compaction methods have proven to be clinically successful in such severe posterior maxillary atrophy with a simultaneous implant placement. However, only one case was reported in this study. To validate the feasibility of osseodensification in RBH <2 mm, further case series, controlled clinical trials, and the long-term follow-up studies are warranted.

Declaration of competing interest

The authors declare no relevant conflicts of interest regarding this article.

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