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Case Report

Graftless Sinus Augmentation via Crestal Sinus Floor Elevation using Densah Burs with Simultaneous Implant Placement: A Clinical Report after Two Years in Service

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Abstract

Maxillary sinus floor elevation is a reliable surgical procedure to establish oral rehabilitation using implant prostheses in the atrophic maxilla. Both lateral sinus floor elevation (LSFE) and crestal sinus floor elevation (CSFE) are viable to augment inadequate alveolar bone height. Still, the results of post-surgical trauma, complications, and patient-reported outcome measures (PROMs) vary. Furthermore, combining bone grafting for maxillary sinus augmentation (MSA) is suggested to increase the volume of the alveolar ridge, yet more researches have demonstrated outcomes of the graftless method. This clinical report describes a graftless sinus augmentation with simultaneous implant placement utilizing Densah burs implementing CSFE through the osseodensification method.

***Keywords:** graftless, crestal sinus floor elevation, densah sinus lift, osseodensification, dental implants*

Introduction

Agenesis of the upper posterior teeth is one of the common clinical findings leading to alveolar ridge resorption, and maxillary sinus pneumatization results as atrophic maxilla in patients seeking oral rehabilitation.[1-3] Maxillary sinus augmentation (MSA) procedures are proposed to reconstruct the defects because of their predictable and effective outcomes.[2-5] Both direct sinus floor elevation, the lateral window technique, and indirect sinus floor elevation, the crestal approach, have advantages and indications.[1,3,4] Unlike lateral sinus floor elevation (LSFE), crestal sinus floor elevation (CSFE) is more minimally invasive, has less operation time, and limits the complications of sinus lifting surgery.[6-10] Common CSFE includes utilizing osteotomes, piezosurgical units, SCA kits, CAS kits, DASK system, and novel osseous densification kits named Densah burs.[1,3,8,11-14]

CSFE via Densah burs was first proposed by Huwais et al in 2018.[11] These specific burs compact autogenous grafting during the osteotomy in a counterclockwise motion.[11,15] The reverse-cutting, as osseodensification mode (OD), compresses the osseous tissue into lateral walls and the apex of the preparation, creating a hydrodynamic compression toward the sinus floor and then causing a greenstick fracture and elevating the Schneiderian membrane as an indirect sinus lift.[3,11,12,15-18] The bone-to-implant contact (BIC) is increased in low-density alveolar ridge while placing dental implants through this osseous densification, leading to the possibility of simultaneous implant placement during CSFE.[12,15,17,19-22]

To obtain a sufficient height of the alveolar ridge to place the implants, Both LSFE and CSFE combing the use of grafting materials have been accepted and proceeded as one of the standard methods.[2,3,23,24]

However, recent studies have shown there is no significant difference in survival rate between placing conventional long implants with bone grafting and the graftless option using short implants.[5,25-31] Some studies even proposed superior outcomes of no grafting sinus elevation due to the enhancement of autogenous bone formation, fewer chances of post-operative pain, and fewer morbidities related to grafting materials.[30,32-41] Furthermore, the use of short implants without MSA or placing implants in palatal positioning is proposed to exclude complications such as Schneiderian membrane perforation and sinusitis.[29,42-47]

This clinical report aims to evaluate the treatment procedure of graftless sinus augmentation with simultaneous single implant placement and the outcome of utilizing Densah burs in CSFE.

Case Presentation

A 61-year-old female came to Hung Kun-Tsung's Dental Clinic with agenesis of the left maxillary first molar. She sought a fixed implant prosthesis solution to restore the mastication. The patient did not have dental implant surgery experience before and requested a single implant placement for now. She was afraid of the sizeable surgical site and the post-operative trauma. A minimally invasive CSFE was proposed to restore the left maxillary first molar.

Computerized tomography (CT), periapical radiographs, and digital photography were used to analyze the situation. The height and the width of the residual maxillary alveolar ridge are measured as 7.1 mm and 11.4 mm. The ideal implant position was then planned at the center of the alveolar crest using the tracing of a 9 mm height and 4.5 mm width implant template (Figures 1a to 1c). The left maxillary second molar was extracted in advance due to severe mobility and plaque accumulation. The initial photo was taken on one month wound follow-up (Figure 2).

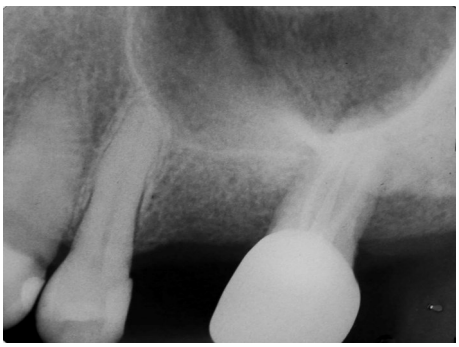

Figure 1a: *Periapical radiograph of agenesis left maxillary first molar.*

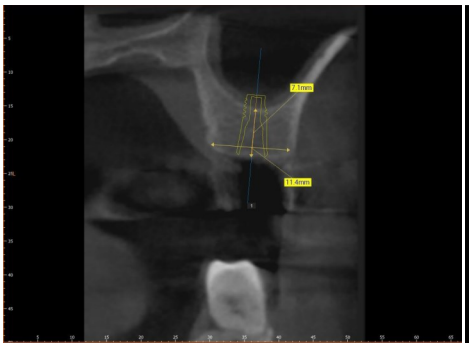

Figure 1b: *Schneiderian membrane thickening was observed through CT sagittal plane. The alveolar ridge was measured at 7.1 mm in height and 11.4 mm in width. A 4.5 x 9 mm implant was planned to fit the condition.*

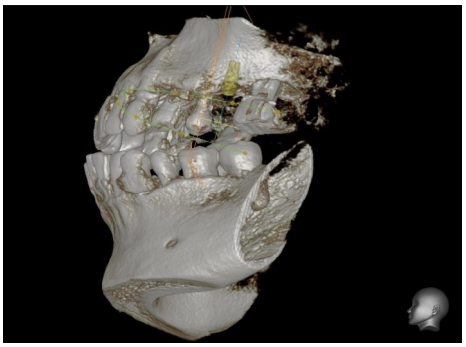

Figure 1c: *3D view to check the planned implant axis.*

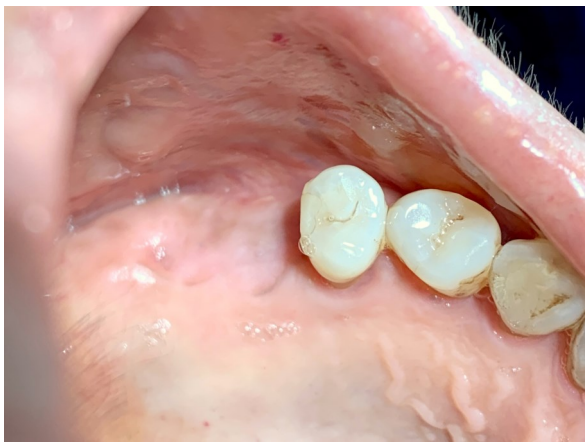

Figure 2: *Initial photo of the left posterior maxillary alveolar ridge with adequate soft tissue volume.*

Standardized surgical techniques were followed and proceeded. Envelope flap reflection was raised utilizing standard instrumentation under the administration of local anesthesia. The horizontal incision was made palatally to allow proper wound closure later. An osseous densification drilling was performed using Densah burs (Universal Densah® Bur Kit; Versah, LLC, MI, USA) in a sequence for crestal sinus floor elevation. The pilot drill was inserted 1mm below the sinus floor to confirm the position and the angulation of the osteotomy (6 mm in length). 2.0 mm Densah bur was utilized to drill the alveolar ridge to the sinus floor (7 mm in length) in reverse-cutting OD mode. 3.0 mm Densah bur was used in OD mode to pass the sinus floor and advance the height no more than 3 mm above the alveolar ridge (7 to 10 mm in length). 4.0mm Densah bur entered the osteotomy in OD mode to obtain the planned diameter of the dental implant (Figure 3). A fluoride-modified screw-shaped implant, 4.5 mm in diameter and 9 mm in length (OsseoSpeed TX 4.5, 9 mm, Astra Tech; Dentsply Sirona, Mölndal, Sweden), was placed and covered in the position of the left maxillary first molar with the insertion torque ≥ 45 Ncm. Autogenous bone particulates by OD mode drilling remained inside the osteotomy. No additional graft materials are inserted. The flap was closed with two stitches of single interrupted suturing on the horizontal incision and one stitch of single interrupted suturing on the vertical incision using 4-0 non-absorbable polyamide monofilament suture (Dafilon®, B. Braun, Melsungen, Germany). Post-operative CT was taken and verified (Figure 4). The Schneiderian membrane was lifted nearly 2 mm without grafting materials, and the implant reached its appropriate position. The patient reported no post-operative pain and discomfort after one week follow-up.

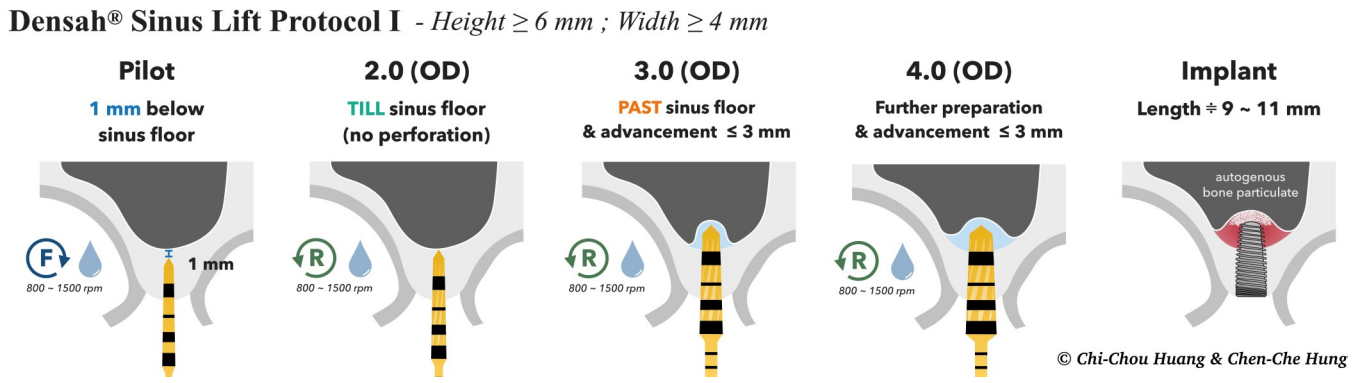

Figure 3: *Schematic of Densah Sinus Lift Protocol 1. The manufacturers designated the guideline to perform graftless CSFE in the residual alveolar ridge height ≥ 6 mm and width ≥ 4 mm. After using the pilot drill to initiate the osteotomy, the following burs and drilling sequences should be performed in osseodensification mode, a counterclockwise motion and obtained the planned preparation.*

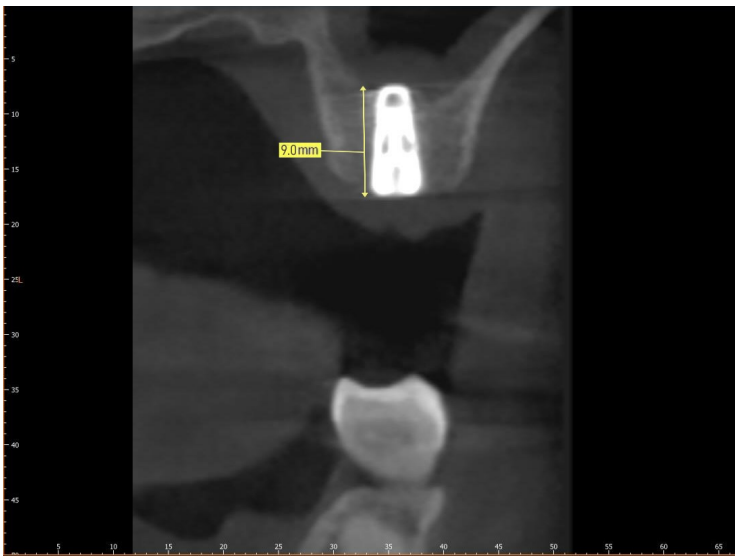

Figure 4: *9 mm implant was placed in the position. The CT showed a dome-shaped Schneiderian membrane and a nearly 2 mm increment of the elevation from the sinus floor. The cavity contained injected normal saline, increasing the capacity between the membrane and the sinus floor.*

A horizontal incision was performed, and a healing abutment (Healing Abutment 5.5, 4 mm, Astra Tech; Dentsply Sirona) was screwed into the implant after six months. The distal side of the incision was sutured with one stitch of single interrupted suturing (Dafilon®, B. Braun) to seal the gingival tissue (Figure 5). A periapical radiograph was taken without signs of sinus cavity infection (Figure 6). After eight weeks, the healing abutment was removed (Figure 7), and the impression coping (Implant Transfer 4.5/ 5.0; Astra Tech; Dentsply Sirona) was connected to the implant. A closed-tray impression was made with vinylpolysiloxane (VPS) impression material (Medium Regular Set DECA, Aquasil Ultra+; Dentsply Sirona, Mölndal, Sweden), capturing the matured peri-implant tissue contour and the rest of tissue contour was reproduced using VPS putty materials (Soft Putty Set, Aquasil; Dentsply Sirona, Mölndal, Sweden). The definitive screw-retained restoration was fabricated and screwed into the implant. The access was covered with Teflon strips and composite resin (Figure 8). Periapical radiographs and CT were taken to verify the fitness of the prosthesis and the level of marginal bone after the delivery (Figure 9) and two years follow-ups (Figure 10a and 10b).

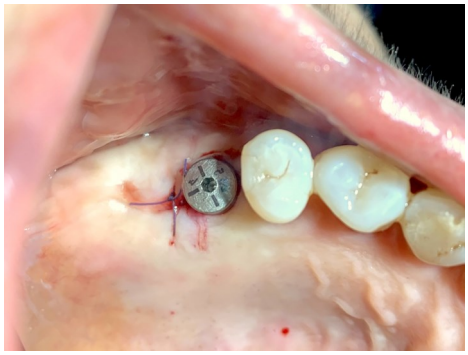

Figure 5: *Healing abutment was inserted and sutured in second-stage surgery.*

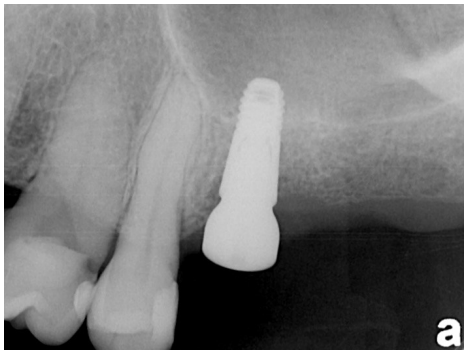

Figure 6: *Periapical radiograph after second-stage surgery. There were no signs of sinus cavity infection or other complications.*

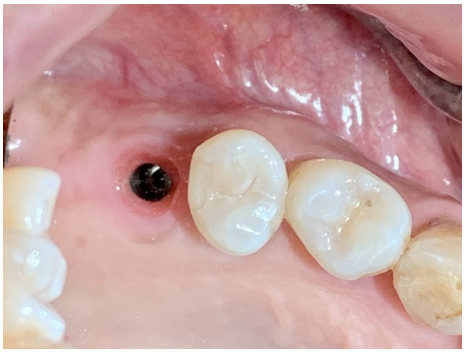

Figure 7: *Removal of healing abutment before taking the final impression. Adequate peri-implant tissue without any inflammation. No significant buccal bone wall resorption after the procedure.*

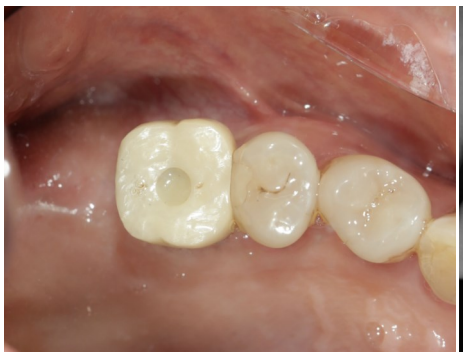

Figure 8: *Proper fitting of definitive screw-retained restoration.*

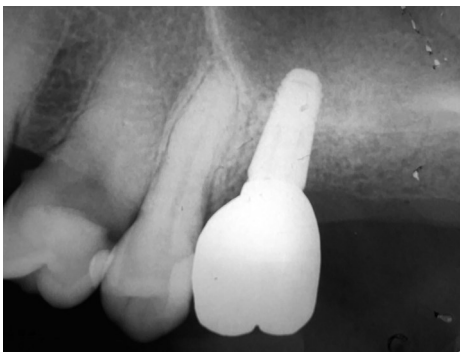

Figure 9: *Periapical radiograph after prosthesis delivery.*

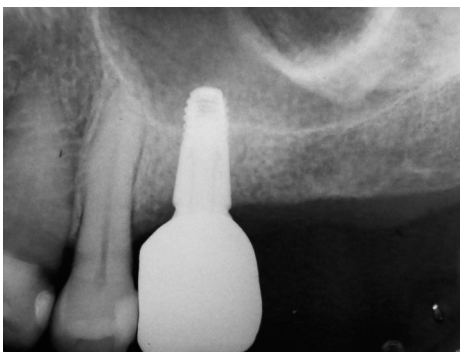

Figure 10a: *Periapical radiograph after two years in service.*

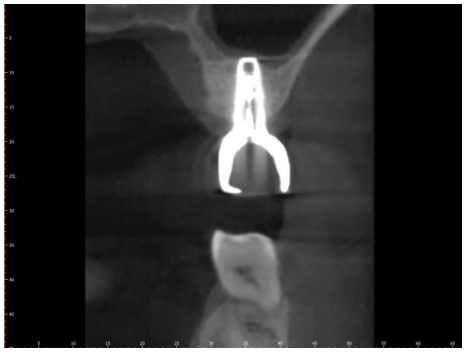

Figure 10b: *CT sagittal plane view of definitive implant restoration of the left maxillary first molar.*

Discussion

Various factors are related to the outcome of MSA. Different approaches, the necessity of grafting materials, and the determination of implant lengths affect the treatment's prognosis. Multiple clinical trials and studies addressed the possibility of attaining proper sinus elevation results, lowering complications, and increasing dental implants' survival rate.

Lateral Approach vs. Crestal Approach

Both LSFE and CSFE have been promising MSAs for inadequate alveolar ridge and have shown high success rates of implant placements in studies by Mohan et al in 2015, Danesh-Sani in 2016, and Bhalla et al in 2021.[1,3,4] In 2008, Wang et al proposed a classification of MSA based on the anatomy of edentulous maxilla and suggested LSFE for RBH ≤ 5 mm, the bone width is ≥ 5 mm, and the bone crest is ≤ 3 mm from the adjacent cemento-enamel junction (CEJ).[48] CSFE is recommended for RBH between 6 to 9 mm in the same study. However, various clinical reports exceed this standard and obtain reliable outcomes in a less aggressive procedure than LSFE.

In 2010, Esposito reported effective crestal sinus lifting in RBH 3 to 6 mm and placing 8 mm length implants simultaneously.[42] In 2014, Gonzalez reported a 100% success rate of 69 cases of CSFE with β-tricalcium phosphate bone grafting and simultaneous implant placements in RBH ≤ 4 mm.[49] In 2020, Soardi et al. concluded that CSFE is a predictable procedure for lifting maxillary sinus floor less than 2 mm. However, the study highlighted that CSFE does not have direct visibility of the Schneiderian membrane, which clinical skills and experiences should bear in mind.[10]

Although there is no absolute preference between LSFE and CSFE in survival rates and long-term outcomes, higher chances of complications are reported in some studies. In 2020, Khehra concluded lower chances of Schneiderian membrane perforation in CSFE because surgical trauma was minimized. Similar results are reported by Molina et al that the incidence of membrane perforation in LSFE and CSFE are around 20 to 25% and 15%, respectively.[5] Furthermore, CSFE is preferred through patient reported outcome measures (PROMs). Al-Almaie designed a split-mouth study and reported that most patients chose CSFE over LSFE due to less time consumption and less post-operative pain in 2017.[7]

Densah Sinus Lift

CSFE using Densah burs in osseodensification method was first introduced by Huwais et al in 2018.[11] The clinical study carried significant results of the utilization and the enhancement of bone density, allowing simultaneous implant placements to obtain primary stability through BIC and matched his previous study in the previous year.[15] Specific guidelines and protocols of the relationship between RBH and the method of MSA are proposed by the manufacturers. Huwais et al proceeded with the technique at the subsinus RBH at a baseline of 5.4 mm. They yielded a cumulative implant survival rate of 97% with propelling bone grafting materials into the sinus cavity.[11] Pai reported a similar result of osseodensification sinus elevation on RBH 5.0 mm without grafting materials in the same year.[50] In 2019, Arafat compared graftless osteotome elevation to the Densah sinus lift method and recorded higher Implant Stability Quotient (ISQ) values immediately postoperatively and at six months in the latter group.[19] El-Ghobashy also reported these results in 2022.[12]

A few studies highlighted the critical condition and achieved proper CSFE utilizing osseodensification sinus elevation. In 2021, Salgar demonstrated a few cases of crestal window approach using Densah sinus lift protocols to substitute lateral window technique in hyper-pneumatized posterior maxilla with a RBH < 1.5 mm and then augmented the sinus with bone grafting up to 15 mm with simultaneous implant placements.[16] In 2022, Rodda reported that specific protocols should be followed to ensure the success of Densah sinus lift in RBH < 3.0 mm.[17] In 2023, Alhayati et al concluded the efficiency of CSFE and higher primary and secondary implant stability applying Densah sinus lift with propelling grafting materials in RBH ≥ 2.0 mm and < 6.0 mm.[18]

Graftless vs. Grafting Materials

The use of grafting materials in MSA remains a matter of controversy. Specific bone substitutes are believed to maintain the volume of the alveolar ridge and histomorphometric outcomes.[23,42,51] However, more studies and results have attained the sustainability of graftless sinus augmentation with simultaneous implant placement. In 2011, Sohn et al discovered a faster and greater new bone formation in sinus elevation receiving no grafting materials in the immunochemical rabbit study.[33] In 2012, Riben et al reported higher implant survival rates for the graftless technique.[34] In 2016,

Silva et al reviewed 30 articles with 868 implants installed in 397 maxillary sinuses from 6 months to 11 years and concluded 96 % of implant survival rate in graftless procedures without major post-operative complications.[25] In the same year, Falah et al analyzed and proposed that blood clots induced new bone formation and considered autologous osteogenic grafting in MSA.[37] In 2017, Parra et al reviewed maxillary sinus lifting without grafting for up to four years. They showed a minimum RBH of 3 mm with enough cancellous bone remaining could guarantee minimum blood supply levels.[27]

More studies had a similar conclusion in 2020. Luongo et al confirmed the validity of graftless MSA with simultaneous implant placement. The method reduces healing time, cost, and complications for the patients.[52] Song et al showed a tenting effect of the dental implant in MSA without grafting, increasing proportions to the length and recorded amount of bone formation inside the sinus cavity.[53] Rammelsberg et al reported no negative effect on implant survival rate utilizing graftless MSA. However, RBH and incidence of membrane perforation influenced ten years survival rate.[54] In 2021, Zahedpasha evaluated graftless sinus lifting and the one using bone substitutes histologically and radiographically. Both groups had shown a bone gain in radiographs. Still, the graftless group presented significant bone thickness of trabeculae under histomorphometric study because of blood clot formation compared to the bone substitutes group.[41]

Long Implants vs. Short Implants

Even though the definition of using shorter implants to avoid MSA has not reached a consensus, more studies have carried more statistical results that using short implants to substitute conventional long implants is reliable. Atieh et al reviewed and concluded that short implants (≤ 8.5 mm) demonstrated a viable alternative to longer implants requiring additional grafting procedures in 2012.[43] In 2017, Pohl et al reported equivalent outcomes of using 6 mm short implants versus ≥ 11 mm long implants with sinus floor elevation.[45] In the same year, Bechara et al reported similar results but preferred short implants because of faster operation time and less expensive.[26] In 2018, Thoma reported no significant distinct comparing these methods after five years in service. But another five years follow-up study by Mester et al in 2023 showed standard implants (≥ 8 mm) combing MSA have a higher survival rate, although statistical significance was not achieved.[55] In 2021, a meta-analysis of randomized controlled clinical trials by Chaware et al proposed the favor of short implant (< 8.5 mm) as the alternative to long implant (> 8.5 mm) with sinus grafting for the rehabilitation of posterior atrophic maxilla through 667 patients and 1595 implants.[30]

Conclusion

MSA with implant placements is a promising surgical procedure to rehabilitate the posterior atrophic maxilla. Even though both LSFE and CSFE are pronounced and efficient methods, CSFE limits the complications and is preferred through PROMs due to its minimally invasive procedure. Within the limits of the study, graftless sinus augmentation via Densah sinus lift is viable and can reproduce the results in RBH ≥ 5 mm. To proceed with this technique on RBH ≤ 4 mm, clinical experiences, and manufacturer's guidelines should be aware and long-term follow-up is required. This clinical report has shown the success of CSFE without grafting materials with simultaneous implant placement and the reliability of sinus lifting through Densah sinus lift. The method effectively decreases risks of complications, both operation time and healing time, cost, and the patient's anxiety. Although additional grafting materials were not used in this clinical case, particulate autogenous bone was harvested and compacted via osseodensification, preventing chances of membrane perforation and increasing bone formation inside the sinus cavity tented by the implant.

Conflict of Interest

The authors declare no conflict of interest, either directly or indirectly, in the materials or information listed in the article.

References

1. Mohan N, Wolf J, Dym H: Maxillary sinus augmentation. Dent Clin North Am 2015;59:375-388
2. Khehra A, Levin L: Maxillary sinus augmentation procedures: a narrative clinical review. Quintessence Int 2020;51:578-584
3. Bhalla N, Dym H: Update on Maxillary Sinus Augmentation. Dent Clin North Am 2021;65:197-210 Danesh-Sani SA, Loomer PM, Wallace SS: A comprehensive clinical review of maxillary sinus floor elevation: anatomy, techniques, biomaterials and complications. Br J Oral Maxillofac Surg 2016;54:724-730

4. Danesh-Sani SA, Loomer PM, Wallace SS: A comprehensive clinical review of maxillary sinus floor elevation: anatomy, techniques, biomaterials and complications. Br J Oral Maxillofac Surg 2016;54:724-730
5. Molina A, Sanz-Sanchez I, Sanz-Martin I, et al: Complications in sinus lifting procedures: Classification and management. Periodontol 2000 2022;88:103-115
6. Borgonovo AE, Vitaliano T, Medagliani P, et al: Crestal sinus lift by using a mini-invasive procedure: a case series. Minerva Stomatol 2016;65:107-117
7. Al-Almaie S, Kavarodi AM, Alorf A, et al: A Split-Mouth Design Comparison for Lateral and Crestal Sinus Lift Techniques with Dental Implants Placements: Short Communication. Open Dent J 2017;11:603-608
8. Zhou X, Hu XL, Li JH, et al: Minimally Invasive Crestal Sinus Lift Technique and Simultaneous Implant Placement. Chin J Dent Res 2017;20:211-218
9. Romero-Millan JJ, Aizcorbe-Vicente J, Penarrocha-Diago M, et al: Implants in the Posterior Maxilla: Open Sinus Lift Versus Conventional Implant Placement. A Systematic Review. Int J Oral Maxillofac Implants 2019;34:e65-e76
10. Soardi CM, Soardi B, Wang HL: Crestal Window Sinus Lift and Its Long-Term Clinical Outcomes. Int J Periodontics Restorative Dent 2020;40:757-764
11. Huwais S, Mazor Z, Ioannou AL, et al: A Multicenter Retrospective Clinical Study with Up-to-5-Year Follow-up Utilizing a Method that Enhances Bone Density and Allows for Transcrestal Sinus Augmentation Through Compaction Grafting. Int J Oral Maxillofac Implants 2018;33:1305-1311
12. Elghobashy MTM, Shaaban AM, Melek LNF: Osseodensification by Densah Burs Versus Osteotome for Transcrestal Maxillary Sinus Lifting with Simultaneous Implant Placement. Alexandria Dental Journal 2022;0:0-0
13. Mamidi AR, Gottumukkala S, Mantena SR, et al: Comparison of clinical and radiological outcomes using crestal approach sinus kit and piezoelectric surgery for sinus membrane elevation: A prospective clinical trial. Dent Res J (Isfahan) 2022;19:88
14. Wu H, Wang J, Wang C, et al: A Comparison of Elevation, Perforation Rate, and Time Spent for the Crestal Sinus Elevation Intervened by Piezosurgery, CAS-Kit, and Osteotome in a Novel Goat Model. J Maxillofac Oral Surg 2022;21:1191-1198
15. Huwais S, Meyer EG: A Novel Osseous Densification Approach in Implant Osteotomy Preparation to Increase Biomechanical Primary Stability, Bone Mineral Density, and Bone-to-Implant Contact. Int J Oral Maxillofac Implants 2017;32:27-36
16. Salgar N: Osseodensified Crestal Sinus Window Augmentation: An Alternative Procedure to the Lateral Window Technique. J Oral Implantol 2021;47:45-55
17. Rodda A, Koduganti RR, Manne HK, et al: Implant Placement Post Maxillary Sinus Lift Using Osseodensification Concept: A Case Report. Cureus 2022;14:e21756
18. Alhayati JZ, Al-Anee AM: Evaluation of crestal sinus floor elevations using versah burs with simultaneous implant placement, at residual bone height >/= 2.0 _ < 6.0 mm. A prospective clinical study. Oral Maxillofac Surg 2023;27:325-332
19. Arafat S, A Elbaz M: Clinical and radiographic evaluation of osseodensification versus osteotome for sinus floor elevation in partially atrophic maxilla: A prospective long term study. Egyptian Dental Journal 2019;65:189-195
20. Inchingolo AD, Inchingolo AM, Bordea IR, et al: The Effectiveness of Osseodensification Drilling Protocol for Implant Site Osteotomy: A Systematic Review of the Literature and Meta-Analysis. Materials (Basel) 2021;14
21. Mello-Machado RC, Sartoretto SC, Granjeiro JM, et al: Osseodensification enables bone healing chambers with improved low-density bone site primary stability: an in vivo study. Sci Rep 2021;11:15436
22. Mullings O, Tovar N, Abreu de Bortoli JP, et al: Osseodensification Versus Subtractive Drilling Techniques in Bone Healing and Implant Osseointegration: Ex Vivo Histomorphologic/Histomorphometric Analysis in a Low-Density Bone Ovine Model. Int J Oral Maxillofac Implants 2021;36:903-909
23. Fouad W, Osman A, Atef M, et al: Guided maxillary sinus floor elevation using deproteinized bovine bone versus graftless Schneiderian membrane elevation with simultaneous implant placement: Randomized clinical trial. Clin Implant Dent Relat Res 2018;20:424-433

24. Valentini P, Bosshardt DD: 20-Year Follow-up in Maxillary Sinus Floor Elevation Using Bovine-Derived Bone Mineral: A Case Report with Histologic and Histomorphometric Evaluation. Int J Oral Maxillofac Implants 2018;33:1345-1350

25. Silva LD, de Lima VN, Faverani LP, et al: Maxillary sinus lift surgery-with or without graft material? A systematic review. Int J Oral Maxillofac Surg 2016;45:1570-1576

26. Bechara S, Kubilius R, Veronesi G, et al: Short (6-mm) dental implants versus sinus floor elevation and placement of longer (>/=10-mm) dental implants: a randomized controlled trial with a 3-year follow-up. Clin Oral Implants Res 2017;28:1097

27. Parra M, Olate S, Cantin M: Clinical and biological analysis in graftless maxillary sinus lift. J Korean Assoc Oral Maxillofac Surg 2017;43:214-220

28. Stefanski S, Svensson B, Thor A: Implant survival following sinus membrane elevation without grafting and immediate implant installation with a one-stage technique: an up-to-40-month evaluation. Clin Oral Implants Res 2017;28:1354-1359

29. Almahrous G, David-Tchouda S, Sissoko A, et al: Patient-Reported Outcome Measures (PROMs) for Two Implant Placement Techniques in Sinus Region (Bone Graft versus Computer-Aided Implant Surgery): A Randomized Prospective Trial. Int J Environ Res Public Health 2020;17

30. Chaware SH, Thakare V, Chaudhary R, et al: The rehabilitation of posterior atrophic maxilla by using the graftless option of short implant versus conventional long implant with sinus graft: A systematic review and meta-analysis of randomized controlled clinical trial. J Indian Prosthodont Soc 2021;21:28-44

31. Starch-Jensen T, Bruun NH, Spin-Neto R: Outcomes following osteotome-mediated sinus floor elevation with Bio-Oss Collagen or no grafting material: a one-year single-blind randomized controlled trial. Int J Oral Maxillofac Surg 2023

32. Thor A, Sennerby L, Hirsch JM, et al: Bone formation at the maxillary sinus floor following simultaneous elevation of the mucosal lining and implant installation without graft material: an evaluation of 20 patients treated with 44 Astra Tech implants. J Oral Maxillofac Surg 2007;65:64-72

33. Sohn DS, Moon JW, Lee WH, et al: Comparison of new bone formation in the maxillary sinus with and without bone grafts: immunochemical rabbit study. Int J Oral Maxillofac Implants 2011;26:1033-1042

34. Riben C, Thor A: The Maxillary Sinus Membrane Elevation Procedure: Augmentation of Bone around Dental Implants without Grafts-A Review of a Surgical Technique. Int J Dent 2012;2012:105483

35. Pinchasov G, Juodzbalys G: Graft-free sinus augmentation procedure: a literature review. J Oral Maxillofac Res 2014;5:e1

36. Perez-Martinez S, Martorell-Calatayud L, Penarrocha-Oltra D, et al: Indirect sinus lift without bone graft material: Systematic review and meta-analysis. J Clin Exp Dent 2015;7:e316-319

37. Falah M, Sohn DS, Srouji S: Graftless sinus augmentation with simultaneous dental implant placement: clinical results and biological perspectives. Int J Oral Maxillofac Surg 2016;45:1147-1153

38. Duan DH, Fu JH, Qi W, et al: Graft-Free Maxillary Sinus Floor Elevation: A Systematic Review and Meta-Analysis. J Periodontol 2017;88:550-564

39. Starch-Jensen T, Schou S: Maxillary Sinus Membrane Elevation With Simultaneous Installation of Implants Without the Use of a Graft Material: A Systematic Review. Implant Dent 2017;26:621-633

40. Andres-Garcia R, Rios-Santos JV, Herrero-Climent M, et al: Sinus Floor Elevation via an Osteotome Technique without Biomaterials. Int J Environ Res Public Health 2021;18

41. Zahedpasha A, Ghassemi A, Bijani A, et al: Comparison of Bone Formation After Sinus Membrane Lifting Without Graft or Using Bone Substitute "Histologic and Radiographic Evaluation". J Oral Maxillofac Surg 2021;79:1246-1254

42. Esposito M, Grusovin MG, Rees J, et al: Effectiveness of sinus lift procedures for dental implant rehabilitation: a Cochrane systematic review. Eur J Oral Implantol 2010;3:7-26

43. Atieh MA, Zadeh H, Stanford CM, et al: Survival of short dental implants for treatment of posterior partial edentulism: a systematic review. Int J Oral Maxillofac Implants 2012;27:1323-1331

44. Penarrocha-Oltra D, Candel-Marti E, Penarrocha-Diago M, et al: Palatal positioning of implants in severely atrophic edentulous maxillae: five-year cross-sectional retrospective follow-up study. Int J Oral Maxillofac Implants 2013;28:1140-1146

45. Pohl V, Thoma DS, Sporniak-Tutak K, et al: Short dental implants (6 mm) versus long dental implants (11-15 mm) in combination with sinus floor elevation procedures: 3-year results from a multicentre, randomized, controlled clinical trial. J Clin Periodontol 2017;44:438-445

46. Thoma DS, Haas R, Sporniak-Tutak K, et al: Randomized controlled multicentre study comparing short dental implants (6 mm) versus longer dental implants (11-15 mm) in combination with sinus floor elevation procedures: 5-Year data. J Clin Periodontol 2018;45:1465-1474

47. Lorenz J, Blume M, Korzinskas T, et al: Short implants in the posterior maxilla to avoid sinus augmentation procedure: 5-year results from a retrospective cohort study. Int J Implant Dent 2019;5:3

48. Wang HL, Katranji A: ABC sinus augmentation classification. Int J Periodontics Restorative Dent 2008;28:383-389

49. Gonzalez S, Tuan MC, Ahn KM, et al: Crestal approach for maxillary sinus augmentation in patients with </= 4 mm of residual alveolar bone. Clin Implant Dent Relat Res 2014;16:827-835

50. Pai UY: Indirect sinus lift of atrophic posterior maxilla using osseodensification: a case report. J Indian Prosthodont Soc 2018;18:S108

51. Starch-Jensen T, Deluiz D, Bruun NH, et al: Maxillary Sinus Floor Augmentation with Autogenous Bone Graft Alone Compared with Alternate Grafting Materials: a Systematic Review and Meta-Analysis Focusing on Histomorphometric Outcome. J Oral Maxillofac Res 2020;11:e2

52. Luongo R, Sgaramella N, Traini T, et al: Graftless Maxillary Sinus Floor Augmentation with Simultaneous Porcine Bone Layer Insertion: A 1- to 5-Year Follow-up Study. Int J Oral Maxillofac Implants 2020;35:808-815

53. Song D-S, Kim C-H, Kim B-J, et al: Tenting effect of dental implant on maxillary sinus lift without grafting. Journal of Dental Sciences 2020;15:278-285

54. Rammelsberg P, Kilian S, Busch C, et al: The effect of transcrestal sinus-floor elevation without graft on the long-term prognosis of maxillary implants. J Clin Periodontol 2020;47:640-648

55. Mester A, Onisor F, Di Stasio D, et al: Short Implants versus Standard Implants and Sinus Floor Elevation in Atrophic Posterior Maxilla: A Systematic Review and Meta-Analysis of Randomized Clinical Trials with >/=5 Years' Follow-Up. J Pers Med 2023;13

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