

The endoscopically assisted transcresal sinus floor elevation with platelet-rich fibrin at an immediate implantation of periapical lesion site

A case report

Hanchi Wang, MS, Jia Wang, DDS, Tianqi Guo, DDS, Xinxin Ding, MS, Wanqi Yu, MS, Jinghui Zhao, DDS, PhD*, Yanmin Zhou, DDS, PhD*

Abstract

Rationale: The traditional maxillary sinus floor elevation has serious postoperative complications and long healing periods, for patients with insufficient residual bone height (RBH). The endoscopic technique improves the blind nature of the sinus floor elevation procedure. Platelet-rich fibrin (PRF) can promote tissue healing and prevent perforation.

Patient concern: A 25-year-old female with residual roots in the maxillary right second molar visited our hospital for dental implants.

Diagnose: CBCT results showed a low-density shadow at the root tip, and the height of the periapical distance from the maxillary sinus floor was less than 1 mm.

Intervention: Patient was immediately subjected to implant after root extraction. Two-step sinus floor elevation was performed under endoscopy. A 12mm-long implant was installed.

Outcomes: At 10 months after surgery, the hard and soft tissues were stable, and a full-ceramic crown was placed.

Lessons: Immediate implant and endoscope-guided sinus floor elevation through a transcresal approach by using PRF as the only grafting material is viable in periapical infected sites with a RBH of less than 1 mm.

Abbreviations: CBCT = cone-beam computer tomography, PESS = platelet-rich fibrin endoscope sinus floor elevation and simultaneous implant placement, PRF = platelet-rich fibrin, ISQ = implant stability quotient, RBH = residual bone height.

Keywords: endoscope, immediate implant placement, periapical infection, platelet-rich fibrin, sinus floor elevation

1. Introduction

Dental implants are an excellent choice for many patients with dentition defects. Traditionally, the implantation of apical inflammatory areas should be postponed several months after tooth extraction to prevent infection in the implant surfaces. However, a systematic review suggested that the implant can be placed into sites with endodontic infection if appropriate clinical

procedures are performed before implantation.^[1] Hence, the treatment time can be shortened effectively, and bone loss can be reduced.^[2]

Bone deficiency caused by maxillary sinus gasification and alveolar bone absorption will affect the successful implantation of dental implants and their long-term effects.^[3] Maxillary sinus floor elevation is a common surgical method for the reconstruction of maxillary defects. Tatum first described “the lateral approach to the maxillary sinus floor” during a lecture in 1977.^[4] Summers^[5] introduced a less invasive procedure in 1994. The sinus membrane was elevated by osteotomes through the transcresal approach. However, this method was subject to visual limitations, which can increase postoperative complications.^[6] In 1997, endoscopically controlled sinus floor elevation was introduced, which allowed the operation to be carried out under direct vision.^[7] Platelet-rich fibrin (PRF) has a 3D fibrin scaffold structure that is rich in platelets and various cytokines, which can effectively promote the regeneration of soft and hard tissues and control the inflammatory reaction.^[8,9] The use of PRF as the only filling material can effectively promote bone regeneration in the case of sinus floor elevation.^[10,11]

A modified precise minimally invasive technique termed platelet-rich fibrin endoscope sinus floor elevation and simultaneous implant placement (PESS) was established by our research team. In PESS, P stands for platelet-rich fibrin, E is for endoscope, S is for sinus floor elevation and S represents simultaneous

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School and Hospital of Stomatology, Jilin University, Department of Dental Implantology, Jilin Provincial Key Laboratory of Tooth Development and Bone Remodeling, Changchun, Jilin Province, China.

* Correspondence: Yanmin Zhou, and Jinghui Zhao, 1500 Qinghua Road, Changchun 130021, Jilin, China (e-mails: Zhouyanmin62@126.com, zhaohj_1986@126.com).

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implant placement. In our case, the residual height of the alveolar crest was less than 1 mm, and the apical area was infected. Residual roots were removed, and endoscope-guided transcrestal sinus floor elevation was conducted by using PRF as the only grafting material followed by simultaneous dental implant placement. This report illustrates that the modified technique could help avoid perforations of the sinus membrane.

2. Case report

A 25-year-old healthy, non-smoking female required the removal of the residual root of the right maxillary second molar, followed by immediate implant placement. The root section of the tooth was below the gums, and a keratinized gingival width of 17 was sufficient (Fig. 1A). Cone-beam computer tomography (CBCT) examination showed a low-density shadow at the root tip, and the height of the periapical distance from the maxillary sinus floor was less than 1 mm (Fig. 1B and C).

The operative risk and complications were communicated with the patient, and the informed written consent was obtained from the patient for publication of this case report and accompanying images. The patient's mouth was rinsed three times with 0.12% chlorhexidine solution for 3 min each. After administering local anesthesia by using articaine with adrenaline 1:100,000, 17 residual roots were removed. The alveolar socket was scratched to completely remove granulation tissue (Fig. 2A). Osteotomy of approximately 1 mm was performed using a pilot drill before reaching the sinus membrane while conducting permanent cooling with physiological saline solution. A rounded tapered osteotome with the diameter of 4.3 mm (ZEPF, Deutschland) was used to fracture the cortical bone of the sinus floor and elevate the maxillary sinus membrane to a height of 3 to 4 mm. During

elevation, endoscopy was used to monitor the state of sinus membrane continuously (Fig. 3). Approximately 30 mL of whole blood was transferred to three glass-coated plastic tubes before the surgery, followed by centrifugation for 10 minutes at 3000 R/min. PRF was obtained in the middle of the tube. By selecting one of the tubes, PRF was pressed into a membrane with sterile dry gauze and filled in the elevated sinus. The mucosa of the maxillary sinus was raised, reaching a total height of 12 mm. An implant ($\Phi 4.8 \times 12$ mm, Straumann, Switzerland) was installed with a torque of 35 N/cm. The healing screw was placed (Fig. 2B), and the 2 remaining PRF slices were covered (Fig. 2C).

Post-surgical care included the intravenous of antibiotics for 3 days (Penicillin Metronidazole and Dexamethasone QD), and mouthwash after meals for 7 days (0.12% chlorhexidine).

CBCT scanning indicated that the mean bone mineral densities in the three regions were -263 , -47 and 113 at 9 months post-operation (Fig. 4A). The mucosal integrity and osteogenesis of the maxillary sinus floor were observed through 3D reconstruction (Fig. 4B). The implant stability quotient (ISQ) at 10 months after implant placement was measured in 5 directions (occlusal, buccal, lingual, medial, and distal), yielding a mean ISQ value of 77.2. Implant-level impression was taken, and a full-ceramic crown was fabricated (Fig. 5).

3. Discussion

Traditionally, residual bone height (RBH) less than 5 mm is treated using the lateral approach for maxillary sinus elevation without simultaneous implant placement.^[12] However, it can lead to postoperative pain, swelling, ecchymosis and long healing periods. Maxillary sinus elevation through the transcrestal approach is viable for patients with an RBH of 1 to 2 mm, but

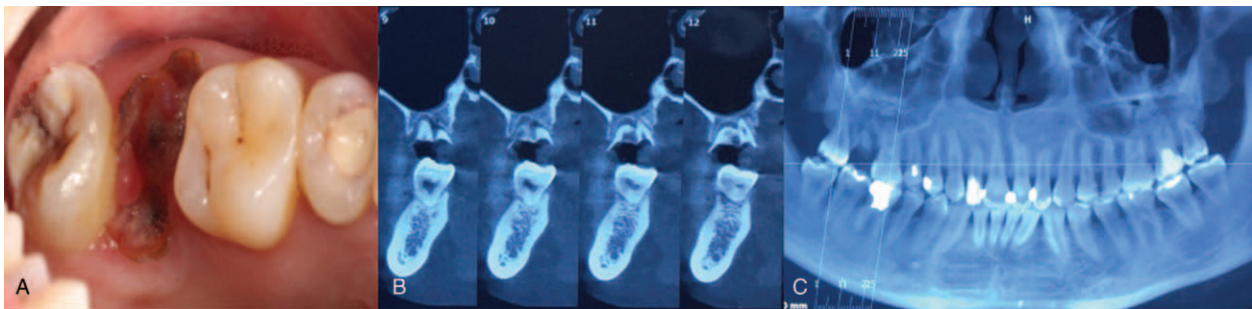


Figure 1. Clinical and radiograph examination before surgery.

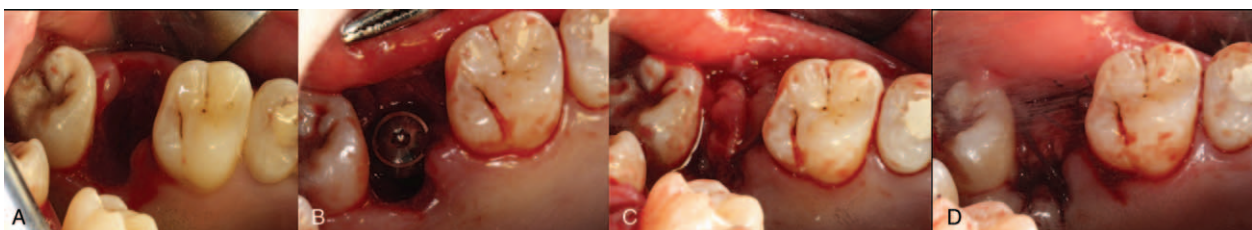


Figure 2. Residual roots and inflammatory tissue were removed (A); an implant ($\Phi 4.8 \times 12$ mm, Straumann, Switzerland) was immediately implanted with a torque of 35 N/cm (B); two pieces of PRF membrane were placed on the healing screw (C); the flap was loosely stitched (D).

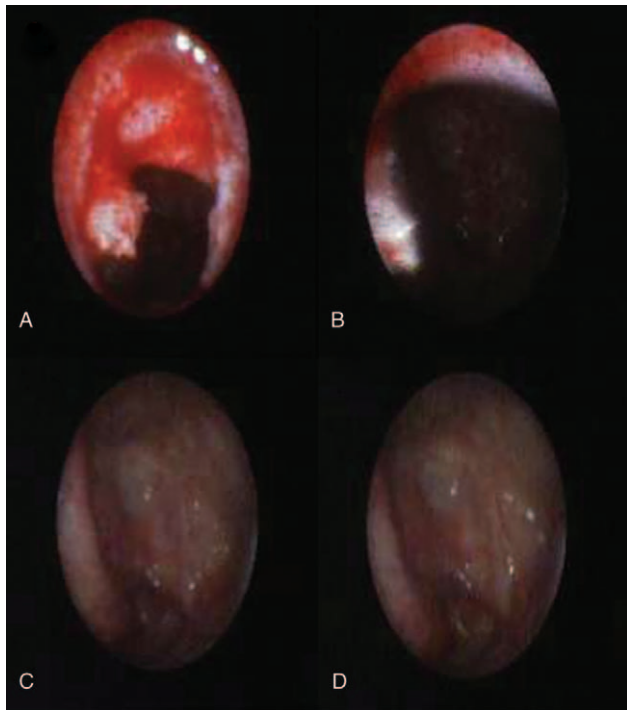


Figure 3. Endoscopic observation shows that the bone was perforated due to inflammatory absorption, but the mucosa of the maxillary sinus floor was intact with an uneven and dark surface.

delayed implant placement is performed.^[13] A new precise minimally invasive operation must be developed to shorten the treatment and healing time in patients with severe bone deficiency.

Transcrestal sinus floor elevation is a minimally invasive procedure. However, it cannot be operated under direct vision, and perforation is not easily determined.^[14] The endoscopic technique improves the blind nature of the sinus floor elevation

procedure. The integrity of the mucosa, hemorrhage of the sinus floor and height of the surrounding bone wall can be explored, and microscopic perforations can be precisely detected.^[15]

This case firstly reported the combination of immediate implant placement and PESS in periapical infected sites with RBH < 1 mm. Immediate implant placement can shorten the treatment time, reduce the absorption of the alveolar ridge, preserve the shape of the alveolar ridge and enhance aesthetic restoration effects.^[16,17] However, extracting teeth with inflammation may cause retrograde infection. Some studies suggested that patients with periapical lesions should avoid immediate implantation.^[18,19] Hence, meticulous debridement may be crucial in immediate implant placement in sites with periapical lesions.^[20,21] A systematic review of the literature showed that PRF may be used as the sole grafting material for sinus floor elevation with simultaneous implant placement. Nevertheless, the lateral wall sinus elevation was recorded in this report instead of the transcrestal sinus floor elevation.^[22] The use of PRF as the sole filling material in the crestal approach could also promote tissue regeneration and the repair of torn sinus mucosa at RBH < 3 mm.^[23] However, in the present case, PRF was used in 2 steps to elevate the maxillary sinus. Firstly, the sinus floor was elevated to 4 mm through the osteotome approach. Secondly, the PRF membranes were filled in the elevated sinus, which could moderate the force directed to the sinus membrane and reduce the morbidity of perforation in the next sinus floor elevation. Thirdly, the mucosa of the maxillary sinus was increased to 8 mm. During healing, PRF could repair microscopic perforations and promote bone formation. To avoid the disadvantage of a blind nature, endoscopy was performed to observe the mucosal conditions during the operation. The endoscope showed that the bone wall was perforated due to inflammatory absorption, but the mucosa remained intact. Considering that the diameter of perforation was less than 4.8 mm, the initial stability of the implant could be provided.

A healing period of 6 months is the standard of care for implantation with sinus floor elevation. The standard of rehabilitation was set at ISQ > 70.^[24] In this case, the mean

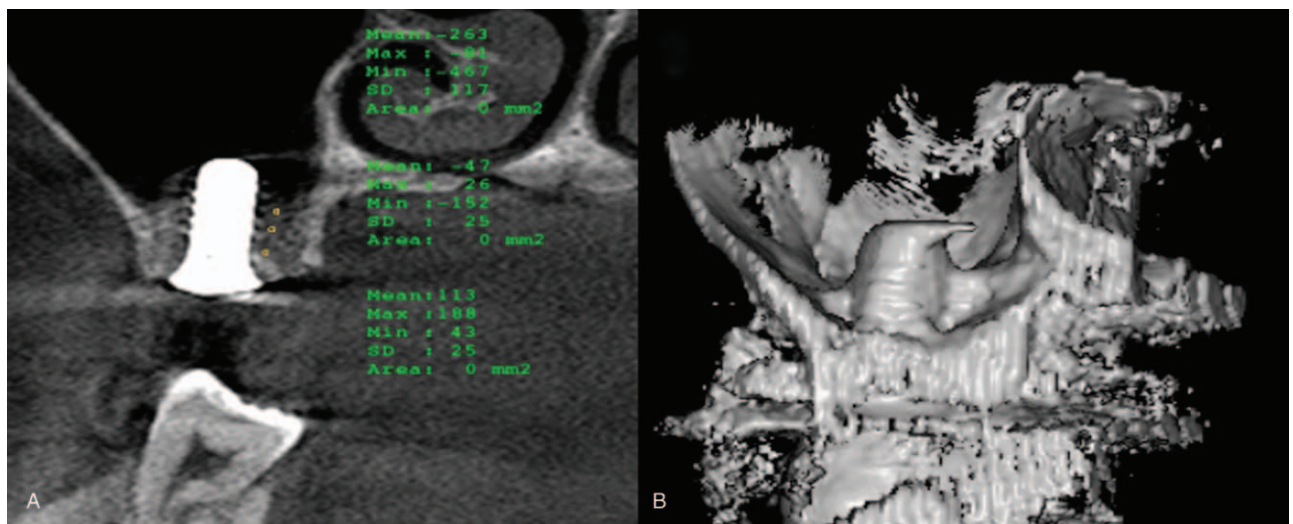


Figure 4. CBCT revealed a mean bone mineral density of 113 in the lower of the implant, -47 in the middle part of the implant and -263 in the upper part of the implant (A). Mucosal integrity and osteogenesis of the maxillary sinus floor were observed through 3D reconstruction (B).

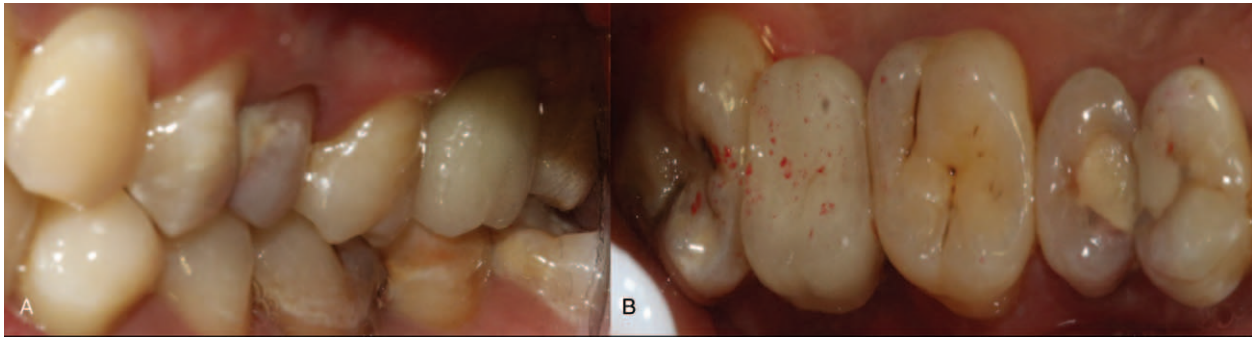


Figure 5. Zirconia ceramic crown was constructed. Buccal view of the final prosthesis (A) and occlusal view of the final prosthesis (B).

ISQ = 77.2 at 10 months after surgery. The mucosal integrity and osteogenesis of the maxillary sinus floor were observed through 3D reconstruction. These findings indicated that the implant demonstrated good stability and excellent osteogenic effect around the implant.

In conclusion, immediate implant and endoscope-guided sinus floor elevation through the transcresal approach with PRF as the only grafting material is viable in periapical infected sites with RBH < 1 mm. The advantages of PESS are as follows: immediate implantation avoids bone loss, transcresal approach reduces, bone and soft tissue injury, PRF promotes tissue healing, postoperative adverse reactions of patients are reduced; and the indications of the treatment of transcresal sinus floor elevation are expanded.

Author contributions

Conceptualization: Hanchi Wang, Yanmin Zhou.

Data curation: Xinxin Ding.

Funding acquisition: Yanmin Zhou.

Methodology: Jinghui Zhao.

Resources: Wanqi Yu.

Software: Jia Wang.

Writing – original draft: Hanchi Wang, Jinghui Zhao.

Writing – review & editing: Hanchi Wang, Jia Wang, Tianqi Guo, Yanmin Zhou.

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