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Case report

Crestal approach sinus floor elevation in atrophic posterior maxilla using only platelet rich fibrin as grafting material: A computed tomography evaluation of 2 cases

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ABSTRACT

We present here the case report of two patients undergoing sinus floor elevation for atrophic maxilla by the crestal approach using only platelet-rich fibrin as a grafting material. Hydroxy apatite-coated, tapered implants were inserted simultaneously in extremely atrophic maxillae with residual bone heights of 3.7 mm (Case 1) and 1.4 mm (Case 2). Both implants achieved primary stability and were successfully loaded after 6 months of healing. Six and 12-month follow-up computed tomography scans showed the implants to have embedded into newly created bone and apical relocation of the sinus floor. Findings from both cases suggest that this procedure, using only platelet-rich fibrin as a grafting material, is suitable for use in atrophic maxillae. More patients and longer follow-up are needed to investigate the reliability of this technique.

1. Introduction

In 1994, Summers introduced a technique, osteotome mediated sinus floor elevation (OSFE) [1], which was less invasive than previously employed procedures for sinus floor elevation. In this approach, the Schneiderian membrane and the bony floor of the sinus are elevated with osteotomes employing a crestal approach, without preparation of a lateral window. Grafting material is traditionally used in combination with this procedure to augment bone volume, thereby providing more support for the implant [2,3]. However, there is no consensus as to the advantages of a bone graft at the apical portion of the implant [4–7].

Recently, the possibility of a sinus lift procedure without grafted material has become a source of considerable controversy [8–10]. In a closed cavity such as a lifted sinus, the osteogenic potential of the bone and sinus membrane is highly protected and thus quite efficient [5,11]. The key rationale behind omitting the graft material is to maintain the Schneiderian membrane in the highest possible position using simultaneous implantation. Implants are stabilized for the residual bone height (RBH), and their tips maintain the membrane at an adequate height by functioning essentially as tent pegs. The main problem of this approach is implant instability in cases with an atrophic maxilla. Moreover, this technique requires virtually perfect membrane lifting, with neither membrane tears nor perforations, although a greater protruding implant length may increase the risk of sinus membrane perforation in cases with an atrophic maxilla.

Recently, platelet-rich fibrin (PRF), a second generation platelet concentrate [12–14], has come to be used as grafting material to accelerate wound healing and to provide membrane protection during elevation and implant insertion [15–18]. To date, only two reports [17,18] have documented OSFE using PRF as the sole grafting material. Diss et al. [17] documented changes in the apical bone levels of implants inserted with an average RBH of 6.6 mm. Toffler et al. [18] reported on early healing for localized sinus augmentation with simultaneous implant insertion with an average RBH of 6.7 mm. Both reports described a noticeable bone gain and stated that this procedure appears to yield highly predictable results.

Herein, we address the application of this technique in two patients with atrophic posterior maxillae. Both patients had less RBH than previously reported cases with such atrophy. In addition, unlike earlier reports relying solely on X-ray evaluation, the results obtained in these two cases were examined in detail and both were followed-up with computed tomography (CT) scans, cone-beam (in Case 1) and medical (in Case 2) CT scans.

☆ AsianAOMS: Asian Association of Oral and Maxillofacial Surgeons; ASOMP: Asian Society of Oral and Maxillofacial Pathology; JSOP: Japanese Society of Oral Pathology; JSOMS: Japanese Society of Oral and Maxillofacial Surgeons; JSOM: Japanese Society of Oral Medicine; JAMI: Japanese Academy of Maxillofacial Implants.

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2. Case report

Informed consent was obtained from both patients before the application of the technique.

2.1. PRF preparation

PRF membranes were prepared as described by Dohan et al. [14] and Choukroun et al. [15]. Before surgery, 20 mL (2 tubes) of whole blood were drawn into 10 mL glass tubes without anticoagulant and immediately centrifuged at 400 × *g* for 10 min. Platelets were immediately activated, thus triggering a coagulation cascade. The result was a fibrin clot located in the middle of each tube (Fig. 1A).

Each clot was removed from the tube and separated from the red blood cell base with pliers (Fig. 1B). The clots were gently pressed between 2 sterile compresses to obtain an autologous fibrin membrane (Fig. 1C). Two membranes were thus generally produced for the treatment of each sinus.

2.2. Case 1

A 63-year-old Japanese female, who desired dental implant prosthesis treatment for the left molar region of the maxilla, was managed as a private practice client. CT scans obtained before surgery showed thin residual bone only 3.7 mm in height. Under local anesthesia, a mid-crestal incision was made at the anticipated site of the implant. Buccal and palatal mucoperiosteal flaps were reflected employing a full thickness approach. Then, 1.6- and 2.2-mm drills, at a maximum cutting speed of 800 rpm, were used for site preparation to within approximately 1 mm of the sinus floor. In other words, drilling ceased leaving at least 1 mm of hard tissue coronal to the sinus floor. Then, a 2.2 mm in diameter osteotome (BOSTOME, KYOCERA Medical Corporation, Osaka, Japan) was used to upfracture the sinus floor. One PRF membrane was placed on the bone wall and carefully pushed into the sinus cavity (Fig. 1D). The sinus membrane was thereby separated from the bone and lifted with a piece of the broken sinus floor (Fig. 1E). Next, another PRF membrane was placed in the space underneath the lifted sinus membrane to cover and thereby protect the released sinus membrane. After PRF placement and elevation of the sinus membrane, bone spreaders (BOS Bone Spreader, KYOCERA Medical Corporation) were used instead of the final drill to widen the prepared hole by condensing the residual bone.

A 4.2 mm in diameter, 10 mm in length hydroxy apatite (HA)-coat tapered implant (POI EX, KYOCERA Medical Corporation) was installed with an insertion torque of approximately 35 N-cm with forward and backward rotation and good implant stability was obtained. After cover screw connection, the flap was repositioned and sutured.

After surgery, the patient received oral antibiotics for 6 days, and nonsteroidal analgesics for 5 days. The patient had a good postoperative response, and there was no hemorrhage from the right side of the nose.

Six months postoperatively, the implant had an abutment placed at 25 N-cm. An impression was taken, and the final restoration was delivered 2 weeks later.

Fig. 2 shows panoramic radiographs obtained before and after implant insertion. Newly formed mineralized tissue is clearly visible on the 12- and 18-month follow-up radiographs.

2.2.1. CT evaluation (Fig. 3A–D)

CT scans obtained before surgery showed thin residual bone with a height of only 3.7 mm. Hounsfield unit (HU) values at the residual bone and sinus cavity were 1840 (dense cortical bone [19]) and −1023 (air [19]), respectively.

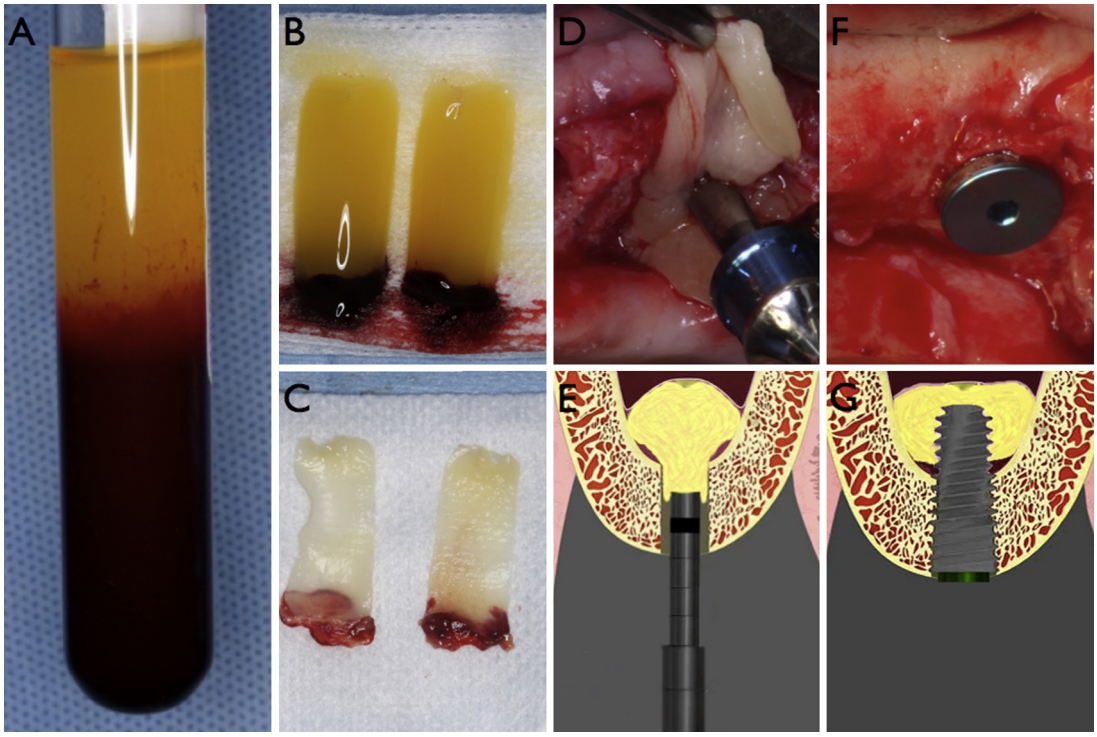

Fig. 1. Blood centrifugation immediately after collection results in a structured and resistant fibrin clot in the middle of the tube, just between the red corpuscles at the bottom and acellular plasma at the top (A). After collection of the PRF itself (B), resistant autologous fibrin membranes are easily obtained by forcing serum out of the clot (C). One PRF membrane was placed on the bone wall and carefully pushed into the sinus cavity (D). The sinus membrane was thereby separated from the bone and lifted with a piece of the broken sinus floor (E) After PRF placement and elevation of the sinus membrane, the HA-coated tapered implant was inserted (F). The implant served as tent pegs to maintain the bone regeneration space (G).