ITI Treatment Guide

Editors:
S. Chen, D. Buser, D. Wismeijer

ITI International Team for Implantology

Authors:
H. Katsuyama, S. S. Jensen

Volume 5

Sinus Floor Elevation Procedures

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The ITI Mission is ...

"... to promote and disseminate knowledge on all aspects of implant dentistry and related tissue regeneration through education and research to the benefit of the patient."

Preface

Dental implants are routinely used throughout the world to replace missing teeth. A vast body of evidence now supports this treatment as a safe and reliable option for the majority of patients. In many clinical situations, however, inadequate bone volume precludes the placement of needed implants. The posterior maxilla is one region of the mouth where insufficient bone is a frequent occurrence.

The floor of the maxillary sinus often lies in close proximity to the roots of the posterior teeth. Dynamic bone remodeling takes place after teeth are extracted, often reducing bone height and bone width and leading to vertical resorption of the alveolar ridge. This presents the clinician with significant challenges in rehabilitating this region of the dental arch.

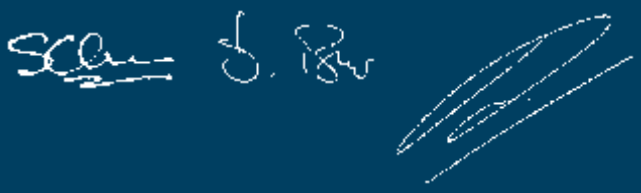
Today, bone grafts and bone substitutes are successfully used to augment the bone volume of the floor of the maxillary sinus. Volume 5 of the ITI Treatment Guide series provides evidence-based data and practical information related to sinus floor elevation procedures.

Strong emphasis has been placed on proper case selection, based on a comprehensive clinical and radiological examination of the patient. Supported by the outcomes of the 4th ITI Consensus Conference held in 2008, an analytical review of the literature underpins the discussion on treatment options and on the advantages and disadvantages of the different approaches available.

The book includes 13 case presentations illustrating the clinical procedures and outcomes of the transcrestal and the lateral window techniques for sinus floor elevation. A DVD is also available to illustrate treatment procedures as well as potential complications and their management.

Volume 5 of the ITI Treatment Guide series will be of great benefit to clinicians in managing patients requiring dental implants in the atrophic posterior maxilla.

Stephen Chen Daniel Buser Daniel Wismeijer



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Dr. Yoji Kamiura
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Dr. Kazutoshi Nakajima
Dr. Yasushi Nakajima
Dr. Kotaro Nakata
Dr. Tsuneyuki Tsukioka
Dr. Eiju Sen

Editors and Authors

Editors:

Stephen Chen, MDSc, PhD
223 Whitehorse Road
Balwyn, VIC 3123, Australia
E-mail: schen@balwynperio.com.au

Daniel Buser, DDS, Dr med dent
Professor and Chairman
Department of Oral Surgery and Stomatology
School of Dental Medicine
University of Bern
Freiburgstrasse 7
3010 Bern, Switzerland
E-mail: daniel.buser@zmk.unibe.ch

Daniel Wismeijer, DDS, PhD
Professor and Chairman Department
of Oral Function and Restorative Dentistry
Head Section Oral Implantology and
Prosthetic Dentistry
Gustav Mahlerlaan 3004
1081 LA Amsterdam, Netherlands
E-mail: d.wismeijer@acta.nl

Authors:

Hideaki Katsuyama, DDS, PhD
MM Dental Clinic, Center of Implant Dentistry (CID)
3F, 3-3-1 Nishi-ku, Minato-mirai
220-0012 Yokohama, Japan
E-mail: katsuyamah@aol.com

Simon Storgård Jensen, DDS
Department of Oral and Maxillofacial Surgery
Copenhagen University Hospital
Blegdamsvej 9
2100 København Ø, Denmark
E-mail: simon.storgaard@jensen.mail.dk

Contributors

Simon Storgård Jensen, DDS
Department of Oral and Maxillofacial Surgery
Copenhagen University Hospital
Blegdamsvej 9
2100 København Ø, Denmark
E-mail: simon.storgaard@jensen.mail.dk

Bjarni Pjetursson
Professor and Chairman
Department of Reconstructive Dentistry
Faculty of Odontology
University of Iceland
Vatnsmyrarvegi 16
101 Reykjavik, Iceland
E-mail: bep@hi.is

Vivianne Chappuis, Dr med dent
Department of Oral Surgery and Stomatology
School of Dental Medicine
University of Bern
Freiburgstrasse 7
3010 Bern, Switzerland
E-mail: vivianne.chappuis@zmk.unibe.ch

Ali Tahmaseb, DDS
Department of Oral Function and
Restorative Dentistry
Section of Oral Implantology and
Prosthetic Dentistry
Academic Center for Dentistry Amsterdam (ACTA)
Gustav Mahlerlann 3004
1081 LA Amsterdam, Netherlands
E-Mail: ali@tahmaseb.eu

Christiaan ten Bruggenkate
Professor
The VU University Medical Center / ACTA
De Boelelaan 1118
1081 HV Amsterdam, Netherlands
E-mail: chr.bruggenkate@vumc.nl

Daniel Buser, DDS, Dr med dent
Professor and Chairman
Department of Oral Surgery and Stomatology
School of Dental Medicine,
University of Bern
Freiburgstrasse 7
3010 Bern, Switzerland
E-mail: daniel.buser@zmk.unibe.ch

Robert A. Levine, DDS
Pennsylvania Center for Dental Implants and
Periodontics, One Einstein Center, Suite 211-212
9880 Bustleton Avenue
Philadelphia, PA 19115, USA
E-mail: rlevine@padentalimplants.com

Paolo Casentini, Dr med dent
Narcodont
Piazza S. Ambrogio 16
20123 Milano, Italy
E-mail: paolocasentini@fastwebnet.it

Luca Cordaro, MD, DDS, PhD
Head Department of Periodontics
and Prosthodontics, Eastman Dental Hospital
and Studio Associato Cordaro
00198 Roma, Italy
E-mail: lucacordaro@usa.net

Waldemar D. Polido, DDS, MS, PhD
Oral and Maxillofacial Surgery/Implant Dentistry
Contento – Odontologia Especializada
R. Marcelo Gama, 1148
Porto Alegre – RS – Brazil
E-mail: cirurgia.implantes@polido.com.br

Eduardo Marini, DDS, MS
Oral and Maxillofacial Surgery/Implant Dentistry
R. General Osório, 329/301
Bento Gonçalves – RS – Brazil
E-mail: emarini@italnet.com.br

Sanja Umanjec-Korac, DDS, MSc
Department of Oral Function and
Restorative Dentistry, Section of Oral Implantology
and Prosthetic Dentistry
Academic Center for Dentistry Amsterdam (ACTA)
Gustav Mahlerlann 3004
1081 LA Amsterdam, Netherlands
E-mail: s.korac@acta.nl

Timothy Head, DDS
Vendôme Surgical Services
5122 Sherbrooke St. West, Suite 201
Montréal, QC, H4A 1T1, Canada
E-mail: thead@maxillovendome.ca

Matteo Chiapasco, MD
Professor, Head Unit of Oral Surgery
School of Dentistry and Stomatology
San Paolo Hospital, University of Milan
Via Beldiletto 1/3
20142 Milano, Italy
E-mail: matteo.chiapasco@unimi.it

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1 Introduction

H. Katsuyama, S. S. Jensen

Continuous advances in the field of implant dentistry have provided clinicians with various treatment options to facilitate the placement of dental implants in patients with vertical bone deficits in the posterior maxilla. Today, one of the most common ways to compensate for inadequate vertical bone height is to elevate the sinus floor. Often employed in combination with bone grafts and bone substitutes, sinus floor elevation procedures are of moderate to high complexity, entailing a significant risk of complications.

In August of 2008, the ITI held the 4th ITI Consensus Conference to discuss a number of current issues in implant dentistry. One focus was on bone augmentation procedures in localized defects and on the clinical efficacy of the different protocols employed with the many grafting materials and techniques available today. The results of this conference were published in a supplement to the International Journal of Oral & Maxillofacial Implants in 2009.

The present fifth volume in the ITI Treatment Guide series summarizes the findings and consensus statements of the 4th ITI Consensus Conference and provides an up-to-date overview of the literature on sinus floor elevation published in the past four years. Reinforced by this scientific evidence, emphasis is placed on clinical recommendations and guidelines for evaluating possible patients for sinus floor elevation and for choosing the appropriate treatment approach and augmentation protocol. All clinical procedures are illustrated and supported by detailed case reports.

As with the preceding four volumes of the ITI Treatment Guide, the authors hope that this fifth volume will prove a valuable resource and reference for clinicians placing implants in patients requiring sinus floor elevation to minimize the risk of complications and to ensure predictable and stable long-term results.

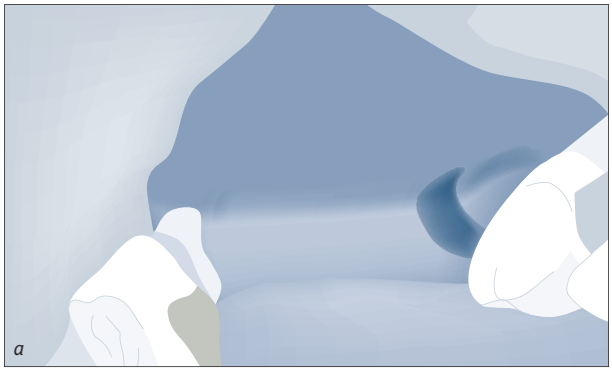


Fig 27a Exposed lateral bone surface of the planned window site.

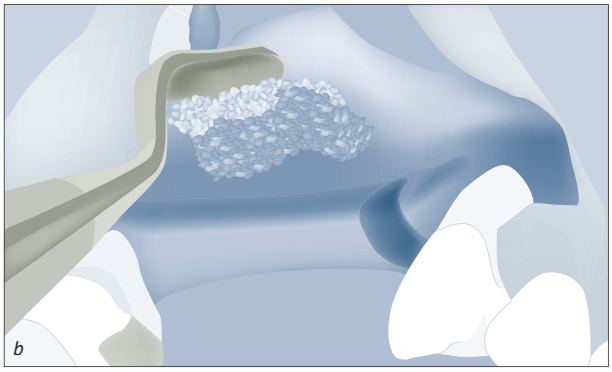


Fig 27b Harvesting of autograft chips with a bone scraper.

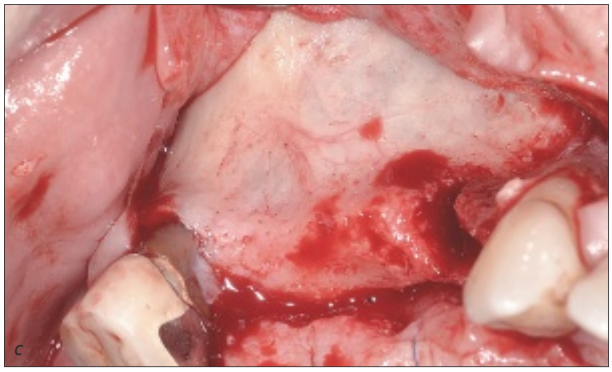


Fig 27c Following flap elevation, the facial bone wall is extensively exposed to harvest bone chips with a bone scraper.

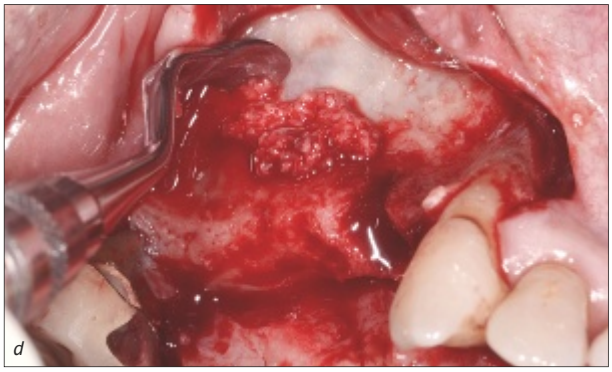


Fig 27d The sharp bone scraper is able to harvest autogenous bone chips of 1.5 to 2.0 mm in size.

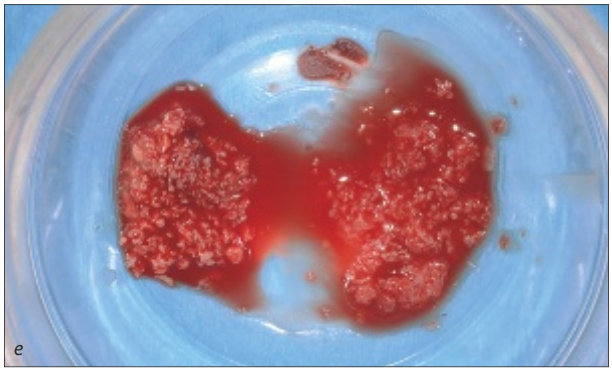


Fig 27e The collected autograft chips are stored in a sterile glass dish.

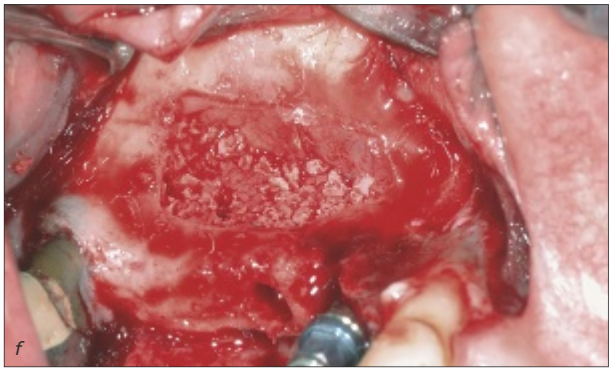


Fig 27f Mixed with DBBM particles, the composite graft is applied in the created defect following elevation of the Schneiderian membrane.

4.3.4 Harvesting Site

Autogenous bone for grafting should be harvested from intraoral rather than extraoral sites, as postoperative discomfort and complications will be less severe (Chiapasco et al. 2009). Whenever possible, bone should be harvested locally from the surgical area. The large area of exposed facial bone surface allows the harvesting of large amounts of autograft chips with specially designed bone scrapers and other bone collection devices. They are used on the lateral bone surface of the planned window site to harvest bone chips (Figs 27a-f). If needed, the harvesting can be extended to the tuberosity area. Autologous bone chips harvested in this way are combined with xenograft or allograft if a composite graft is preferred by the surgeon. When a large volume of autogenous bone is required (e.g. for bilateral augmentation of severely pneumatized sinuses), sufficient amounts of bone can usually be harvested from the mandible. Harvesting from extraoral sites like the iliac crest becomes necessary when larger amounts of bone are required (e.g. for additional onlay grafts in the horizontal and/or vertical dimensions). The ramus and symphysis are most commonly selected as intraoral donor sites.

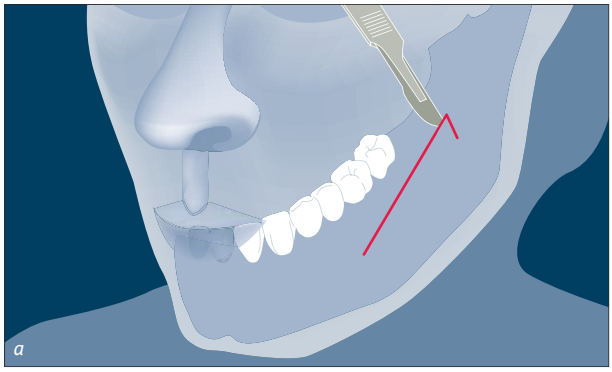


Fig 28a Incision line for ramus harvesting.

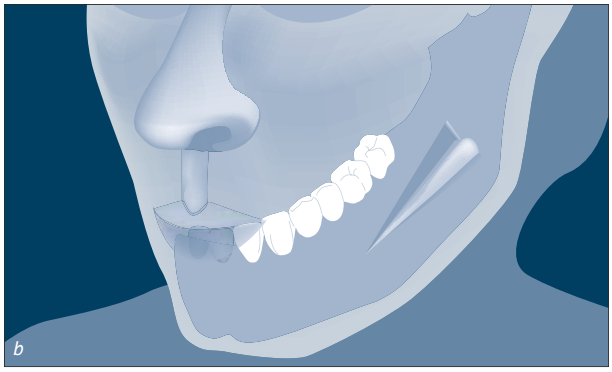


Fig 28b Flap elevation for ramus harvesting.

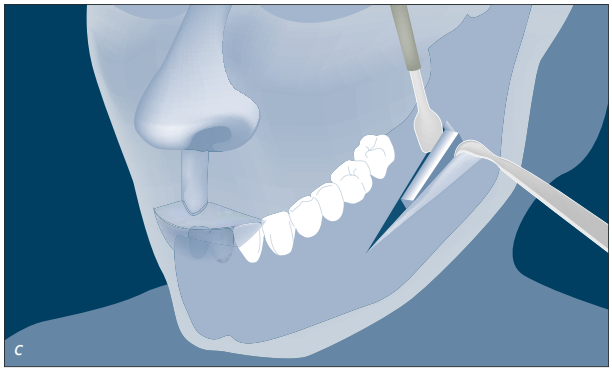
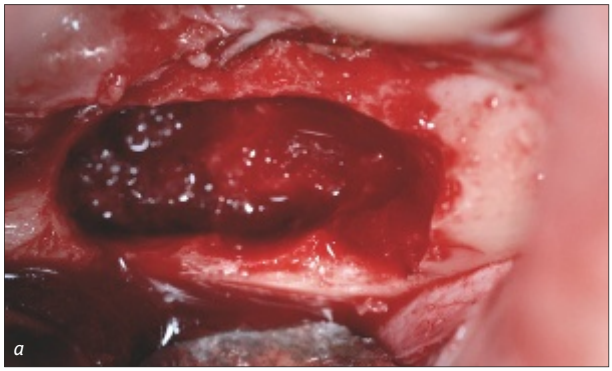
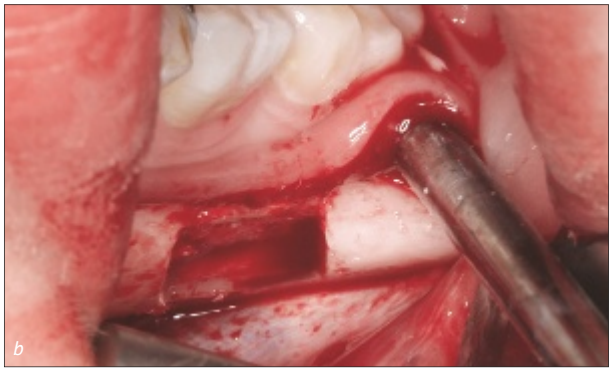


Fig 28c Removal of bone block.





Figs 29a-b Bone harvesting from the mandibular ramus. In this specific case, bone harvesting was performed in combination with guided bone regeneration (GBR). For bone harvesting only, the incision line would be placed far buccally. While a CT scan is not required for bone harvesting from the ramus, anatomical limitations should be respected so as not to damage the nerve and vessels. Once bone has been harvested from the ramus, a collagen sponge or some other hemostatic biomaterial is applied to avoid continued bleeding. The bone volume harvested from the ramus of this patient was sufficient (a). Bone graft material could be harvested as bone chips or bone block (b).

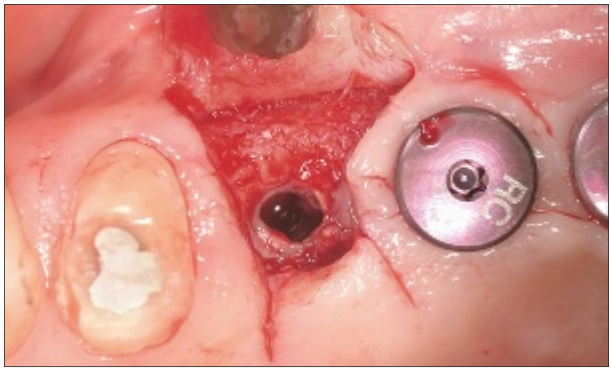


Fig 29 Second-stage surgery to expose the implant at site 25, conducted 11 weeks after placement. Papilla-sparing incisions were used. During the same visit, a reverse-torque test at 35 Ncm was successfully completed.

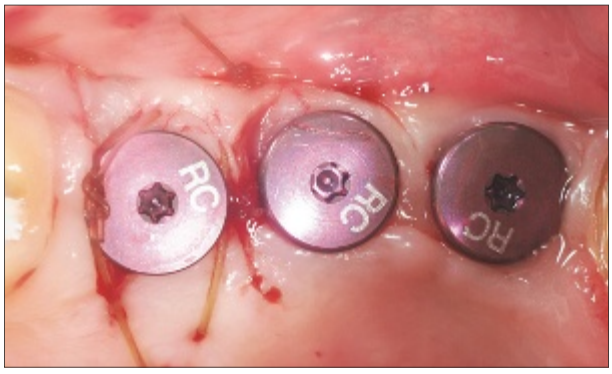


Fig 30 After attaching an RC conical healing abutment (6 × 6 mm) to the implant at site 15, the tissue was sutured. Impression-taking was scheduled for 3–4 weeks later.

After a healing period of 11 weeks, a second-stage procedure was conducted to expose the implant at site 25. At the same visit, the bottle-shaped healing abutments were replaced with conical (6 × 4 mm) ones to "stretch" the tissue to develop the "transition zone" for final impressions. Papilla-sparing incisions were used mesially and distally, with an additional palatocrestal incision to maintain keratinized gingiva on the facial aspect. Prior to placing the healing abutments, the bone was tested for each implant, using the reverse-torque test at 35 Ncm with Regular CrossFit (RC) sterile implant carriers and a Straumann torque driver (Figs 29 and 30). The soft tissue around implant 25 was closed with a 4-0 resorbable chromic gut suture. The radiographic assessment confirmed final bone healing. A waiting period of 3 to 4 weeks would permit adequate soft tissue healing for the final impressions.

Prosthetic Phase

The patient returned to her restorative dentist 4 weeks after the second-stage procedure. This visit was used for final impressions using a closed tray technique. Subsequently the laboratory-customized stock abutments for 25 and 26 plus the waxed 27 were scanned for custom abutments using CAD/CAM technology (Figs 31 to 33). The case was inserted as single crowns and cemented with permanent cement (Figs 34 to 39).

Fig 31 Scanned laboratory wax-up of customized milled abutment for 27 (Etkon; Straumann, Basel, Switzerland).

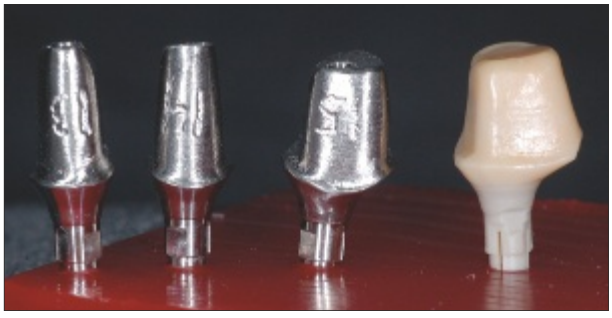


Fig 32 Prosthetic abutments: 25 and 26 were customized stock RC abutments; 27 was a custom abutment based milled on the basis of a wax-up (far right) which was fabricated (Etkon; Straumann AG, Basel, Switzerland).

Fig 33 Good restorative position of the final abutments; non-reflective scan paste was applied to all abutments for scanning of the final case (Etkon; Straumann, Basel, Switzerland).

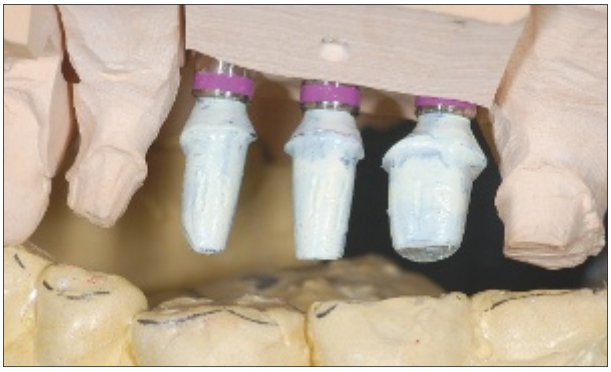


Fig 34 A restoratively driven surgical guide facilitated the establishment of appropriate emergence profiles and implant depths.

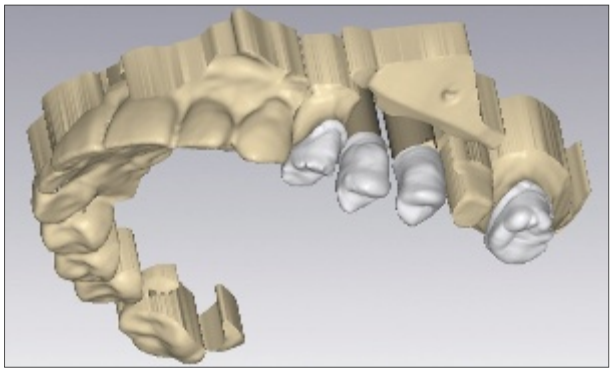


Fig 35 Final design with zirconia copings at sites 24, 25, 26 and 28. Ceramic veneers were to be added in the laboratory. The restoration at site 27 was custom-milled after being designed as noted above.

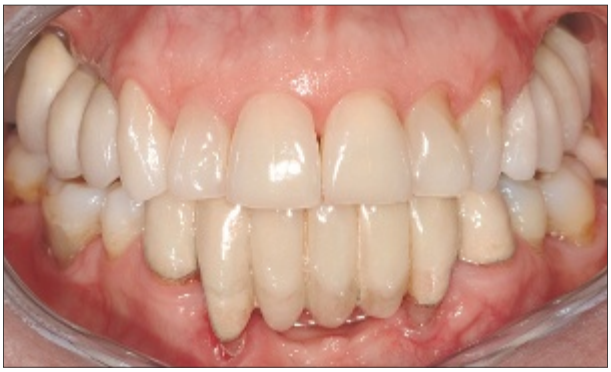


Fig 36 Final restorations in the maxillary posterior segments.

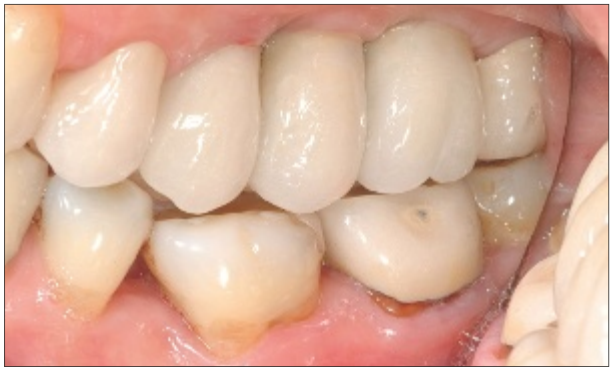


Fig 37 Final clinical view of the single crowns at sites 24, 25, 26, 27, and 28.

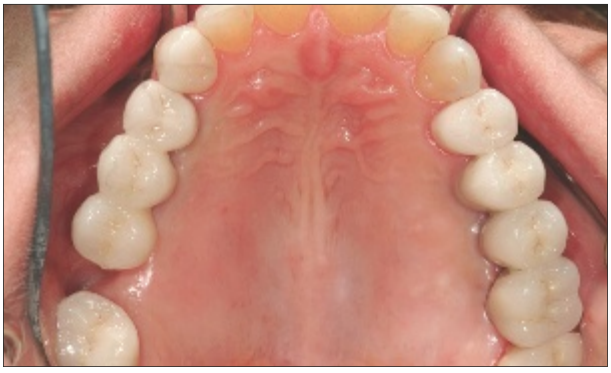


Fig 38 Occlusal view of the final outcome.

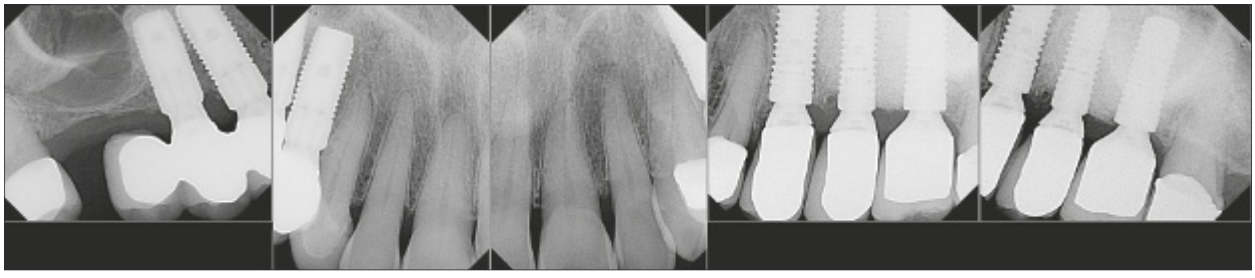


Fig 39 Final radiographs obtained after 3 months.

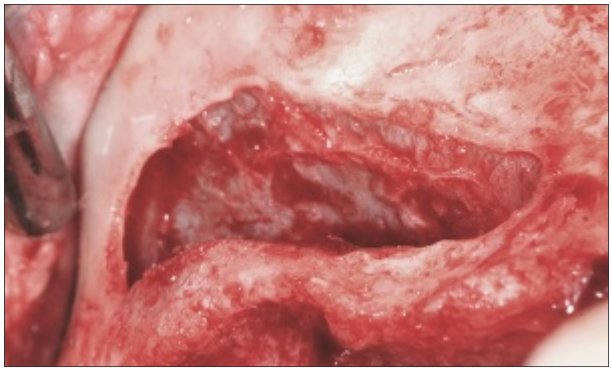


Fig 4 A lateral window was prepared using the routine technique with rotational devices and traditional instruments. No membrane perforation was observed.

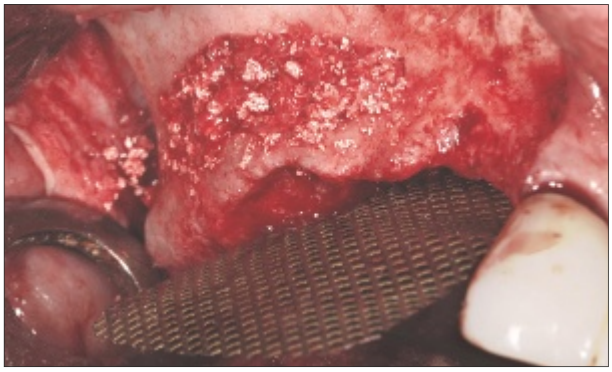


Fig 5 A mixture of autogenous bone and β-TCP was grafted into the sinus cavity.

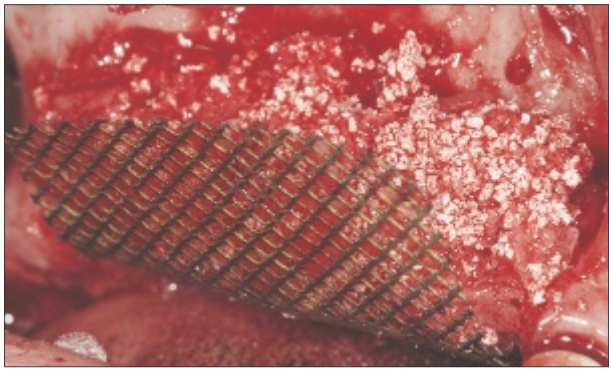


Fig 6 Following horizontal and vertical placement of the grafting material, a titanium mesh was applied and trimmed for space preservation and stabilization of the composite autogenous bone and β-TCP graft.

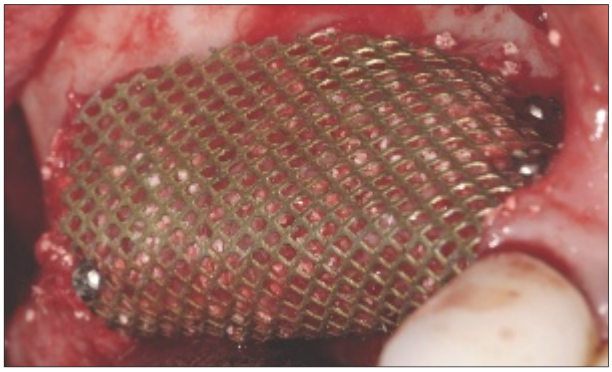


Fig 7 Fixation of the titanium mesh with screws.

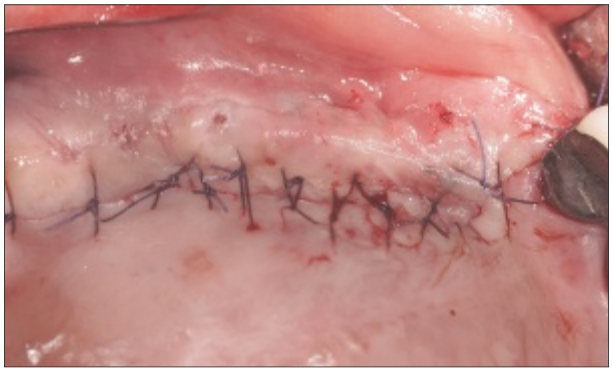


Fig 8 Primary wound closure was achieved using a releasing incision into the periosteum and an appropriate flap design. Vicryl suture material was used for secure flap adaptation.

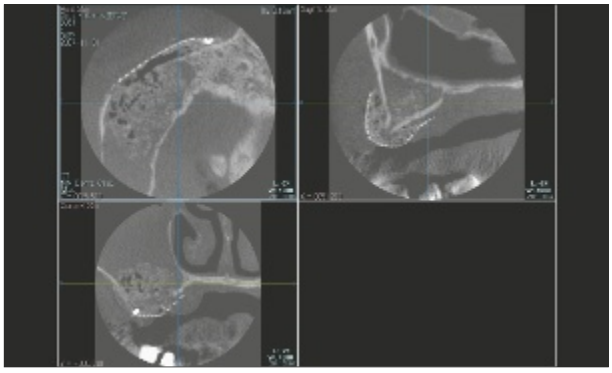


Fig 9 CBCT scan obtained after SFE and three-dimensional bone augmentation. Three-dimensional conditions were found to be ideal at the augmented site.

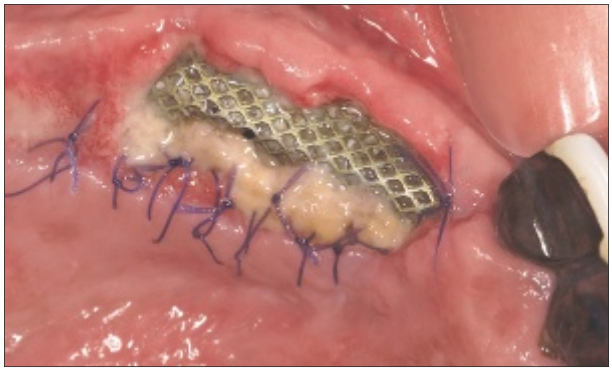


Fig 10 After 1 week, a soft tissue dehiscence with necrotic mucosa was observed. Oral rinses were locally applied to prevent infection, including an antiseptic (benzethonium chloride 0.2%; Nippon Shika Yakuhin, Yamaguchi, Japan) and an antibiotic gel (gentamicin sulfate 0.1%; MSD KK, Tokyo, Japan).

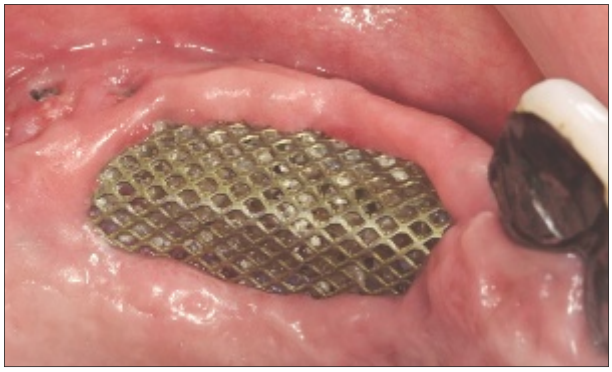


Fig 11 Clinical view 2 months after surgery. Note the exposure both of the titanium mesh and of the fixation screws located buccally. Oral rinses were applied, including an antiseptic (benzethonium chloride 0.2%; Nippon Shika Yakuhin, Yamaguchi, Japan) and an antibiotic gel (gentamicin sulfate 0.1%; MSD KK, Tokyo, Japan).

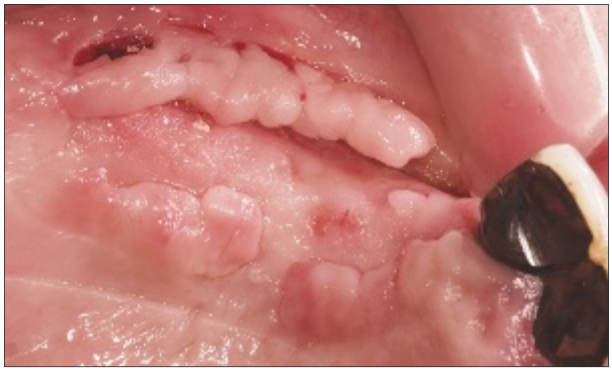


Fig 12 This view was obtained 1 month after removal of the titanium mesh, which was removed 3 months after surgery. While soft tissue covering the raw surface is apparent under the titanium mesh, the soft tissue situation at the site is suboptimal.

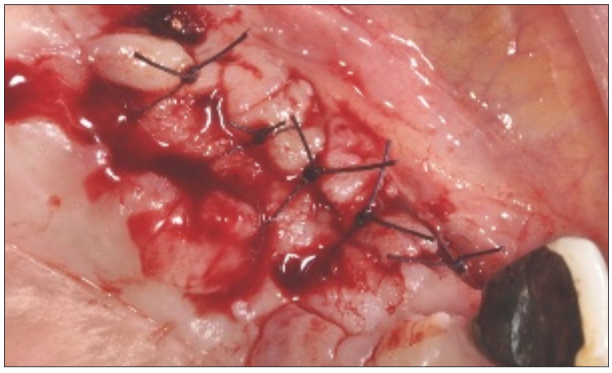


Fig 13 Soft tissue correction and implant placement was simultaneously performed 5 months after initial surgery and 2 months after removal of the titanium mesh. A submerged healing protocol was used.

A dehiscence of the surgical wound, but without any signs of infection, was noted soon after the procedure (Fig 10). There were no signs of infection, but the patient was instructed to exercise prophylaxis by applying an antibiotic gel to the exposed titanium mesh. She was also told to use oral rinses of an antiseptic twice daily (benzethonium chloride 0.2%; Nippon Shika Yakuhin, Yamaguchi, Japan) and an antibiotic gel (gentamicin sulfate 0.1%; MSD KK, Tokyo, Japan). The titanium mesh was left in situ for maturation of the underlying tissue. Periodic recall visits were scheduled to verify the continued absence of infection. At the 2-month follow-up, the center of the titanium mesh and the fixation screw on the buccal aspect were exposed without showing any signs of infection (Fig 11). At the 3-month follow-up, the titanium mesh was removed. Newly formed tissue was present beneath the mesh. While the dehiscence wound was surgically corrected to ideal tissue form at this time, wound healing was less than ideal and the dehiscence recurred. Healing as such was uneventful (Fig 12). Another 2 months later, an implant was placed in the augmented site, with soft tissue plastic surgery being performed simultaneously. A submerged healing protocol was used (Fig 13). Due to the repeated soft tissue surgery, the mucosa was fragile and soft tissue healing less than ideal around the implants, particularly on the buccal aspect