Int J Clin Exp Med 2014;7(6):1607-1610
www.ijcem.com /ISSN:1940-5901/IJCEM0000598

Case Report

Sinus floor augmentation using miniscrew and in situ hardening biomaterial: method and case report

Wilfried Engelke[1], Ramón Fuentes[2], Víctor Beltrán[1,2]

[1]*Department of Oral and Maxillofacial Surgery, School of Dentistry, Georg-August-University, Göttingen, Germany;* [2]*CIMOFIR Research Center, Dental School, Universidad de La Frontera, Temuco, Chile*

Received April 22, 2014; Accepted May 30, 2014; Epub June 15, 2014; Published June 30, 2014

Abstract: Sinus floor augmentation in case of severe pneumatization is a challenge for surgical management. We present a low invasive endoscopically assisted technique facilitating the stabilization of augmentation material in the subantral space. The technique consists of (1) trepanation of the lateral sinus wall with tunnelling of the sinus membrane and creation of the subantral space, (2) subantroscopically assisted insertion of a mini screw, (3) precise stepwise placement of in situ hardening graft material with antroscopic control. Based on a case example, details of the procedure are presented. The technique provides a minimally invasive treatment for difficult and instable augmentation sites.

Keywords: Bone grafting, maxillary sinus, sinus augmentation, endoscopy

Introduction

Implant placement in the edentulous maxilla often represents a clinical challenge because of insufficient bone height and width after crestal bone resorption and a severe maxillary sinus pneumatization [1]. Stabilization of grafted bone material is an essential part of the technique of bone grafting. This crucial element has been inadequately addressed in sinus lift procedures [2]. The same applies to the use of biomaterials for sinus augmentation when large volumes are applied and a delicate Schneiderian membrane is present [3, 4]. Support endoscopy [5, 6], allows a minimally invasive lateral approach to the sinus floor by subantroscopic laterobasal tunneling. The augmentation material is placed directly underneath the Schneiderian membrane without preparation of the bony sinus wall in a trap door manner [7]. However with the increasing amount of graft material placed below the Schneiderian membrane, the risk of unintended displacement increases.

In order to optimize sinus floor augmentation under minimal invasive conditions, the present technical report describes an endoscopically assisted procedure using a mini screw and self hardening augmentation material for sinus floor augmentation.

Case report

A 43 year-old woman was referred for replacement of missing upper first and second molar. Indication for sinus floor augmentation right was given by an insufficient height of the implant site with less than 2 mm of vertical bone height (**Figure 1**). A crestal incision was made with a vestibular relief incision in the first premolar region. Using full thickness mucoperiosteal flap the anterobasal aspect of the sinus wall was exposed. A laterobasal trepanation was made directly anterior to the zygomatic buttress at the inferior aspect of the anterior sinus wall. A 5 mm trepanation of the laterobasal sinus wall is created for laterobasal tunnelling of the Schneiderian membrane. Endoscopic access is given to the tunnel (subantral space) below the Schneiderian membrane as well as to the maxillary sinus lumen via antroscopy (**Figure 2**).

Following the tunnel preparation, a self-tapping bone screw (Biomaterials, Seoul, Korea) is placed horizontally through the lateral sinus wall to protrude into the subantral space. The

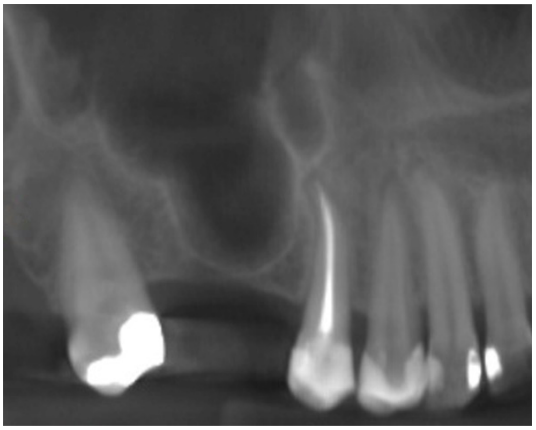

Figure 1. Preoperative Computed Tomography (CT) based panoramic view of the upper right molar site. Note the extended sinus pneumatization.

Figure 2. Antroscopy during laterobasal tunnel formation (Göttingen maxillary training phantome).

screw position following detachment of the Schneiderian membrane can be verified bidirectionally using 30 and 70 degree 2.7 mm Storz Hopkins scopes (Karl Storz, Tuttlingen, Germany) (**Figure 3**). The subantral space is filled with beta-tricalcium phosphate augmentation material (easy-graft CLASSIC, Degradable Solutions AG, Switzerland). The material is moldable and hardens within minutes upon contact with body fluids, forming a stable, porous scaffold. Antroscopic observation reveals that the miniscrew is covered completely by the augmentation material, and that the Schneiderian membrane has remained intact during the process of augmentation (**Figure 4**).

The mini screw removal was performed at 7 months and an implant was inserted in the molar zone (3, 75 mm diameter and 11, 5 mm length, SPI, Alpha Bio, Tel Aviv, Israel). A Computed Tomography (CT) was taken showing no signs of sinus pathology (**Figure 5**).

Discussion

Stabilization of augmentation material at the sinus floor is mandatory to avoid displacement during regeneration. A healthy Schneiderian membrane often may be too thin and fragile to provide roofing for the bone graft material [7]. Therefore, the use of membranes has been proposed to close Schneiderian membrane perforations [3]. Self hardening material as an alternative, consisting of polylactide “linker”, has been used in various indications [8]. The placement of titanium screws in conjunction with the in situ hardening material forms a stable complex resulting in a similar biomechanical situation as observed with bone graft material [2]. Thus even in case of large augmentation volumes or in conjunction with Schneiderian membrane repair biomechanically stable situation may be obtained to reduce the risk for implant loss, infectious complications or displacement of graft material. The application of screw supported bone graft material has the advantage, that membranes for material support may be omitted. However in case of large perforations of the Schneiderian membrane [9], the screw may serve as rescue technique to hold a pouch in place, which is formed by a resorbable membrane [3].

Endoscopic control via antroscopy as described in 1997 [10] is a valuable and low invasive procedure which serves to examine the extension of the subantral space, the location of the screw and intactness of the schneiderian membrane. Thus quality control, optimized view of the surgical field and precise placement of the graft material [11] can be achieved using the minimally invasive lateral access.

The technique reported here allows a precise visual guidance of the entire procedure, early

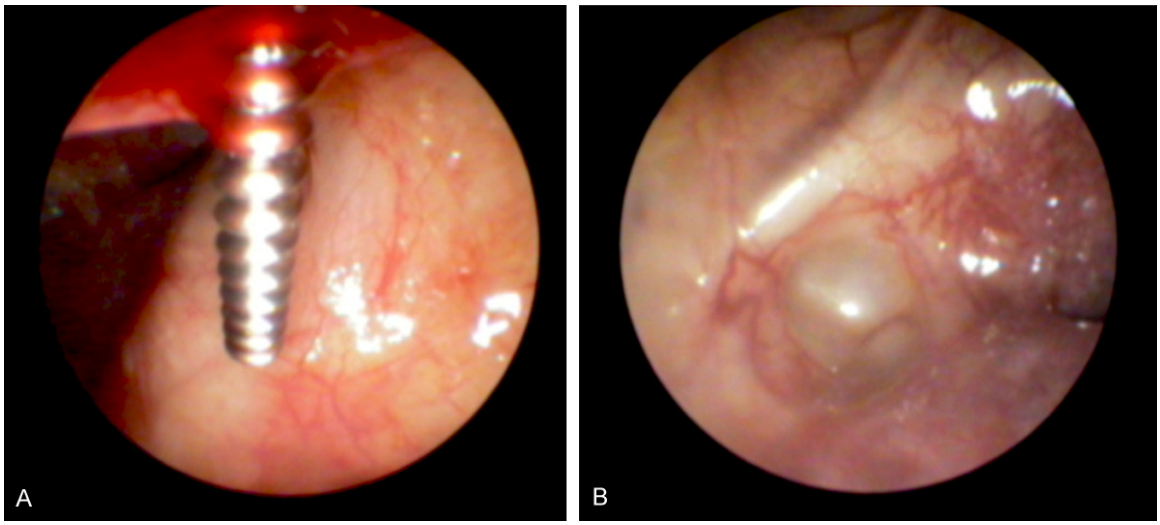

Figure 3. A: Miniscrew insertion through the lateral sinus wall (subantroscopic view); B: Antroscopic control of the mini screw placed below the Schneiderian membrane.

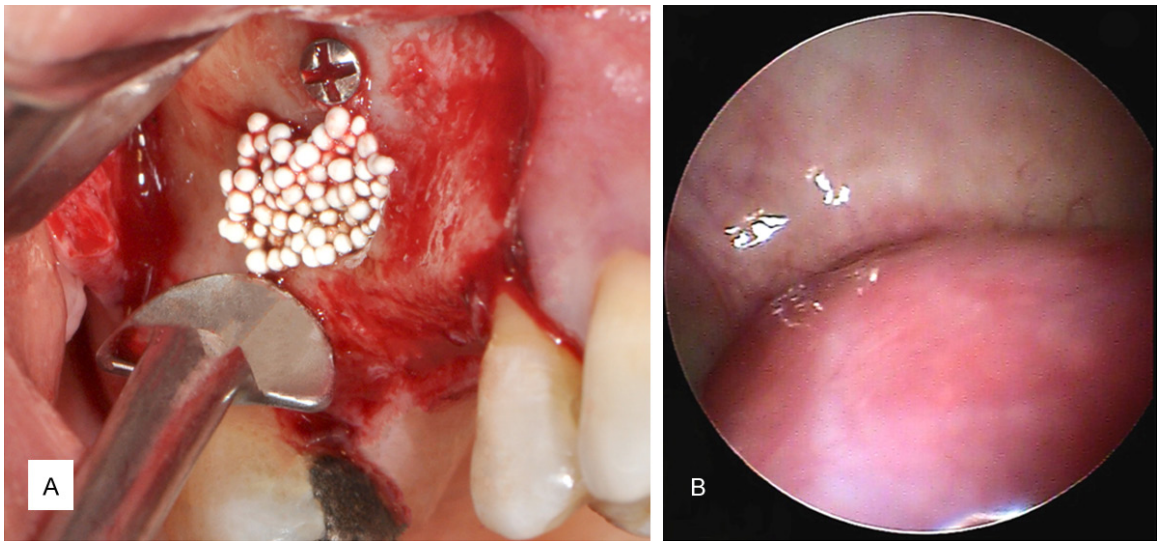

Figure 4. A: Final view of the trepanation following augmentation, support endoscope in situ; B: Antroscopic final control following of the sinus floor augmentation.

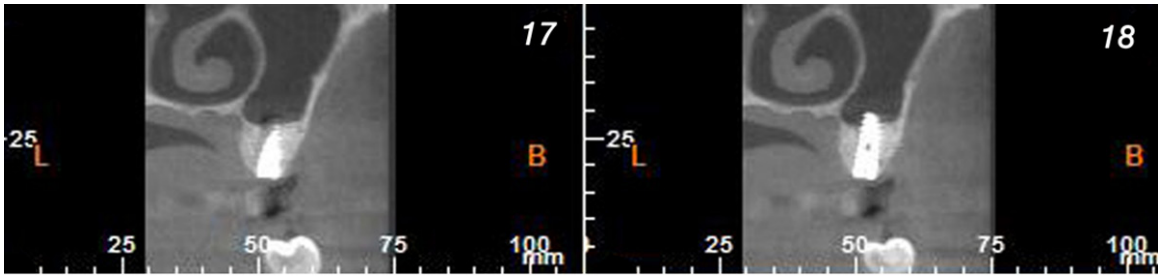

Figure 5. Postoperative Computed Tomography (CT), crossectional reformats (right, 17-18) showed the implant in the first molar zone, augmentation and schneiderian membrane without pathology.

detection of complications like rupture of the Schneiderian membrane, control of screw position and graft localization during and following the augmentation. In situ hardening material has the advantage to maintain its shape independent of the use of membranes. Miniscrews may be used optionally as stabilization aids and contribute to avoid graft displacement in case of a delicate Schneiderian membrane and/or circumscript perforations. Both components in turn facilitate the minimally invasive concept. The present modification contributes to quality control, prevention and management of complications and furthermore may be used as rescue technique in case of conventional lateral sinus augmentation.

Acknowledgements

This study was supported in part by Degradable Solution Company, Schlieren, Switzerland and the Universidad de La Frontera, Temuco, Chile.

Disclosure of conflict of interest

None.

Address correspondence to: Dr. Víctor Beltrán, CIMOFIR Research Center, Dental School, Universidad de La Frontera, Claro Solar N° 115 - Of. 420, Temuco 4781176, Chile. Tel: 56-45-2325775; E-mail: victor.beltran@ufrontera.cl

References

[1] Acocella A, Sacco R, Niardi P, Agostini T. Early implant placement in bilateral sinus floor augmentation using iliac bone block grafts in severe maxillary atrophy: a clinical, histological, and radiographic case report. J Oral Implantol 2009; 35: 37-44.

[2] Momtaheni DM, Schweitzer K, Muenchinger F. Technique for stabilization of autogenous cancellous bone grafts in sinus lift procedures. Oral Surg Oral Med Oral Pathol 1994; 78: 14-16.

[3] Testori T, Wallace SS, Del Fabbro M, Taschieri S, Trisi P, Capelli M, Weinstein RL. Repair of large sinus membrane perforations using stabilized collagen barrier membranes: surgical techniques with histologic and radiographic evidence of success. Int J Periodontics Restorative Dent 2008; 28: 9-17.

[4] Tabrizi R, Amid R, Taha Özkan B, Khorshidi H, Langner NJ. Effects of exposing dental implant to the maxillary sinus cavity. J Craniofac Surg 2012; 23: 767-769.

[5] Beltrán V, Fuentes R, Engelke W. Endoscopic visualization of anatomic structures as a support tool in oral surgery and implantology. J Oral Maxillofac Surg 2012; 70: e1-e6.

[6] Iwai T, Matsui Y, Hirota M, Tohnai I. Endoscopic removal of a maxillary third molar displaced into the maxillary sinus via the socket. J Craniofac Surg 2012; 23: e295-e296.

[7] Engelke W, Schwarzäller W, Behnsen A, Jacobs HG. Subantroscopic Laterobasal Sinus Floor Augmentation (SALSA): An Up-to-5 Year Clinical Study. Int J Oral Maxillofac Implants 2003; 18: 135-143.

[8] Gacic B, Todorovic L, Kokovic V, Danilovic V, Stojcev-Stajcic L, Drazic R, Markovic A. The closure of oroantral communications with resorbable PLGA-coated beta-TCP root analogs, hemostatic gauze, or buccal flaps: a prospective study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2009; 108: 844-850.

[9] Becker ST, Terheyden H, Steinriede A, Behrens E, Springer I, Wiltfang J. Prospective observation of 41 perforations of the Schneiderian membrane during sinus floor elevation. Clin Oral Implants Res 2008; 19: 1285-1289.

[10] Engelke W, Deckwer I. Endoscopically controlled sinus floor augmentation. A premiminary report. Clin Oral Implant Res 1997; 8: 527-531.

[11] Wiltfang J, Schultze-Mosgau S, Merten HA, Kessler P, Ludwig A, Engelke W. Endoscopic and ultrasonographic evaluation of the maxillary sinus after combined sinus floor augmentation and implant insertion. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2000; 89: 288-91.