

EUROPEAN JOURNAL OF **ORAL**  
**IMPLANTOLOGY**

---

*Official publication of the British Society of Oral Implantology (BSOI),  
the Italian Society of Oral Surgery and Implantology (SICOI),  
and the Danish Society for Oral Implantology (DSOI)*

**EJOI**

---



VOLUME 3 / ISSUE 3  
AUTUMN 2010

Tiziano Testori, Gabriele Rosano, Silvio Taschieri, Massimo Del Fabbro

# Ligation of an unusually large vessel during maxillary sinus floor augmentation.

## A case report



**Tiziano Testori, MD, DDS**  
Section of Implantology and Oral Rehabilitation (Head), Dental Clinic, IRCCS Galeazzi Orthopaedic Institute, Department of Health Technologies, Università degli Studi di Milano, Milano, Italy

**Gabriele Rosano, DDS**  
PhD Student and Tutor, Section of Endodontics (Assistant), Dental Clinic, IRCCS Galeazzi Orthopaedic Institute, Department of Health Technologies, Università degli Studi di Milano, Milano, Italy

**Silvio Taschieri, MD, DDS**  
Visiting Professor, Section of Endodontics (Head), Dental Clinic, IRCCS Galeazzi Orthopaedic Institute, Department of Health Technologies, Università degli Studi di Milano, Milano, Italy

**Massimo Del Fabbro, BSc, PhD**  
Researcher, Section of Oral Physiology (Head), Dental Clinic, IRCCS Galeazzi Orthopaedic Institute, Department of Health Technologies, Università degli Studi di Milano, Milano, Italy

**Correspondence to:**  
Dr Massimo Del Fabbro  
Università degli Studi di Milano  
Dipartimento di Tecnologie per la Salute  
IRCCS Istituto Ortopedico Galeazzi  
Via R. Galeazzi, 4  
20161 Milano, Italy  
Phone: +39 02 50319950  
Fax: +39 02 50319960  
Email:  
massimo.delfabbro@unimi.it

**Key words** *alveolar ridge augmentation, complications, dental implants, maxillary sinus, oral implants, sinus floor augmentation, vascularisation*

**Conflict-of-interest statement:** The authors state that they do not have any financial or personal relationships with people or organisations that could inappropriately influence the present paper.

**Purpose:** The purpose of the present case report was to document a maxillary sinus floor augmentation procedure involving ligation of a blood vessel with a nearly 3-mm diameter in the lateral wall of the maxillary sinus.

**Materials and methods:** A bilateral maxillary sinus floor augmentation procedure was performed in a 51-year-old healthy man. The preoperative computed tomography scan revealed a bony canal within the lateral maxillary sinus wall of the right as well as the left side close to the alveolar ridge.

**Results:** A vessel with a diameter of nearly 3 mm was identified during the sinus floor augmentation on the left side. The vessel was exposed and ligated. A vessel with a diameter of approximately 1 mm was identified on the right side and the sinus floor augmentation was performed without ligation. No complications were observed and the postoperative healing was uneventful.

**Conclusions:** Although accidental laceration of vessels with an unusually large diameter during maxillary sinus floor augmentation is not life-threatening, impaired visualisation may compromise the augmentation procedure, including the elevation of the Schneiderian membrane. Moreover, postoperative bleeding and formation of a haematoma may occur. Therefore, ligation of vessels with an unusually large diameter is recommended during maxillary sinus floor augmentation to minimise intra- and postoperative complications.

## ■ Introduction

Maxillary sinus floor augmentation using autogenous bone or various bone substitutes is frequently used before or concomitant with implant installation to increase the alveolar bone height in patients

with atrophy of the posterior part of the maxilla<sup>1-4</sup>. Various complications may compromise the outcome of the surgical procedure and severe haemorrhage may occur as a result of arterial injury<sup>5-9</sup>. Therefore, detailed knowledge of the anatomy of the maxillary sinus is mandatory.

The vascularisation of the anterolateral wall of the maxillary sinus is characterised by the presence of intraosseous anastomoses between the dental branch of the posterior superior alveolar artery (PSAA), also known as the alveolar antral artery (AAA)<sup>5</sup>, and the infraorbital artery (IOA). Such anastomoses were identified by computed tomography (CT) scans in only 53% of the cases. However, anastomoses were found within the cortical bone of the lateral wall of the maxillary sinus at a variable distance from the alveolar crest of the posterior maxilla in all cases during clinical inspection<sup>6,8-10</sup>.

The AAA, with a diameter of up to 2.5 to 3 mm, supplies the Schneiderian membrane and the anterior lateral wall of the sinus<sup>9,11</sup>. Therefore, excessive bleeding may occur during the preparation of the lateral window to the maxillary sinus during maxillary sinus floor augmentation. Although accidental laceration of the vessel is not life-threatening, impaired visualisation may compromise the augmentation procedure, including elevation of the Schneiderian membrane. The purpose of the present case report is to present a case of a needed ligation of a vessel with a diameter of nearly 3 mm during maxillary sinus floor augmentation.

### ■ Case report

A bilateral maxillary sinus floor augmentation procedure was performed in a 51-year-old healthy man. A preoperative CT scan revealed a bony canal within the right and left antral walls, close to the alveolar ridge (Fig 1).

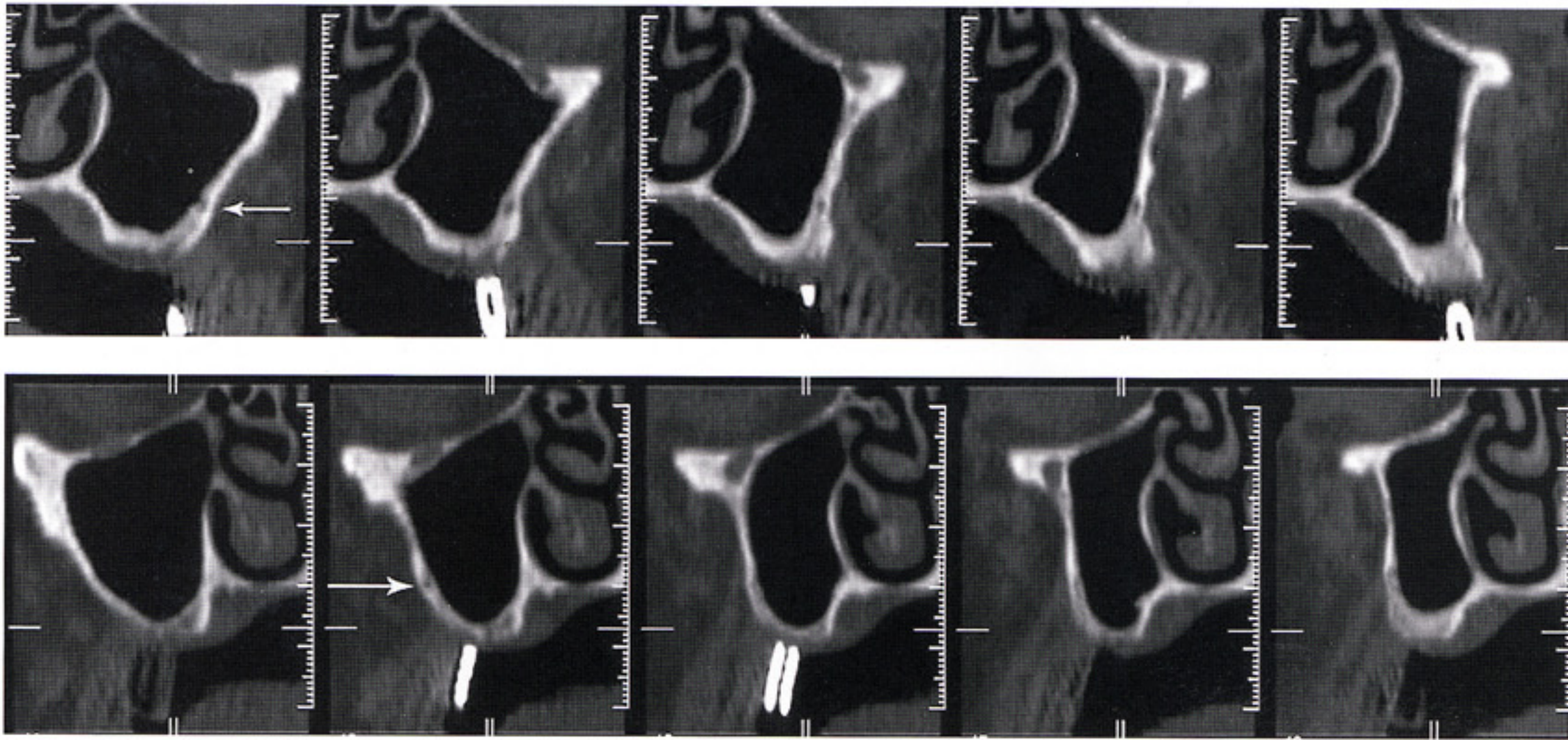
The bilateral maxillary sinus floor augmentation was performed under local anaesthesia. A midcrestal incision was made from the maxillary tuberosity to the canine area, including two vertical releasing incisions mesially and distally. The lateral walls of both sinuses were exposed and an oval window was cut through the lateral sinus walls until the intraosseous anastomoses between the PSAA and the IOA, and the Schneiderian membrane were visualised. The osteotomy was performed using piezoelectric inserts (Piezosurgery 3<sup>®</sup> unit, Mectron, Carasco, Genoa, Italy). A vessel with a diameter of nearly 3 mm was identified on the left side (Fig 2), while a vessel with a diam-

eter of approximately 1 mm was identified on the right side. The AAA was exposed on the left side and carefully dissected from the membrane using a microsurgical periodontal elevator. The vessel was ligated and subsequently sectioned to prevent bleeding during the surgical procedures as well as postoperatively (Fig 3). The sinus lift procedure within the right side was performed without vessel ligation and complications. A deproteinised bovine bone substitute (Bio-Oss<sup>®</sup> Spongiosa granules, 1 to 2 mm, Geistlich Pharma, Wolhusen, Switzerland) was then placed and the flap was repositioned without tension (Fig 4). The postoperative healing was uneventful.

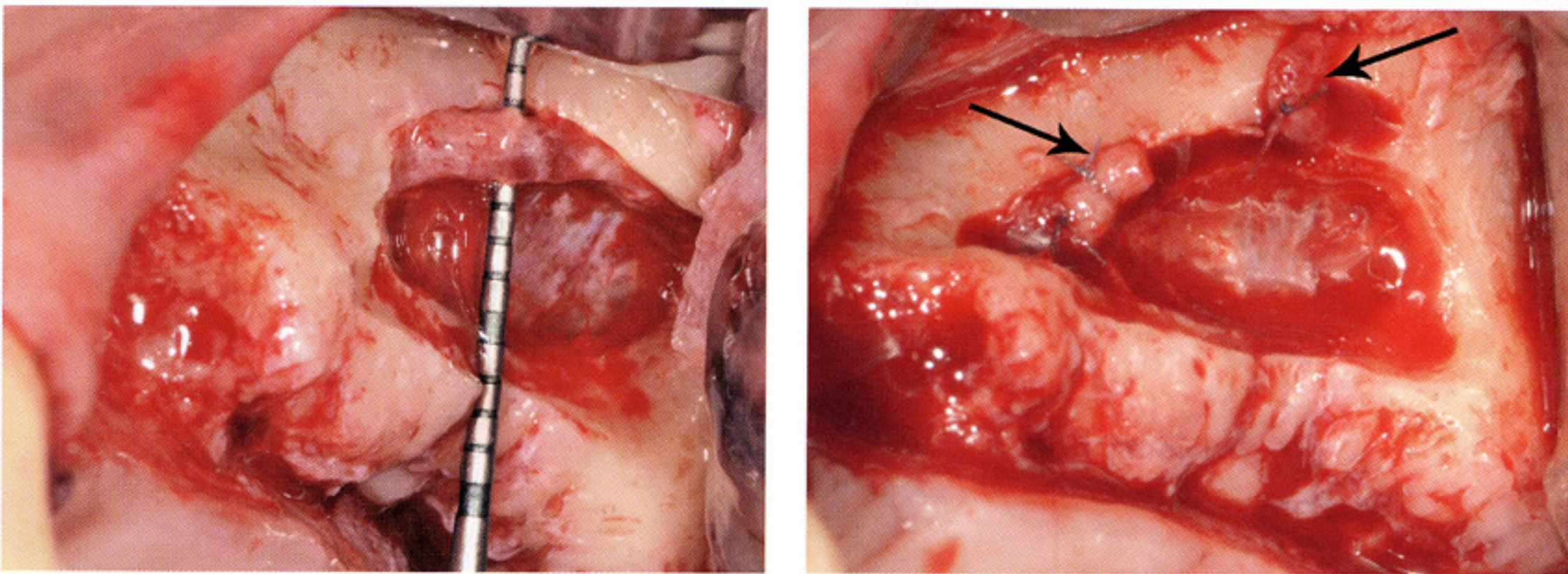
### ■ Discussion

The present case report documented the ligation of a vessel with a nearly 3-mm diameter in the lateral wall of the maxillary sinus during a sinus floor augmentation procedure. As stated by Mardinger et al<sup>9</sup>, AAAs seldom reach a diameter of 2 to 3 mm. Although this anatomical variation is unusual, it deserves special attention from a clinical point of view. Trans-section of a vessel with a diameter exceeding 2 mm may not cause life-threatening bleeding, but may impair visualisation during membrane elevation as well as during placement of the graft. Moreover, laceration of a large AAA has the potential to cause postoperative bleeding and haematoma formation<sup>12,13</sup>. In the present case, a CT examination was essential to detecting the location of the AAA preoperatively. In addition, piezoelectric surgical inserts may be beneficial to minimise laceration of the vessel, as well as the membrane.

In a radiographic study, Elian et al<sup>7</sup> observed the AAA on the CT scans in only 53% of the cases and reported that only large vessels could be identified on the CT scans. Moreover, a recently published study revealed that the AAA may be located partially intraosseously between the Schneiderian membrane and the lateral bony wall of the sinus<sup>13</sup>. Therefore, even AAAs with a large diameter may not be identified on the CT scans. Comparable bony canals were detected preoperatively on both sides by CT scans in the present case (Fig 1). A large vessel was clinically identified only on the left

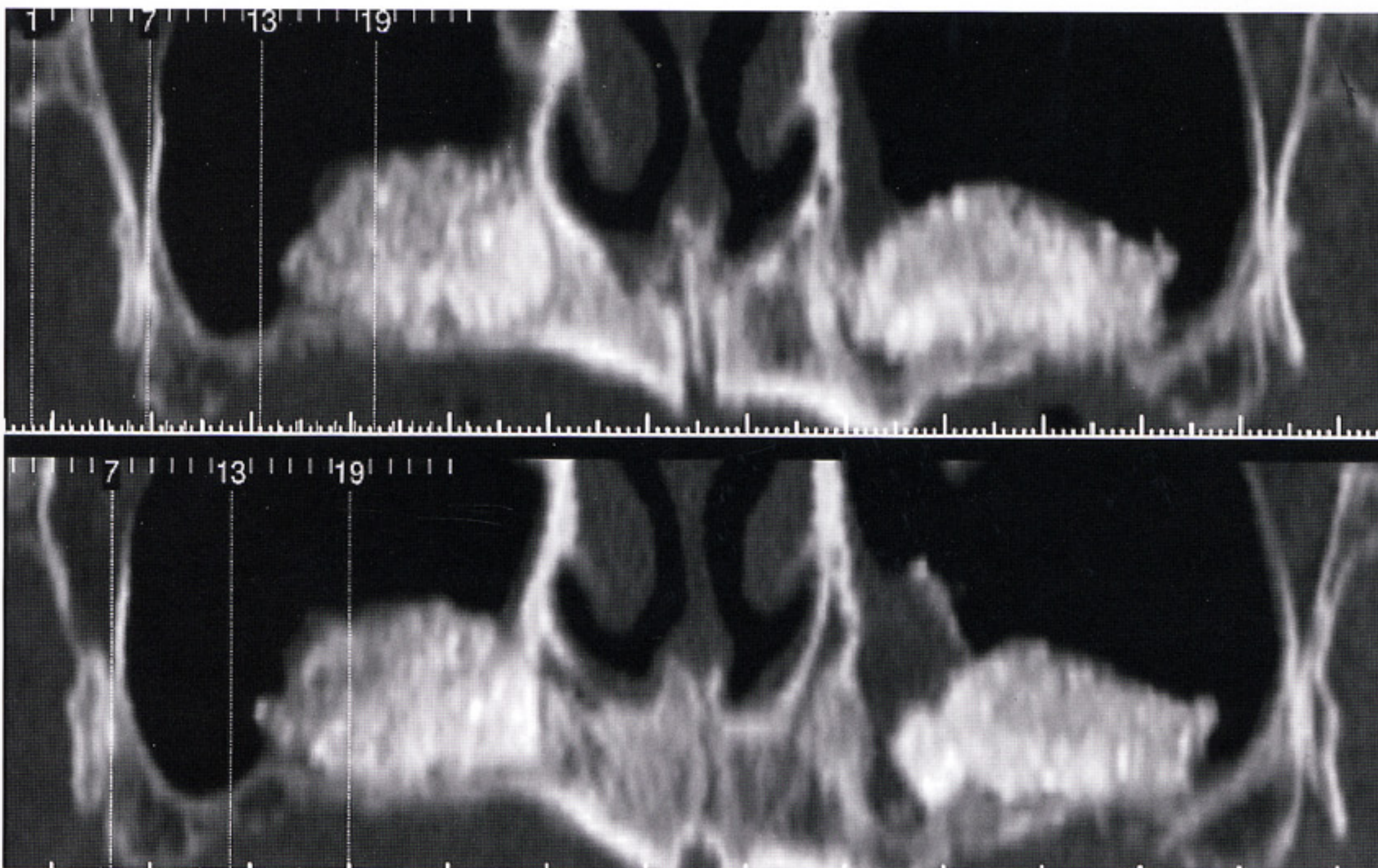


**Fig 1** Preoperative computed tomography scan images. Bony canals (arrows) are present in the right (upper panel) and left (lower panel) lateral antral wall and in close proximity to the alveolar ridge.



**Fig 2** Detection of the alveolar antral artery during left sinus floor augmentation: the diameter of the vessel was nearly 3 mm.

**Fig 3** The alveolar antral artery (arrows) after ligation.



**Fig 4** Postoperative computed tomography scan (panoramic view) after right and left maxillary sinus floor augmentation.

side during the operation, and this suggests that CT scans are not reliable for the assessment of the diameter of the AAA. However, when the AAA is visible by CT, adequate intraoperative precautions should be taken to avoid laceration of the vessel. In addition, potential sinus pathologies as well as the location and size of antral septa can be identified, thereby minimising the risk of complications during maxillary sinus floor augmentation. During recent years, craniomaxillofacial diagnosis has been improved substantially by the introduction of cone-beam computed tomography (CBCT). Due partly to the substantially reduced total radiation, this technique is increasingly used before maxillary sinus floor augmentation procedures. Nevertheless, further studies are needed before this technique can be recommended as a routine procedure prior to maxillary sinus floor augmentation using the lateral window technique.

### ■ Conclusions

Ligation of vessels with an unusually large diameter may be a reliable method to prevent bleeding during and after maxillary sinus floor augmentation.

### ■ Acknowledgements

The authors would like to thank Prof Mario Mantovani, MD, for his critical revision of the manuscript from an otorhinolaryngological perspective.

### ■ References

- Wallace SS, Froum SJ. Effect of maxillary sinus augmentation on the survival of endosseous dental implants. A systematic review. *Ann Periodontol* 2003;8:328-343.
- Aghaloo TL, Moy PK. Which hard tissue augmentation techniques are the most successful in furnishing bony support for implant placement? *Int J Oral Maxillofac Implants* 2007;22(Suppl):49-57.
- Del Fabbro M, Rosano G, Taschieri S. Implant survival rates after maxillary sinus augmentation. *Eur J Oral Sci* 2008;116:497-506.
- Esposito M, Grusovin MG, Rees J, Karasoulos D, Felice P, Alissa R, Worthington HV, Coulthard P. Interventions for replacing missing teeth: augmentation procedures of the maxillary sinus. *Cochrane Database Syst Rev* 2010;3:CD008397.
- Zijderveld SA, van den Bergh JPA, Schulten EAJM, ten Bruggenkate CM. Anatomical and surgical findings and complications in 100 consecutive maxillary sinus floor elevation procedures. *J Oral Maxillofac Surg* 2008;66:1426-1438.
- Rosano G, Taschieri S, Gaudy JF, Del Fabbro M. Maxillary sinus vascularization: a cadaveric study. *J Craniofac Surg* 2009;20:940-943.
- Chanavaz M. Sinus grafting related to implantology. Statistical analysis of 15 years of surgical experience (1979-1994). *J Oral Implantol* 1996;22:119-130.
- Elian N, Wallace S, Cho SC, Jalbout ZN, Froum S. Distribution of the maxillary artery as it relates to sinus floor augmentation. *Int J Oral Maxillofac Implants* 2005;20:784-787.
- Mardinger O, Abba M, Hirshberg A, Schwartz-Arad D. Prevalence, diameter and course of the maxillary intraosseous vascular canal with relation to sinus augmentation procedure: a radiographic study. *Int J Oral Maxillofac Surg* 2007;36:735-738.
- Solar P, Geyerhofer U, Traxler H, Windisch A, Ulm C, Watzek G. Blood supply to the maxillary sinus relevant to sinus floor elevation procedures. *Clin Oral Implants Res* 1999;10:34-44.
- Ella B, Sédarat C, Da Costa Noble R, Normand E, Lauerjat Y, Siberchicot F, Caix P, Zwetyenga N. Vascular connections of the lateral antral wall of the sinus: surgical effect in sinus augmentation. *Int J Oral Maxillofac Implants* 2008;23:1047-1052.
- Testori T, Wallace SS, Monteverdi R, Baj A, Gianni AB. Complications: diagnosis and management. In: Testori T, Del Fabbro M, Weinstein R, Wallace S (eds). *Maxillary sinus surgery and alternatives in treatment*. London: Quintessence, 2009:312-323.
- Rosano G, Taschieri S, Gaudy JF, Weinstein T, Del Fabbro M. Maxillary sinus vascular anatomy and its relation to sinus lift surgery. *Clin Oral Implants Res* 2010 (in press).