

## 歯科インプラント術後におこりえる上顎洞炎に対する、術前に行う鼻内視鏡手術

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<https://doi.org/10.15017/1474986>

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出版情報：福岡醫學雜誌. 105 (9), pp.182-189, 2014-09-25. 福岡医学会  
バージョン：  
権利関係：

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## Case Report

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# Minimally Invasive Endoscopic Middle Meatal Antrostomy for the Prevention of Maxillary Sinusitis in Association with Dental Implantation in the Posterior Maxilla - A Proposal -

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### Abstract

Penetration of the maxillary sinus floor membrane during sinus lift occasionally induces maxillary sinusitis. However, maxillary sinusitis may still develop even when its floor membrane has been kept intact during such procedures. The decisive factor for the occurrence of maxillary sinusitis is not the integrity of the membrane; more important is the patency of the maxillary sinus natural ostium. The occlusion of the natural ostium presumably results from the expansive edema of the sinus membrane induced by surgical manipulations to the maxillary sinus floor.

We propose a minimally invasive endoscopic sinus surgery which conceivably is useful to prevent potential occlusion of the natural ostium associated with maxillary sinus floor augmentation procedures. Although our technique is not a new concept, this is the first report to propose this kind of procedure as an adjunct to dental implantation. Our method is cost-effective and can be performed under topical anesthesia as a same-day surgery. In addition, it brings about no serious complications, such as orbital injuries or cerebrospinal fluid leakage. It aims to correct anatomical deviations, such as septal deviation, concha bullosa, hypertrophied uncinat process, and excessively pneumatized ethmoid bulla, all of which precipitate the occlusion of the natural ostium.

Our method consists of a combination of resection of the uncinat process, widening of the natural ostium, and excision of the anterior and inferior edge of the middle turbinate.

First, the anterior and inferoposterior segments of the uncinat process are resected with a curved rongeur, leaving the agger nasi cell intact (caution must be exercised to avoid injury to the nasolacrimal duct). This enables visualization of the maxillary natural ostium. The ostium is widened in all directions, using a forceps and/or a scalpel. The resultant widened ostium is bordered anteriorly by the nasolacrimal duct, inferiorly by the base of the inferior turbinate, posteriorly by the anterior surface of the ethmoid bulla, and superiorly by the medio-inferior angle of the orbit. Then the anterior and inferior edge of the middle turbinate is trimmed to prevent its adhesion to the lateral nasal wall or narrowing of the middle meatus.

This surgery does not cause cerebrospinal fluid leakage and, at the same time, minimizes the risk for olfactory dysfunction. The antrostomy window thus formed is large enough to secure drainage and ventilation of the maxillary sinus. Moreover, the middle meatus, now deprived of the antero-inferior aspect of the middle turbinate, enables the patient to irrigate the maxillary sinus with a saline solution at home. Septal deviation can also be corrected simultaneously, if postoperative packing of bilateral nasal cavities is tolerable to the patient.

Our experiences in treating over 100 patients are encouraging; although postoperative care such as irrigation of the maxillary sinus at home was mandatory and the start of dental implantation was delayed for 2–6 months, no patient who underwent surgery at our clinic developed maxillary sinusitis

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during the following course of dental implantation.

We believe that collaboration between the otorhinolaryngologist and the dentist/oral surgeon is required to minimize the risk of maxillary sinusitis associated with dental implantation in the maxilla.

**Key words :** Dental implantation · Maxillary sinusitis · Endoscopic sinus surgery · Complication

## Introduction

Maxillary sinusitis is one of the most serious complications associated with dental implantation in the posterior maxilla, particularly when the alveolar ridge is atrophied. Penetration of the implant into the healthy maxillary sinus floor membrane does not necessarily induce maxillary sinusitis<sup>1)</sup>. Rather, maxillary sinusitis may develop even if maxillary sinus floor membrane is not penetrated during sinus lift or implant placement. The most decisive factor for the development of maxillary sinusitis following such procedures is the functionality of the natural ostium of the maxillary sinus. Therefore, even when disease is not seen in the maxillary sinus, anatomical deviations precipitating the occlusion of the natural ostium, such as septal deviation, concha bullosa, paradoxical bending of the middle turbinate, hypertrophic unciniate process, overpneumatized ethmoid bulla, and infraorbital ethmoid cells (Haller cells), should be corrected before proceeding with dental implantation procedures<sup>1)</sup>. In case of compromised sinus drainage, sinus floor lifting procedures may reduce the sinus drainage further and thus may provoke exacerbation of the sinusitis<sup>1)</sup>.

The aim of this article is to propose a minimally invasive endoscopic endonasal surgery that is feasible under topical anesthesia as a same-day surgery. Our experiences with over 100 patients referred from local dental clinics demonstrate that these techniques are useful not only to prevent maxillary sinusitis associated with dental implantation but also to treat mild maxillary sinusitis found incidentally during preoperative dental evaluation.

## Indications

The purpose of our method is, with minimally invasive procedures, to correct anatomical deviations that may compromise the function of the maxillary natural ostium as the only pathway for drainage and ventilation of the maxillary sinus. Those anatomical deviations include concha bullosa, paradoxical bending of the middle turbinate, hypertrophied unciniate process, and excessively pneumatized ethmoid bulla. Mild septal deviation can also be corrected simultaneously, although packing of bilateral nasal cavities are required. Our method can also be performed on patients with mild maxillary sinusitis without marked mucosal thickening or pooling of pus.

### Exclusion criteria

#### 1. Cases with marked septal deviation

Correction of marked septal deviation often requires removal of an extensive area of bone and cartilaginous structures. This kind of radical deviatomy is performed preferably under general anesthesia as inpatient surgery.

#### 2. Cases with moderate to high degrees of disease in the maxillary sinus with or without a pooling of pus

When the mucosa in the maxillary sinus is highly polypous and a pooling of pus is seen, the ostium should be widened more extensively. To achieve this, not only the resection of the ethmoid bulla but also dissection of the posterior ethmoid sinus is required.

#### 3. Cases with moderate or marked disease in the ethmoid infundibulum requiring resection of not only the unciniate process but also the ethmoid bulla

Disease in the ethmoid infundibulum occasionally accompanies polypous changes in the frontal sinus with/without a pooling of pus in the frontal sinus. In this kind of case, a complete dissection of the agger nasi cell and the suprabullar cells must be performed to drain the frontal sinus.

#### 4. Cases with a history of recurrent sinusitis

The area for surgical dissection is determined based on the findings of the nasal endoscopy and computed tomography during the acute stage of sinusitis. When the posterior ethmoid sinus is markedly affected during the acute stage, for example, the portion is preferably dissected even if no disease is present during surgery.

#### 5. Cases with mucociliary dyskinesia

#### 6. Cases with Haller's cells

When Haller's cells are present, the posterior ethmoid sinus has to be dissected.

### Operative procedure

Our method can be performed as a same-day, outpatient surgery. When septal deviation is not marked but obstructs the operating field, a conservative septoplasty (resecting only the most protruded portion of the convexity or spur) is performed before proceeding to endoscopic sinus surgery.

#### The steps of our method are as follows ;

#### 1. Removal of the anterior and inferior-posterior segments of the uncinat process [Fig. 1a, 1b, 1c]

The uncinat process is gently back-fractured with the angled probe and carefully removed with a straight or curved rongeur to expose the lateral wall of the infundibulum and the maxillary sinus natural ostium. (The authors do not remove the upper segment of the anterior (vertical) portion of the uncinat process to avoid damage to the agger nasi cell.) Care is taken to conserve the mucosal membranes of the lateral infundibular wall. The tail or postero-inferior remnant of the uncinat process may occlude the natural ostium. Thus,

this remnant must be identified and removed to clearly see the natural ostium of the maxillary sinus. Caution must be exercised to avoid damage to the nasolacrimal duct.

#### 2. Identification of the natural ostium

The location of the natural ostium is variable, but it usually can be found behind the transitional zone formed by the anterior and inferoposterior portion of uncinat process. The superior border of the natural ostium demarcates the junction of the medial orbital floor with the lamina papyracea (i.e., the junction of the floor and the medial wall of the orbit).

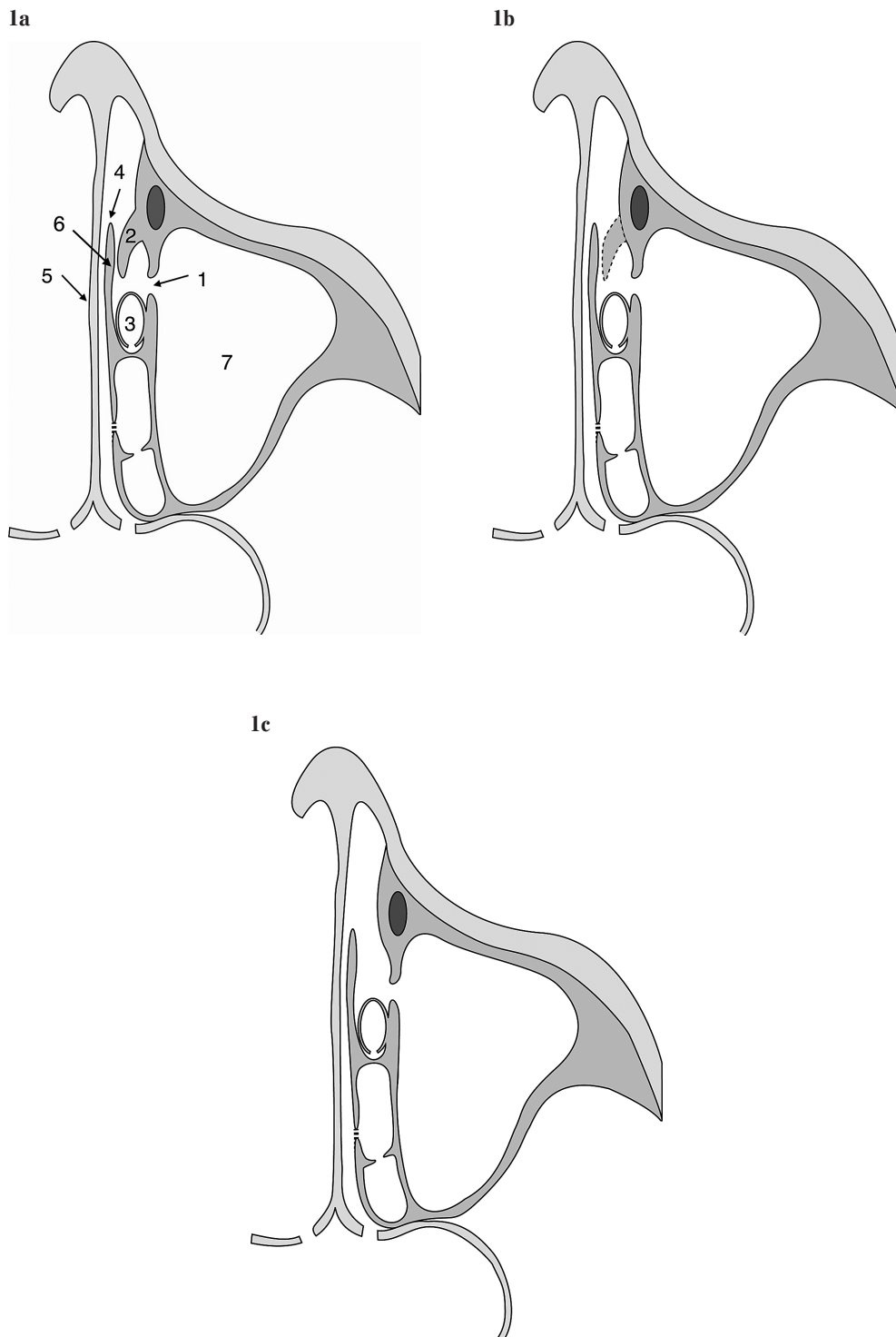
#### 3. Widening of the natural ostium [Fig. 2]

For limited disease of the anterior ostiomeatal complex, an uncinectomy, exposure of the maxillary natural ostium, and a limited antrostomy may be all that is necessary. When the natural ostium is  $> 3$  mm in diameter and the wall around it is not thick, this step can be omitted. However, if there is significant sinus disease, then it is necessary to widen the natural osmium.

In most cases, resection of the ethmoid bulla (short arrow) is unnecessary. The maxillary sinus natural ostium is widened in all directions using sharp instruments such as the forceps, scalpel, and a curved rongeur. The antrostomy window thus formed is bordered anteriorly by the nasolacrimal duct, inferiorly by the base of the inferior turbinate, posteriorly by the anterior surface of the ethmoid bulla, and superiorly by the medio-inferior angle of the orbit. The nasolacrimal duct (long arrow) must be spared. If possible, mucosa from the maxillary sinus is drawn over the resulting wound<sup>2)</sup>.

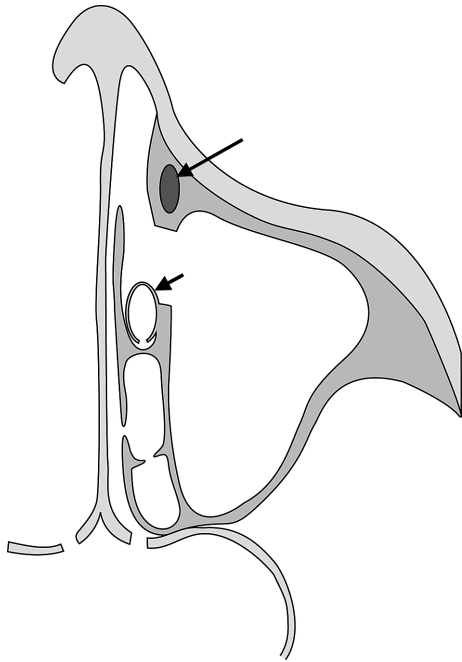
#### 4. Partial resection of the middle turbinate

The anterior and lower edge of the middle turbinate is trimmed [Fig. 3]. Its attachment with the agger nasi is spared to avoid adhesion. When the middle turbinate is extensively pneumatized (concha bullosa), its lateral lamella is also resected.

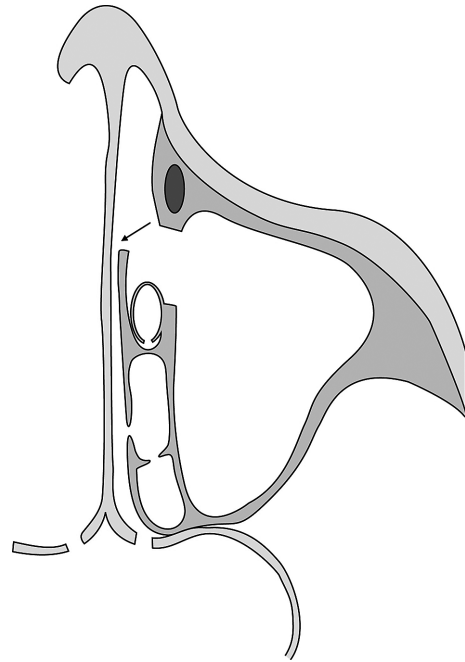


**Fig. 1** Axial section of paranasal sinuses.

- 1a.** Before surgery. 1. natural ostium 2. uncinete process 3. ethmoid bulla 4. middle turbinate 5. nasal septum 6. middle turbinate 7. maxillary sinus  
**1b.** The uncinete process (dotted line) is going to be resected.  
**1c.** The uncinete process has been resected.



**Fig. 2** Axial section of paranasal sinuses. The natural ostium of the maxillary sinus has been widened. The short arrow indicates the ethmoid bulla and the long one nasolacrimal duct.



**Fig. 3** Axial section of paranasal sinuses. The anterior and lower edge of the middle turbinate has been trimmed (arrow).

When the middle turbinate is paradoxically bent, the laterally bent portion should be resected.

### Discussion

Maxillary sinusitis is one of the most serious problems associated with dental implantation in the posterior maxilla. Maxillary sinusitis occurs frequently in association with sinus floor augmentation procedures (SFAP). Penetration of the maxillary floor mucosa does not necessarily cause maxillary sinusitis when SFAP is performed for a normal (aseptic) maxillary sinus. Rather, maxillary sinusitis may develop even when the dental implant does not penetrate the sinus floor membrane, as we have reported previously<sup>3)</sup>. In our experience, the most decisive factor for the development of maxillary sinusitis is the patency of the natural ostium. The ostium can be occluded as a result of the edema of the membrane caused by SFAP. It is our common observation that the whole maxillary sinus membrane gets swollen after SFAP. Therefore, it is mandatory to get rid

of those factors which potentially precipitate the occlusion of the natural ostium before starting dental implantation. Aberrations in the ostiomeatal complex are one of the most critical factors.

Our technique is not a new concept<sup>4)</sup>. Various techniques for partial resection of the middle turbinate have also been reported by many authors<sup>2)5)~12)</sup>. As far as we know, only Felisati and colleagues<sup>13)</sup> have proposed a one-step surgical procedure for patients with sinusitis. They found good results in 10 consecutive patients who underwent endoscopic sinus surgery and maxillary sinus floor elevation simultaneously. We have not experienced such cases. Whether maxillary sinusitis is present or not, we always perform endoscopic sinus surgery in advance, because the vast majority of our patients are referred from other dental clinics. Once the wound in the nose and paranasal sinuses have healed, our patients return to their respective clinics. The primary difference between Felisati and colleagues and us is that the primary purpose

of our technique is not to treat sinusitis surgically but to correct anatomical aberrations to minimize the risk for maxillary sinusitis in patients with a normal (aseptic) or almost normal maxillary sinus. Accordingly, our technique is more conservative, as compared with those from the aforementioned authors.

Our technique is cost-effective and feasible on an outpatient basis. In addition, it can be performed with minimal morbidity; it does not cause serious complications such as cerebrospinal fluid leakage and olfactory dysfunction<sup>14</sup>), because the middle turbinate is excised only partially along its anterior and inferior margin and the ethmoidal roof is not exposed. Although the medio-inferior corner of the orbit is manipulated, injury to the orbit can be avoided if the fontanelle is excised cautiously.

It should be noted that after surgery, the paranasal sinus mucosa occasionally becomes thick temporarily due presumably to the interruption of the blood and the lymphatic flows in the maxillary sinus<sup>4</sup>). In our experience, however, such thickening of the mucosa does not hinder the following dental implantation surgery as long as the antrostomy window remains sufficiently large. Previous studies suggest that a minimum of 2.4 mm in diameter is sufficient to maintain an adequate pO<sub>2</sub> (116 mmHg)<sup>15</sup>).

It should be also kept in mind that mucosal pathology and anatomical aberrations in the ostiomeatal complex cannot be correctly assessed by radiographic examination alone. Nasoendoscopy is indispensable for detailed and reliable diagnosis<sup>1</sup>). Therefore, it is mandatory for the dentist or oral surgeon to consult an experienced rhinologist prior to proceeding with dental implantation when abnormal findings are found on preoperative CT or the patient has a history of recurrent sinusitis. The rhinologist should closely examine for the presence of inflammation and/or a tumorous lesion around the maxillary sinus natural ostium not only radiographically but also endoscopically. He or she should also pay atten-

tion to anatomical aberrations such as concha bullosa, enlarged ethmoid bulla, hypertrophic uncinate process, and septal deviation, all of which also precipitate the occurrence of maxillary sinusitis associated with dental implantation.

The vast majority of the patients referred to the senior author's clinic before dental implantation in the posterior maxilla had various degrees of maxillary sinusitis. The surgical techniques presented in this article have been performed only on those patients with minimal to mild mucosa thickening in the maxillary sinus. In patients with more severe inflammation accompanying marked thickening of the mucosa and/or pooling of pus, more extensive middle meatal antrostomy is required. Our experiences involving over 100 patients in the former group of patients are encouraging; although postoperative care such as irrigation of the maxillary sinus at home was mandatory and the start of dental implantation was delayed for 2–6 months, no patient who underwent surgery at our clinic developed maxillary sinusitis during the following course of dental implantation.

### Acknowledgements

We'd like to thank Michael W. Myers for editing the English in our drafts.

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(Received for publication June 18, 2013)



(和文抄録)

## 歯科インプラント術後におこりえる上顎洞炎に対する、 術前に行う鼻内視鏡手術

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上顎のインプラント治療の合併症として最も頻度が高いのは上顎洞炎である。インプラント治療によって上顎洞底の粘膜に穿孔が生じても必ずしも上顎洞炎が生じる訳ではない。逆に、上顎洞底粘膜に穿孔が生じなくとも上顎洞炎が起きることがある。上顎のインプラント治療後に上顎洞炎が生じるかどうかを決定するのは、上顎洞自然孔である。上顎洞底挙上術などによって生じる洞内の粘膜の浮腫が自然孔にまで及び、自然孔が閉塞されたならば上顎洞炎が生じる。上顎洞自然孔の鼻腔側は鈎状突起や篩骨胞に挟まれており、軽度の粘膜浮腫によっても閉塞されやすい。鈎状突起の過剰発育、篩骨胞の過剰な含気化、中甲介の含気化や外側への彎曲などが認められる患者では、上顎洞自然孔周囲の粘膜浮腫によって一層、自然孔が閉塞されやすい。したがって上顎洞底挙上術を行う場合には、あらかじめこれらのリスクファクターを除去しておくのが好ましい。

今回我々は、日帰り手術が可能な保存的な内視鏡下手術を提案する。鈎状突起の下方から後方を切除して上顎洞自然孔を明視下に置き、上顎洞自然孔を四方に広げる。このようにして開大されたウィンドウの前縁は鼻涙管隆起の後縁、上縁は眼窩下壁・内側壁移行部、後縁は篩骨胞の前面、そして下縁は下甲介の付着部になる。次いで、中鼻道前端付近のスペースを確保するために中甲介の前縁～前下方をトリミングする。

本術式は重篤な合併症が生じにくい。手術侵襲も少なく、上顎洞内に高度の病変が認められない症例では、上顎洞底挙上術を行う前の上顎洞炎予防処置として優れた術式と考えられる。ただし、高度の鼻中隔彎曲症がある症例には本手術は適さない。