Maxillary sinus grafting: A proposal for avoidance of postoperative complications

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Abstract

Introduction
According to the literature, it is well known that the occurrence of postoperative sinusitis, in conjunction with maxillary sinus graft, appears to be limited to patients with a predisposition for this. In order to prevent post- and also intraoperative complications, it is essential to be able to be precise in anatomical particularities and to diagnose the health status of maxillary sinus prior the grafting procedure. A team approach gathering the implant surgeon and the ENT specialist to identify those parameters is crucial for the patient selection and the prevention of complications. The aim of this short communication was to discuss a proposal for avoidance in postoperative complications in maxillary sinus grafting.

Short communication
Prevention of complications is essential for the success of the procedure. A strict protocol must be implemented for patient selection in order to prevent complications.

Conclusion
The team approach gathering the implant surgeon and the ENT specialist is essential for outcome of the procedure.

Introduction
Nowadays, the lateral approach for maxillary sinus grafting has become a routine technique that allows to obtain a long-term implant survival rate over 96%1-3 the maxillary posterior region.

However, this technique can give way to complications that can impact on the short- and long-term implant survival rate. They can be classified into two categories— intraoperative complications and postoperative complications that are, mostly infectious complications5.

The first category includes damage of the alveolo-antral artery and perforations of the sinus membrane. Their frequency is inversely proportional to the surgeon’s skill and they have no influence on implant survival, if they are properly managed6.

The second category includes infectious complications that occur in the form of chronic or acute sinusitis. Their frequency ranges from 3 to 5%5-7.

They can result from an inadequate management of intraoperative complications, or from a poor evaluation of the sinus pathology before surgery. In both cases, they may have severe consequences (Figure 1).

According to Timmenga et al., postoperative sinusitis seems to occur only in patients with a specific predisposition for this type of pathology.

Therefore, it is essential to be able to identify the pathologies or the specific anatomical variations leading to this predisposition. The aim of this article was to discuss ways to avoid postoperative complications in maxillary sinus grafting.

Short communication
The authors have referenced some of their own studies in this short communication. These referenced studies have been conducted in accordance with the Declaration of Helsinki (1964), and the protocols of these studies have been approved by the relevant ethics committees related to the institution in which they were performed. All human subjects, in these referenced studies, gave informed consent to participate in these studies.

Before performing any maxillary sinus graft in order to place implants, it is important to be able to answer two questions:

1. Is the sinus to be grafted healthy or not?
2. If the sinus is healthy, is there any infectious risk after grafting?

Is the sinus to be grafted healthy or not?
Lateral window procedure, although performed with the utmost sterility of the surgical field, may nevertheless bring some bacteria from the oral flora inside the sinus in case of tearing of the sinus membrane. In a normal sinus, those bacteria will be trapped in the gel phase of the mucus and propelled through the natural ostium of the sinus by the mucociliary clearance. Therefore, risk is minimal as soon as the sinus ostium is patent and the mucociliary clearance is preserved.

Conversely, the presence of bacteria inside the sinus may contaminate the bed of the graft during the elevation of the sinus membrane.

Since sinus opacities are frequently observed on CT scan prescribed...
by the implantologist, the main issue is to determine whether they result from a pathology placing the graft at risk (Figure 2). In other words, those opacities related to benign process such as transient inflammation, as in the course of acute rhinitis, which may heal spontaneously, or to mucous cysts? Alternatively, are they caused by chronic infection, as in the case of aspergilloma, or bacterial sinusitis possibly of dental origin, or by sustained inflammation as in the course of nasal polyposis? All those conditions will place the patient at risk for the procedure.

In order to solve this problem, it is mandatory for the implantologist to collaborate with an ENT specialist\textsuperscript{8,9} who will confront patient medical history with the data of the endoscopic examination. The ostium, that is the natural drainage pathway of the maxillary sinus, may not be directly observed during endoscopy since it is hidden by the uncinate process. However, examination of the middle nasal meatus, the space located under the middle turbinate, may allow detecting oedema or secretions that indirectly point at disease inside the sinus. Likewise, polyps may be observed in the case of nasal polyposis.

On the other hand, the implantologist will analyse with the radiologist the status of the remaining teeth if any, in order to eliminate sinusitis of dental origin.

In case of mucosal disease, the aim of the treatment is to restore mucociliary clearance and ostium patency. Medical treatment may adequately restore physiological conditions, such as local or even systemic steroids in the case of moderate nasal polyposis, or prolonged antibiotics in case of bacterial sinusitis. However, an antrostomy may be required when this treatment fails or in the case of aspergilloma.

Caution is needed when bacterial sinusitis is related to one tooth and sinus ostium is blocked. Extraction of the causal tooth may allow sinus empyema to drain through the alveolar socket, which may result in an oro-antral communication. In such condition, antrostomy may be advised before the extraction in order to avoid this complication.

\textbf{If the sinus is healthy, is there any infectious risk after grafting?}

The answer to this question requires being able to anticipate the outcome of the sinus physiology following the grafting procedure. There are some local and general factors that may lead to postoperative infectious complications.

The first factor is anatomical and may affect the drainage pathway through the middle nasal meatus. Any sinus surgery entails oedema of the sinus membrane, which may lead to the ostium stenosis if the natural ostium is particularly narrow. Likewise, the presence of a concha bullosa (Figure 3), which is a pneumatization of the middle turbinate, may reduce the width of the drainage pathway. Although the level of evidence is slow\textsuperscript{8}, this may allow, in case of an undetected perforation of the sinus membrane, the granules originating from the graft material to remain trapped inside the ostium (Figure 3).

Then, an antrostomy should urgently be performed in order to preserve the graft and the implants as
Mucous cysts are frequently detected on CT, which do not require a specific surgery since they are nonsymptomatic and frequently disappear spontaneously. However, at the time of grafting, surgery elevation of the sinus membrane might impact the mucous cyst in the sinus ostium and occlude the drainage pathway. This is why it is suggested to drain this cyst at the time of the grafting surgery, by puncture performed through the lateral window with an insulin syringe. The second factor is tooth related. In the same way as for the mucous cyst, the presence of endodontic paste remnants inside the sinus cavity may be particularly dangerous because they can induce an aspergilloma. It then becomes imperative to have it removed by the ENT specialist before surgery.

The preservation of some teeth may be at risk as illustrated through the following clinical case. In 1992, a female patient underwent a grafting procedure of her maxillary left sinus with the simultaneous insertion of two implants in position 25 and 26. In 2004, she lost the two implants and her bridge as well (Figure 4). The CT scan revealed the cause of the infection (Figure 5). The upper first left premolar supporting an iatrogenic prosthetic restoration was cracked, which led to a chronic infection of the graft and the implant loss.

To prevent this type of complication, the surgeon must be able to identify the teeth at risk and to provide them with an adequate endodontic treatment. For a perfect endodontic diagnosis, the CT scan may be a precious tool. However, the teeth will have to be extracted, if the endodontic or prosthetic prognosis remains doubtful.

The last possible factor able to induce infectious complications is a systemic factor. The two follow-

**Figure 3:** Residues of graft blocked in the meatus (left arrow) causing an acute sinusitis. The concha bullosa (right arrow).

**Figure 4:** Intraoral situation after the loss of the implants 25 and 26.

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The clinical examination revealed a severe oedema but no infectious symptoms. The patient said he had been sneezing 30 to 40 times due to a pollen allergy. Despite the recommendations to sneeze with an open mouth, buccal dislodged fragment of the graft was revealed when a CT scan was performed on emergency (Figure 6).

Following the ENT’s recommendation, antibiotics were immediately prescribed using second-generation quinolones (Levoflaxin), and the patient was operated the next day. After elevating a flap, the dislodged fragments of the main graft were eliminated using a curette, the stability of the implants was checked and the site was rinsed using buccal iodine. The graft was completed with a new layer of biomaterial, and then covered with a collagen membrane soaked with buccal iodine. The CT scan performed 4 months later shows a perfect healing of the graft (Figure 7). So, obviously, it is preferable to avoid surgeries for such patients at springtime and during summer.

The second patient is a totally edentulous 63-year-old female who received a bilateral sinus lift procedure and graft in March. A control CT scan reveals a very poor quality of the graft with central lacunae (Figure 8). When questioned, the patient admitted she had forgotten to inform that she was treated with Alendronate (Fosamax®) since 8 years, which may explain the poor results obtained. Therefore, patients treated with bisphosphonates over a long period of time will have to be excluded, even if these medications are taken orally.

Discussion

The maxillary sinus grafting technique using a lateral approach is a reliable and predictable technique. In this aim, case selection must be very strict in order to prevent any complication. Therefore, a pre-operative CT scan or cone beam ex-

Figure 5: Fistula (arrow) in relation with tooth 24.

Figure 6: Dislodged buccal fragment of the graft.

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Figure 7: Healing 4 months later.

Figure 8: Bilateral osteonecrosis after bisphosphonates treatment.

amination and a perfect knowledge of the patient’s medical history are essential. The close team approach between the implantologist and the ENT remains the key to success.

Conclusion
The maxillary sinus grafting procedure using lateral approach is a reliable and predictable technique. However, case selection must be strict to prevent complications. Therefore, a pre-operative CT scan or cone beam as well a perfect knowledge of the patient medical history are essential. A close team approach between the implantologist and the ENT remains the key for success.

References