Complication of Maxillary Sinusitis

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Contributor: Alessandro Trotolo

Maxillary sinusitis a common complication, there is an absence of precise and shared guidelines on the diagnosis, post-operative follow-up and treatment of maxillary sinusitis following zygomatic implantology. To date there are no shared protocols for maxillary sinusitis treatment. According to the literature in the presence of risk factors such as age, comorbidities, smoking, nasal septal deviation or other anatomical variants, functional endoscopic sinus surgery (FESS) is suggested to perform at the same time as placement of zygomatic implants.

zygomatic implants sinusitis FESS

1. Introduction

Implant-based dental rehabilitation can be achieved with multiple approaches. The use of conventional implants requires adequate bone height and width in patients. In patients with severe atrophic maxilla (classes V e VI according to the Cawood-Howell classification of edentulous jaw) conventional rehabilitation is not a viable option. Brånemark et al. [1] proposed positioning zygomatic implants (ZIs) as a reliable technique for maxillary rehabilitation using the resistant zygomatic bone as an anatomical site for anchoring [2]. Various other alternatives are commonly employed in maxillary atrophy, such as sinus floor elevation for bone grafting, free re-vascularized flaps, Le Fort I osteotomy and bone grafts from the iliac crest or other sites [3][4][5].

Different techniques have been proposed for ZI placement, and many researchers have contributed to improve and modify Brånemark's initial technical proposal [6] in which ZIs were placed within an intrasinusal pathway using a sinus window to elevate and preserve the sinus membrane. Nowadays, the zygomatic anatomy guided approach (ZAGA) proposed by Aparicio [7] is gaining greater success, in which the surgical technique is customized to the patient's anatomy in relationship to the maxillary sinus. The extrasinusal approach involves placing the implants outside the maxillary sinus without compromising the Schneider's membrane, while the sinus slot technique proposed by Stella et al. in 2000 [8] is a technique involving consideration of extrasinusal and intrasinusal positioning [6]. Nowadays, the most used protocol for the edentulous maxilla involves the placement of two zygomatic implants in the premolar area and two to four conventional dental implants in the premaxilla area to provide additional support for a full-arch maxillary prosthesis [9]. Furthermore, the QUAD-ZYGOMA technique describes the use of four ZIs (two for each side) in cases where the premaxilla does not allow the placement of conventional implants [10].

Regardless of the surgical technique, successful outcomes have been demonstrated. Chrcanovic et al. in 2016 showed a cumulative survival rate of 95% at 12 years, with most failures occurring in the first 6 months after surgery [11]. Generally, the level of patient satisfaction was excellent as reported by Sartori and colleagues in 2012 [12].

Even though prosthetic failure is infrequent, ZIs are not free of complications. Maxillary sinusitis is reported to be the most common [13][14][15] and, together with intraoral soft-tissue infection [2][7][15], chronic pain, nerve deficits [13][16][17] and oro-antral fistula [18][19], may reduce implant survival and undermine patient's quality of life.

While many studies have focused on long-term implant stability, less importance has been dedicated to describing how ZIs can affect maxillary sinuses [20], as well as the management and/or prevention of sinusitis.

2. Current View

Zygomatic implants (ZIs) represent one of the most used therapeutical choices in response to severe atrophic maxillae (Cawood-Howell V and VI) rehabilitation. There are different techniques to place ZIs. Parel et al. [21] used a crestal incision to displace a large flap facilitating the exposure of the zygomatic bone, followed by the creation of a window for the displacement of the sinus membrane. The technique of Stella [8] differed from the original technique, as there was no need for a classical window opening on the wall of the maxillary sinus. Instead, they proposed a slot acting as a smaller antrostomy to orient the twist drill for implant placement. The third technique is completely performed outside the maxillary sinus, without windows opening or channels in the wall of the maxillary sinus. This has been used for patients with a pronounced maxillary sinus lateral wall concavity [22].

The most used ZI positioning protocol for edentulous maxilla usually involves two zygomatic implants in the premolar area and two to four standard dental implants placed anteriorly to provide additional support for a full-arch maxillary prosthesis [9]. Furthermore, the Quad technique provides the use of four ZIs, two for each side, where the premaxilla does not allow positioning of traditional implants. This protocol can support the whole prosthesis. Stiévenart and Malevez [15] evaluated patients treated with the Quad approach and reported that the cumulative survival rate after 40 months was 96%; generally; the weighted average success in zygomatic implant positioning is 97.05% [5].

In comparison to conventional treatment, ZIs preserve the patient from multiple surgical procedures and reduce the entire rehabilitation process (immediate loading is also described), time for healing and the risk of infections. Moreover, use of ZIs avoid extraoral harvesting for osseointegration, providing predictable success and absolute retention. Even if it prosthetic failure was rare, some researchers[11][23][24][25] demonstrated some drawbacks related to ZIs. They are positioned closed to delicate structures in the midface (e.g., maxillary and palatine artery, facial and V2 nerve branches), and because of the surgical procedures should be performed by a trained surgeon. In addition, any problems related to ZIs are more difficult to approach than in conventional dental implant rehabilitation. During the early stages after surgery, sinusitis appears to be one of the most common complications.

The 13 publications included evaluated 478 patients and 1156 zygomatic implants overall, with only 69 patients (14.5%) with sinusitis, of which 42 (8.8%) showed clinical relevance in the follow up.

From a diagnostic point of view, maxillary sinusitis may be observed radiologically (usually by orthopantomography or, more often, maxillofacial computed tomography with clinical assessment. These diagnostic tools are useful not only for proper evaluation and surgical planning before ZI placement, but for monitoring the clinical and prosthetic outcomes in more detail afterwards. Otherwise, in the literature examined, there was no evidence of precise diagnostic analysis of sinusitis itself.

Clinical outcomes of sinusitis seemed difficult to find when compared with radiological outcomes [26], which is a critical point considering the greater evidence of radiological signs [7] that can cause silent sinusitis with otorhinolaryngological consequences, both chronically and over time [27][28]. Indeed, both symptomatic and silent sinusitis were taken into account to extend the analysis to the evaluation of sinusitis diagnosis (nasal endoscopy and radiological assessment) and treatment (FESS vs. simple antibiotic vs. follow-up).

The literature to date does not specifically report on the status of the region of the osteo-meatal complex (COM) and the middle meatus. Particularly, there is a lack of the following information:

- Alterations of the natural ostium of the maxillary sinus.
- Presence of the accessory ostium, which could modify the physiological drainage capacity from the maxillary sinus as well as (in the case of surgical treatment)modify the approach to setting up at typical antrostomy.
- Alteration of the middle meatus with consequent difficulty of sinus drainage due to a paradoxical curvature of the middle turbinate or its pneumatization with a concha bullosa, which, in both cases, would drastically reduce the space of the middle meatus resulting in the condition of dysventilation.

The above should be taken into account and considered as further correlated risk factors for sinusitis onset after ZI positioning [29][30][31].

Preserving the sinus membrane is still debated, and no evidence in literature could be found to establish a strict protocol to follow for implant zygomatic surgery. However, damage of the maxillary mucosa due to a protruding implant is not the leading cause in developing sinusitis and not linked to a shorten survival rate of ZI [32][33]. Nevertheless it may be advisable to avoid oroantral communication during zygomatic implant placement. Chow et al. [14] suggested an extrasinusal procedure, in which a retained bone window is made up and used as a shield to preserve the attached sinus membrane intact before positioning the implant. Avoiding the breach of the membrane by the extrasinusal position of the ZI leads to positive results and perfect osteointegration. Galli et al. in 2001 [34] explained this by the absence of mobility of these implants, avoiding irritation of the sinus mucosa and/or obstruction of the meatal complex. However, seven patients needed partial (one patient) or complete (six patients) ZI removal to relieve symptoms of sinusitis. Many factors were associated with the onset of sinusitis, from a blockage of the maxillary ostium [35] to the poor osseointegration of the implants in the posterior palatal region

undermining prosthetic stability [18] or the creation of a direct link for the passage of bacteria from the oral cavity into the maxillary sinus [15]. In addition, trauma involved in the placement of zygomatic implants can cause a maxillary hemosinus which, by slowing down the epithelial and mucociliary activity in the sinus, can contribute to the onset of sinusitis [36].

In the literature there was no definite and clear evidence about the relationship between maxillary sinusitis and the technique used for ZI positioning. The great majority of surgeons seems to prefer the extrasinusal approach (765 ZIs with an extrasinusal approach compared to 107 ZIs with an intrasinusal approach), but a detailed analysis of an increase in complications in terms of sinusitis of one technique compared to the other was not possible. It emerged that there are episodes of sinusitis even in cases of extrasinusal implants placement. In this case, therefore, one possible goal might be to evaluate, both from a clinical and radiological point of view, the timing of the onset of sinusitis to assess the pathogenesis of sinusitis. It may be possible to find reactive sinusitis six months after the surgery [37] specifically related to surgical procedures.

In this regard, it could be interesting to investigate, in the case of the extra-sinusal technique, where the onset of sinusitis is not immediately correlated to the surgical maneuvers, the timing of the FESS treatment.

Regardless of the surgical technique used the treatment of sinusitis was approached with administration of antibiotic therapy in most cases. This needs further study, since antibiotic therapy alone may resolve the acute condition but not completely resolve the pathology of the sinus. However, no univocal treatment protocol emerged. This raises the question of the need for surgical treatment by FESS in favor of a single antibiotic therapy with further follow-up on signs and symptoms (with published references) for the treatment of sinusitis arising after zygomatic implant surgery. Further study is required on the analysis of associated risk factors to establish a prophylactic protocol beforehand, and to identify surgical or conservative responses later, for these cases of sinusitis. Unfortunately, the heterogeneity of the studies and the diagnostic and instrument tools used did not allow for a consistent result concerning this topic. In some cases, risk factors were found to have no relevance in facilitating sinusitis; however, this could not be stated conclusively because of lack of information about diagnosis of the disease and its assessment during the follow-up. For example, smoking and an average age over 52 years could be a predisposing factor for the onset of maxillary sinusitis with the need for close clinical and radiological follow-up.

Considering this, the main focus has to be on the diagnostic protocol (radiological, probably) to gain sound information. Starting from here, the association between risk factors, surgical techniques and the onset of sinusitis could be clear, and advice in terms of follow-up and therapeutic strategies could be provided with confidence. An otolaryngological approach should be combined with surgical and prosthetic rehabilitation, due to the occurrence of sinusitis after these kinds of procedures. Presumably, the otolaryngologist would be involved in the diagnostic and follow-up phases, as well as during the surgical procedure when an FESS is appropriate.

Given the onset of sinusitis following the placement of ZIs, it may be appropriate to evaluate the feasibility of intraoperative FESS intervention, requiring interventions under general anesthesia.

The researchers are well aware of the difficulty in designing in vivo clinical studies, especially in heterogeneous cases like those of zygomatic implant surgery; however, performing a diagnosis of the status of maxillary sinus and monitor it during follow-up using instrumental tools is highly recommended. This allows the gathering of unambiguous information. Based on such information, a more predictable protocol could be established for treatment of sinusitis after zygomatic surgery and the potential need for referral to an otorhinolaryngologist.

Researchers observed that 8.8% of patients presented maxillary sinusitis with clinical relevance that needed pharmacological or surgical treatment. However, to date, there are no standardized therapeutic protocols described in the literature. In the analyzed papers, researchers found a heterogeneous approach in treating maxillary sinusitis. Some researchers perform FESS in a contextual manner to prevent the onset of sinusitis, while others perform it only in the event of the onset of maxillary sinusitis. In most of the cases, antibiotic treatment was the prime choice.

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