CLINICAL ORAL IMPLANTS RESEARCH

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Importance of ENT assessment in stratifying candidates for sinus floor elevation: a prospective clinical study

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Abstract

Objectives: The aim of this article was to describe our experience in the field of preoperative ear, nose and throat (ENT) assessment in each candidate for (maxillary) sinus floor elevation (SFE) after the introduction of a systematic protocol. The protocol evaluates the sinus compliance by means of ENT preliminary examination with nasal fiberoptic endoscopy to identify all of the situations that may predispose to post-lifting complications, i.e. potentially irreversible (PIECs) and presumably reversible (PRECs) ENT contraindications to SFE, and to evaluate its impact on SFE success.

Material and methods: Patient candidates for SFE were carefully assessed by means of case-history collection, complete ENT evaluation with nasal fiberoptic endoscopy and imaging to detect PIECs, PRECs, or no ENT contraindications for SFE. In case of PRECs, SFE was postponed until complete clinical recovery. Impact of preoperative ENT assessment on SFE outcome was assessed by means of post-lifting telephonic interview and ENT evaluation.

Results: PRECs were detected and resolved before SFE was performed in 38.2% of our 34 patients; no intra- or post-lifting complications occurred in the patients with no ENT contraindications or PRECs.

Conclusions: The results of the study suggest that a careful multi-tasking preoperative management, including an ENT assessment with fiberoptic endoscopy and a radiological evaluation extended to the ostio-meatal complex, is very useful in candidates for SFE.

(Maxillary) sinus floor elevation (SFE) is a widespread and highly successful surgical procedure aimed at creating a mucoperiosteal pocket over the maxillary floor and beneath the Schneider's membrane in which to place the graft material or endo-osseus implants to rehabilitate the upper dental arch.

However, given the strict anatomical relationship between the maxillary floor and the overlying maxillary sinus and the fact that any surgical procedure may lead to a transient inflammatory reaction, the possibility of post-lifting infectious sequelae should be considered. In particular, SFE may impair physiological maxillary drainage into the middle meatus by inducing transient inflammatory peri-ostial swelling or other mechanisms predisposing to acute maxillary sinusitis (the most frequent post-lifting complication) (Timmenga et al. 2001) and possibly lead to bone graft loss (Buiter 1976).

Although the prompt post-surgical recovery of the maxillary mucosa with a rapid return to pre-operative sterility is frequent (Misch 1992; Timmenga et al. 2003), it must be pointed out that the "sinus compliance", which represents the intrinsic potential of recovery of the normal maxillary sinus homeostasis after SFE, depends on its baseline anatomo-physiological condition: the better the starting condition (high sinus compliance), the lower the risk of complications. Preoperative anamnestic, clinical and possibly radiological assessments, the invaluable instruments needed to define the sinus compliance, are therefore desirable to identify all of the situations that may predispose to post-lifting complications. Moreover, rare conditions significantly (and presumably irreversibly) impairing sinus drainage are responsible for an excessive risk of SFE failure, and need to be preoperatively detected as current contraindications to the procedure.

On the basis of these considerations, we drew up a series of guidelines (Pignataro et al. 2008) concerning ear, nose and throat (ENT) contraindications to SFE that distinguishes those that are potentially reversible (PRECs) and possibly emendable by means of adequate medical and/or surgical treatment

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with the recovery of sinusal drainage and ventilation, and those that are presumably irreversible (PIECs) and jeopardize the likelihood of a good outcome.

The aim of this article was to describe our experience in the field of preoperative ENT assessment in each candidate for SFE after the introduction of a dedicated systematic protocol. The protocol evaluates the sinus compliance by means of ENT preliminary examination and pertinent imaging to identify PIECs and PRECs contraindications to SFE, and to evaluate its impact on SFE success.

Patients and methods

Study design

A prospective study with data collection at a tertiary hospital.

Study subjects

The study involved candidates for maxillary SFE. No specific exclusion criteria were considered.

Our local Ethics Committee approved the study, and the patients gave their written informed consent.

Study setting

The study was carried out between November 2009 and November 2010 at the Department of Specialist Surgical Sciences of the University of Milan (Milan, Italy).

Interventions

Patients were carefully assessed for possible general and specific risk factors for SFE and/or sino-nasal disease, including smoking (active or passive exposure), allergic rhinitis (documented by a positive skin prick test within the previous 12 months), previous nasal surgery or trauma, a history of chronic and/or recurrent sinusitis (the former defined as a sinus infection lasting more than 4 weeks, and the latter as at least four episodes of acute sinusitis in the previous 12 months or at least three episodes in the previous 6 months), the chronic use of nasal steroids and/or vasoconstrictors (not because *di per se* contraindicated, but because indicating a possible naso-sinusal disease), chronic nasal obstruction and/or rhinorrhea, chronic hyposmia and/or hypogeusia, previous treatment for head and neck neoplasms, co-morbidities (particularly systemic diseases and pathologies interfering with mucosal composition or ciliary movements, such as primary or secondary immunodeficiencies, cystic fibrosis, Kartagener's and Mousier–Kuhn's syndromes, dehydration, ciliostatic drugs, peripheral hyper-eosinophilia, asthma, chronic pulmonary disease and acetylsalicylic acid hypersensitivity).

All patients underwent a complete ENT evaluation, including nasal fiberoptic endoscopy to assess the conditions of nasal mucosa, septum, turbinates, meatal grooves and ostio-meatal complexes. In the case of nasal polyposis, Stammberger's classification (Stammberger 1999) was used.

All the patients also underwent a Dentalscan (extended to the ethmoid roof to visualize the Ostio-Meatal-Complex –COM-) or traditional axial and coronal maxillofacial computed tomography (CT) in the case of suspected chronic or recurrent sinusitis. On the basis of the radiological data, the patients were graded using the Kennedy (Kennedy 1992) and Lund-McKay clinico-radiological classifications (Lund & Kennedy 1997).

The clinical and radiological assessments were also used to detect conditions which could jeopardize the physiological maxillary ventilation and drainage functions, impairing the antral homeostasis, such as sino-nasal anatomical alterations (i.e. septal deviations, concha bullosa, paradoxical bending of the middle turbinate, etc.), maxillary ostium stenosis, post-surgical endonasal scars, synechiae of the middle meatal region, nasal polyposis or masses obstructing the medio-meatal region, antro-ethmoidal foreign bodies, oro-antral fistulae and sino-nasal neoplasms.

At the end of the examination, a statement concerning the ENT risk was drawn up for each patient, i.e. the presence of PIECs or PRECs or no ENT contraindications. In case of PIECs, the patients were informed of the presumably high risk of SFE failure and advised not to undergo the procedure; in case of PRECs, the patients were prescribed appropriate treatment and followed up until complete resolution; in case of no ENT contraindications, the patients were invited to plan the procedure with their oral surgeon.

In particular, in the case of patients with chronic sinusitis unsustained by endo-antral foreign bodies and presumably unrelated to mycosis, traditional medical treatment with oral and topical steroids was attempted before surgery. In selected patients with endo-antral foreign bodies without concomitant maxillary sinusitis, the foreign bodies were removed by means of minimally invasive endoscopy through the canine fossa using a dedicated instrument conceived by the senior authors (MM and LP) and called "Antral Retriever" (commercially available at: Simed Tec Srl, Sirtori, Lecco, Italy) (Mantovani et al. 2011). This new instrument, which consists of a trochar with its sheath (Fig. 1), can be easily inserted in the canine fossa at a safe distance from the trunks of the infra-orbital nerve using Robinson's manoeuvre (Robinson & Wormald 2005), and allows the simultaneous introduction of a rigid endoscope, aspirator and operative instruments, with minimal patient discomfort and also under local anaesthesia (Mantovani et al. 2011).

The presence of anatomical alterations (i.e. septal deviations, concha bullosa, paradoxical bending of the middle turbinate, etc.), cicatrization sequelae (i.e. maxillary ostium partial stenosis, post-surgical endonasal scars, synechiae of the middle meatal region, etc.) or isolated polyps not associated with history or evidence of sinus disease *di per se* were neither considered a contraindication for SFE, nor needed a pre-lifting surgical treatment (Mantovani 2009).

Small antral cysts were not considered ENT contraindications too and, in such cases, we advised the oral surgeon to evacuate the cyst transantrally during the SFE procedure. Once an antral window has been created, the surgeon can use it to puncture the cyst by means of a small needle syringe and aspirate the fluid content. In patients with a favourable anatomy (i.e. complete nasal and middle meatal patency and a homolateral accessorial ostium that is large enough to allow the introduction of a thin flexible fiberoptic endoscope), an ENT specialist can assist the surgeon by directly attesting the deflation of the cyst.

A telephone interview was performed 1 month after SFE procedure to assess the outcome of SFE and the occurrence of intra- and post-operative complications. In particular, the interviewers investigated the development of any sign or symptom suggesting post-lifting maxillary sinusitis, including

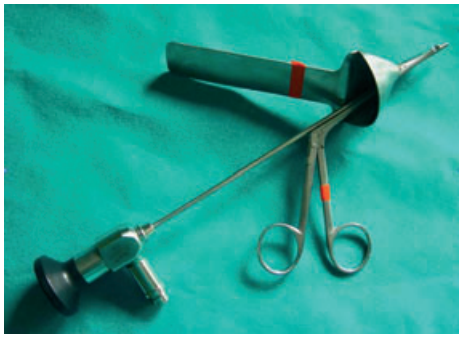

Fig. 1. Antral retriever with endoscope and operative instrument inserted.

nasal obstruction or a purulent nasal discharge, facial pain or tenderness, fever, cacosmia and a purulent oral discharge. A post-operative ENT assessment including nasal fiberoptic endoscopy with inspection of the antrum (whenever possible) was performed 3–6 months after SFE.

Data analysis

All the anamnestic, clinical and radiological data and their potential effects on SFE outcome were described by means of descriptive methods using STATA 10.0 software (StataCorp, College Station, TX, USA).

Results

Thirty-four patients (50% men; median age 52 years, range 35–73) who were candidates for SFE (a total of 45 sinus floor elevation proposals) were evaluated. Table 1 shows their demographic and anamnestic characteristics.

Table 1. **Demographic and anamnestic characteristics of the study population**

	No. (%) Demographic
Demographic characteristics	
Males (%)	17 (50)
Median age (range)	52 (35–73)
Sinus lift	
Unilateral*	23 (67.7)
Bilateral	11 (32.3)
General anamnesis	
Asthma	2 (5.9)
Exposure to tobacco smoke†	10 (29.4)
Previous head and neck surgery	2 (5.9)
Systemic disease‡	11 (32.3)
Specific anamnesis	
Known chronic naso-sinusal disease§	9 (26.5)
Known allergic rhinitis	4 (11.8
Chronic nasal obstruction	8 (23.5)
Chronic rhinorrhea	6 (17.6)
Previous nasal surgery¶	2 (5.9)
Previous nasal trauma**	6 (7.6)
Chronic employment of intranasal topic therapy††	4 (11.8)

*Right (15), left (8).
†Most of them (8 of 10) being mild smokers.
‡Essential arterial hypertension (2), diabetes mellitus type II (1), chronic vasculopathy (1), chronic ischaemic heart disease (1), B-cell chronic lymphocytic leukaemia (1), osteoporosis (1), systemic lupus erythematosus (1), rheumatoid arthritis (1), idiopathic hypothyroidism (1), chronic inflammatory bowel disease (1).
§Chronic rhino-sinusitis without polyposis (7), chronic rhino-sinusitis with polyposis (2).
¶Functional endoscopic sinus surgery for chronic rhinosinusitis (1) and septoplasty (1).
**Not requiring any surgical correction.
††Topical vasoconstrictors (1) and topical steroids (3).

ENT assessments using nasal fiberoptic endoscopy documented the absence of pathological nasal conditions in most patients; on the other hand, impaired middle meatal patency was found in 40% of the sinuses, and impaired OMC patency in 28.9% of sinuses. The main features associated with the partial or complete obstruction of the middle meatal and OMC regions were severe homolateral septal deviation (24.4% of sinuses) or a homolateral septal ridge (20% of sinuses), moderate or severe hypertrophy of the middle turbinate (22.2% of sinuses), middle meatal neoformations (13.3% of sinuses) and hypertrophy of the infundibular mucosa (8.9% of sinuses) (Table 2).

Radiological assessments confirmed that homolateral septal deviation (52.9% of patients) was the main anatomical variation, whereas other OMC impairments were less frequent; endo-antral foreign bodies of odontic origin (dental implants or other dental material) were discovered in seven patients (20.6% of patients) (Figs 2 and 3), and small homolateral trans-antral cysts in three (8.9% of patients) (Table 3).

None of the patients presented a PIEC, but PRECs were detected in 14 (38.2%), including chronic sinusitis (20.6%), endo-antral foreign bodies with or without maxillary sinusitis (14.7% and 5.9%) and post-traumatic nose deformity (2.9%) (Table 4). Seven patients (20.6%) therefore underwent the removal of endo-antral foreign bodies with or without functional endoscopic sino-nasal surgery, five (14.7%) underwent septo-turbinoplasty with or without endoscopic sinus surgery and one (2.9%) underwent functional rhino-septo-turbinoplasty before SFE. In the case of patients with chronic sinusitis unsustained by endo-antral foreign bodies and presumably unrelated to mycosis, traditional medical treatment with oral and topical steroids was attempted before surgery, but without complete recovery. In selected patients with endo-antral foreign bodies without concomitant maxillary sinusitis (11.8%), the foreign bodies were removed by means of minimally invasive endoscopy through the canine using "Antral Retriever" without any significant complication, although one patient experienced temporary numbness of the upper lip, spontaneously resolved within few months.

Most patients (61.8%) did not present any ENT contraindications to SFE, but in the case of oedema of the infundibular mucosa (8.9%), we advised the patients to undergo preparation with nasal irrigations and topical nasal steroids administered from 21 days before until 14 days after the SFE. Patients

Table 2. **Endoscopic characteristics of the study population***

	No. of sinuses (%)
Nasal mucosa	
Trophism	
Eutrophic	40 (88.9)
Atrophic	1 (2.2)
Hypertrophic	4 (8.9)
Colour	
Rosy	24 (53.3)
Pale	11 (24.5)
Hyperaemic	10 (22.2)
Nasal septum	
Homolateral septal deviation	18 (40)
Not inducing stenosis of the nasal fossa	7 (15.6)
Inducing sub-stenosis of the nasal fossa	7 (15.5)
Inducing stenosis of the nasal fossa	4 (8.9)
Other septal anomalies†	1 (2.2)
Nasal secretions	
Yes	12 (26.7)
Serous	3 (6.7)
Mucous	7 (15.6)
Purulent	2 (4.4)
Inferior meatus	
Hypertrophy of inferior turbinate	23 (51.1)
Mild	12 (26.7)
Moderate	9 (20)
Severe	2 (4.4)
Neoformations	0 (0)
Patency	
Preserved	31 (68.9)
Partially preserved	12 (26.7)
Impaired	2 (4.4)
Middle meatus	
Hypertrophy of middle turbinate	16 (35.5)
Mild	6 (13.3)
Moderate	6 (13.3)
Severe	4 (8.9)
Neoformations‡	6 (13.3)
Accessorial ostium	
Present and practicable	4 (8.9)
Present but not practicable	7 (15.6)
Absent	34 (75.5)
Middle meatus patency	
Preserved	27 (60)
Partially preserved	13 (28.9)
Impaired	5 (11.1)
Ostio-meatal complex patency	
Preserved	32 (71.1)
Partially preserved	6 (13.3)
Impaired	7 (15.6)
Hypertrophy of infundibular mucosa	4 (8.9)
Superior meatus	
Hypertrophy of superior turbinate	4 (8.9)
Mild	4 (8.9)
Moderate	0 (0)
Severe	0 (0)
Neoformations§	1 (2.2)
Patency	
Preserved	43 (95.5)
Partially preserved	2 (4.4)
Impaired	0 (0)

*Assessed in relation to the 45 sinus lift proposals.
†Post-septoplasty perforation.
‡Middle meatal polyps (5), polypoid degeneration of the middle turbinate (1).
§Superior meatal polyp.

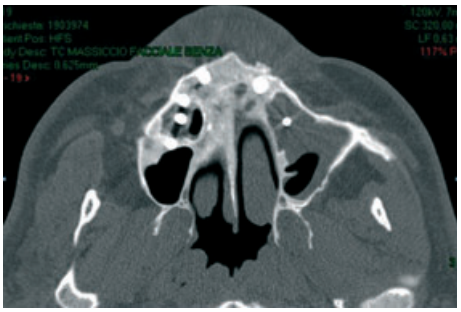

Fig. 2. Chronic maxillary sinusitis of dental origin in axial CT scan sustained by endo-antral dental implant.

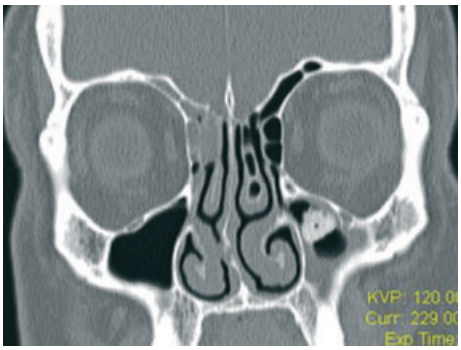

Fig. 3. Chronic maxillary sinusitis of dental origin in coronal CT scan. Note endo-antral odontic material migrating towards maxillary natural ostium.

Table 3. **Radiological characteristics of the study population**

	No. of patients (%)
Maxillary sinus	
Median bone height, mm (range)	2 (1–5)
Homolateral antral cyst	10 (22.2)
Homolateral concentric antral mucosal hypertrophy	18 (40)
Staging	
Radiological staging according to Kennedy	
0	27
1	4
2	1
3	2
Radiological staging (by side)	
0	9
1	4
2	3
3	3
4	0
5	2
Middle meatal ano-malies	
Concha bullosa	1 (2.9%)
Maxillary ostium stenosis	6 (17.6%)
Septal deviations	18 (52.9%)
Paradoxical bending of middle turbinate	6 (17.6%)

mm, millimetres.

Table 4. **Decisions for sinus floor elevation**

Radiological characteristics and decisions for sinus floor elevation	No. of patients (%)
Decisions for sinus lift	
ENT contra-indications	
Potentially irreversible ENT contraindications	0 (0)
Presumably reversible ENT contraindications	13 (38.2)
Post-traumatic nose deformity	1 (8.9)
Hyperplastic chronic sinusitis*	2 (5.9)
Non-hyperplastic chronic maxillary sinusitis†	5† (14.7)
Endo-antral foreign bodies‡	7 (20.6)
No ENT contraindications	21 (61.8)
Treatments and prescriptions	
No preparation requested	8 (23.5)
Pre-sinus lift medical therapy§	8 (23.5)
Pre-sinus lift surgical treatment	13 (38.2)
Functional rhinoseptoplasty	1 (2.9)
ESS±septo-turbinoplasty¶	5 (14.7)
Removal of endo-antral foreign bodies±septo-turbinoplasty**	7 (20.6)
Other preparations	16 (47)
Allergy assessment	3 (8.8)
Trans-antral evacuation of cyst	3 (8.8)
Stop smoking	10 (29.4)

*: Group III, according to Stamberger's classification [6].
†: Including one patient with fungus ball and two patients with endo-antral foreign body with maxillary sinusitis.
‡: Including two patients with concomitant chronic sinusitis and five patients without concomitant chronic sinusitis.
§: Topic nasal steroids administered for 20 days before sinus lift and for 7 days after surgery; in one patient, systemic steroids and antibiotics were combined.
¶: Middle meatal antrostomy (1); middle meatal antrostomy and anterior etmoidectomy (3); septo-turbinoplasty with middle meatal antrostomy and anterior etmoidectomy (1).
**: Endo-antral foreign body removal via canine fossa (4); endo-antral foreign body removal via canine fossa with septo-turbinoplasty (1); endo-antral foreign body removal via middle meatal antrostomy (2).

with seasonal allergic rhinitis were advised to avoid undergoing SFE during their allergic period, and smokers or "passive smokers" were advised to avoid smoke exposure in the perioperative period. Finally, we recommended postponing SFE in the case of acute upper respiratory tract infection.

The patients who received surgical treatment for a PREC were clinically and endoscopically followed up, and SFE was carried out 6–9 months later (a median of 7 months) when they had completely and stably recovered.

Six patients (17.6%) did not undergo SFE for personal reasons unrelated to any ENT disease. In the remaining patients, a telephone interview, 1 month after oral surgery ensured that the patients who underwent SFE did not experience any intra- or post-operative complication. Moreover, an ENT evaluation with nasal fiberoptic endoscopy performed 3–6 months post-operatively (a median of 5 months) disclosed the development of any pathological naso-sinusal process. In eight patients, endoscopic inspection of the antrum was feasible on the basis of previous antrostomy (seven patients) or the presence of a practicable accessorial ostium (one patient) without evidencing neither endoantral purulent discharge or neoformations, nor any impairment of the mucosal healing.

Flowchart of the study population is reported in Fig. 4.

Discussion

Dental implant surgery is a common routine practice in dentistry that increasingly requires recourse to SFE to restore adequate maxillary bone in the postero-superior sectors to make feasible, simultaneously or subsequently, the placement of dental implants (Jensen et al. 1998; Wallace & Froum 2003; Del Fabbro et al. 2004; Aghaloo & Moy 2008; Del Fabbro et al. 2008; Pjetursson et al. 2008). However, although SFE is considered an efficacious procedure, oral surgeons need to remember that the proximity of the maxillary sinus means that SFE may impair antral physiology causing unpleasant complications that may compromise a positive outcome. The most frequent complication is maxillary sinusitis, which has been reported in up to 27% of cases (Misch 1987; Chanavaz 1990; Quiney et al. 1990; Tidwell et al. 1992; Ueda & Kaneda 1992; Regev et al. 1995; Kaptein et al. 1998; Kasabah et al. 2003). Its development may be related to intra-operative events, such as the perforation of Schneider's membrane, or conditions impairing maxillary clearance, such as OMC or internal antral ostium obstructions (Doud Galli et al. 2001; Pignataro et al. 2008).

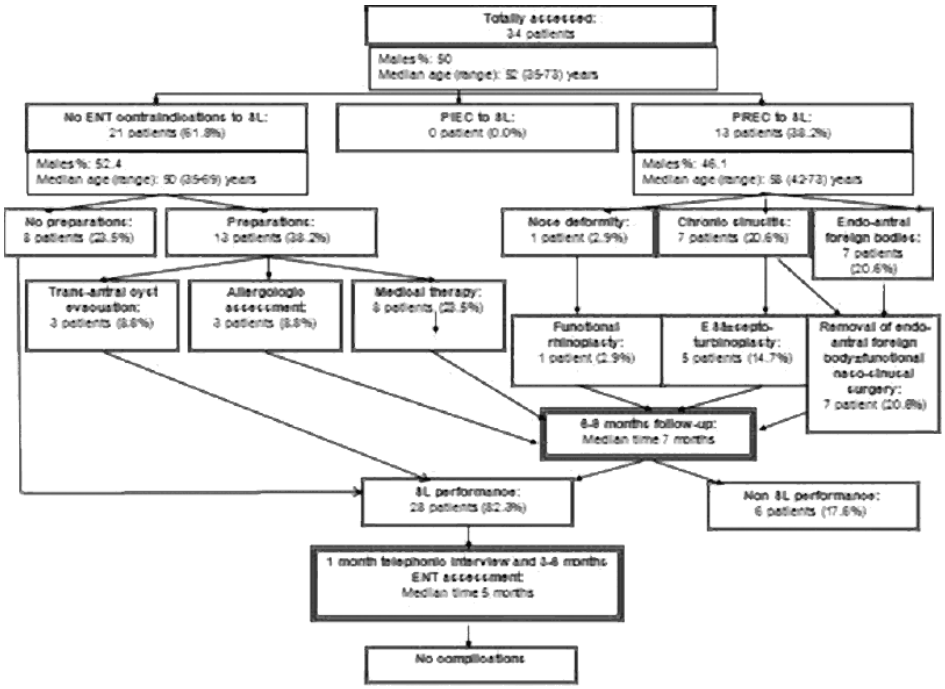

Fig. 4. Flowchart of the study population.

For this reason, we recommended (Pignataro et al. 2008) that candidates for maxillary SFE with any radiological or anamnestic evidence suggesting impaired maxillary sinus conditions should undergo an ENT evaluation that includes nasal endoscopy and, possibly, CT of the maxillo-facial district.

In our own preliminary experience of such a preventive/diagnostic evaluation, we found that most of our patients did not present any ENT contraindication to SFE (i.e. they apparently had no predisposing factors for sinus disease) and rather showed good sinus compliance and low risk for maxillary-related complications. In such cases, it was declared that there was no ENT impediment to SFE, and the surgery was performed immediately without any complication.

Patients judged as PREC carriers have been treated pharmacologically or surgically before the SFE to re-establish the physiological maxillary drainage and ventilation, and reduce the risk of post-lifting maxillary sinusitis, which may be responsible not only for bone graft loss and consequent SFE failure (Buiter 1976) but also for dangerous complications relating to the spread of the infection to the nearby noble structures.

It needs to be remembered that any surgical treatment of the maxillary sinus activates the mediators of cell inflammation and promotes transient sinusitis (Pignataro et al. 2008), and this is particularly true in the case of SFE as a mild post-operative inflammatory reaction has been discovered histologically after the procedure (Timmenga et al. 2003). This occurs because the traumatic lifting of Schneider's membrane may temporarily inhibit ciliary activity (Mantovani 2009), thus predisposing to an altered mucous composition and bacterial infection (Misch 1987; Zimbler et al. 1998). Furthermore, physiological maxillary drainage into the middle meatus can be impaired during SFE in various ways, including the induction of transient inflammatory peri-ostial swelling, excessive raising of the maxillary floor (especially in the presence of antral cysts) (Buiter 1976) and the endo-antral displacement of graft fragments through mucosal lacerations, which can obstruct the maxillary ostium especially if they are larger than 5 mm (Zimbler et al. 1998). This last must be taken into account because perforation of the membranous sinusal lining during its detachment from the maxillary floor is not at all unusual (Regev et al. 1995; Kasabah et al. 2003).

However, it is well known that sinus mucosa recovers well after surgery, and previous studies have shown that the maxillary mucosa can promptly return to homeostasis after SFE, especially if sinus drainage is good (Stammberger 1986; Jensen et al. 1998; Timmenga et al. 2003). However, in unfavourable situations, post-lifting maxillary homeostasis cannot occur, which leads to bacterial sinusitis that can compromise the surgical outcome. The preoperative detection (and, whenever possible, correction) of all the conditions impairing maxillary ventilation and clearance seems to be necessary to reduce the risk of SFE-related morbidity, which means that a preoperative ENT assessment may be very important for stratifying candidates for SFE.

We found PRECs (mainly chronic sinusitis with or without odontic endo-antral foreign bodies) in about 40% of our patients, and odontogenic maxillary sinusitis in about 15%. This is quite interesting, as it seems to suggest that patients who have previously undergone dental treatment deserve a particularly careful evaluation to exclude a possible silent maxillary sinusitis of dental origin, which has to be completely resolved before performing SFE. It has been clearly demonstrated that there is a direct relationship between dental infection and maxillary mucosal impairment, and it is known that the loss of teeth due to periodontal disease and the presence of periapical lesions and endodontically treated teeth, predispose to the development of bacterial dental inflammation or infection that can slowly progress and spread to the antral mucosa (Legert et al. 2004).

Our experience suggests that common anatomical alterations, such as mild septal deviation or the presence of small concha bullosae or paradoxical middle turbinates not associated with history or evidence of sinus disease, should not be considered ENT contraindications to SFE and thus do not require any pre-lifting surgical correction. In such cases, particular attention should be paid to maximize the sinus compliance properly treating any possibly associated naso-sinusal minor disease (i.e. nasal hyperreactivity, allergic or extrallergic, by means of preoperative topic steroid therapy, nasal douches, etc.) (Mantovani 2009).

Similarly, we do not consider allergic rhinitis and non-allergic nasal hyper-reactivity without chronic sinusitis as not contraindications *per se*, although patients with these conditions should be prepared with topical nasal steroids and irrigations (started at least 3 weeks before SFE and continued for 1/2 weeks after the procedure), and SFE should be avoided during the seasonal exacerbation of allergic rhinitis to reduce ostial oedema and improve sino-nasal drainage (Mantovani 2009). Accordingly to our experience, the presence of an antral cyst on the sinus floor was also not considered a PREC: if judged large enough to obstruct the inner natural ostium of the maxillary sinus when lifted with the sinus floor, we advised the oral surgeon to evacuate it, using a fine needle, before detaching the Schneider's membrane through the vestibular window.

There were no intra- or post-lifting complications nor any signs or symptoms attributable to post-lifting maxillary sinusitis in the patients with no ENT contraindications or those with PRECs. This suggests that careful multi-tasking preoperative management, including an ENT assessment by means of fiberoptic endoscopy and a radiological evaluation covering the upper dental arch, the maxillary sinus *in toto* and the region of the ostio-meatal complex region, resulted to be very useful in candidates for SFE to obtain favourable results.

We moreover underline that, despite about 30% of our patients were smokers, condition known to be correlated to increased failure rate in dental implant apposition (Moy et al. 2005), none of them presented intra- or post-operative complications related to SFE performance.

The lack of a randomized control group (that is candidates to SFE not undergoing the preoperative ENT evaluation) making possible to compare the rate of intra- and post-lifting complications should be considered one limitation of this study; however, we believe that this would not be ethical and, in any case, there are previously published data concerning the occurrence of post-lifting maxillary sinusitis that can be used for comparative purposes (Misch 1987; Chanavaz 1990; Quiney et al. 1990; Tidwell et al. 1992; Ueda & Kaneda 1992; Regev et al. 1995; Kaptein et al. 1998; Kasabah et al. 2003).

Conclusions

The use of a preventive/diagnostic protocol consisting of a tertiary specialist ENT evaluation is aimed at: (1) detecting all of the possible PIECs or PRECs to SFE; (2) solving them whenever possible; (3) documenting complete clinical recovery after the surgical correction of PRECs by means of regular follow-up examinations, possibly including direct endoscopic inspection of the antrum through middle meatal antrostomy (if performed) or any accessorial maxillary ostium, if present and practicable; and (4) making a declaration of sinus compliance (i.e. estimating the risk of SFE failure due to any ENT factors).

Although larger case series are needed to confirm these encouraging preliminary results, our experience suggests that this protocol is very useful reducing the risk of unpleasant complications that are dangerous for implant survival. Furthermore, by improving patient well-being, it also provides oral surgeons with a good medico-legal guarantee before the procedure is attempted.

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