CHAPTER
18

Complications

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Introduction

Zygoma implants have been proposed to facilitate and shorten the time period for prosthetic rehabilitation of the edentulous atrophic maxilla, because bone grafting procedures are not needed It is important to note that this procedure is not without complications. However these can be minimized by thorough planning and a careful minimally invasive surgical technique. Although complications have been reported in the literature, the survival rates for zygoma implants are generally high (94.2–100%). Reported complications include postoperative sinusitis, oroantral fistula formation periorbital and conjunctiva hematoma or edema, lip lacerations, pain facial edema, temporary paresthesia, epistaxis, gingival inflammation and orbital penetration.

Loss of zygoma implants may occur as a result of overloading and persistent infection. Speech alterations and problems in maintaining hygiene of the dental prosthesis, apical excess emergence in the infratemporal fossa, buccosinusal fistula secondary to defective surgical closure, and chronic gingivitis have also been described Severe sinus infection is rarely present, although sinus membrane perforation is common during this type of surgery.

Fig 18-1 Skull model illustrating the curvature of the zygoma bone in relation to the osteotomy. Note that it is easy to drill out of the bone boundaries.

In this chapter the most frequent complications associated with zygoma implant therapy that have been reported in the literature will be described All illustrations in this chapter except for Figs 18-2 and 18-6, have been collected during the years of use and development of the technique. For didactic purposes, possible complications will be classified in relation to the stage of the original zygoma rehabilitation procedure: intrasurgical complications, early complications, and late complications.

Intrasurgical complications

Invasion into the temporal fossa and/or the orbit

Accidental penetration of anatomical structures adjacent to the zygomatic arch or along the implant pathway is an important concern during surgery. The surgical procedure demands good knowledge of the local anatomy. This is particularly relevant where there is severe maxillary atrophy and when the use of four zygoma implants is considered The volume of the zygoma bone may be insufficient for anchorage of two implants,[1] and it will then be necessary to direct the implants toward the eye socket. This may cause some postoperative discomfort such as conjunctival and periorbital edema and hematoma, although the symptoms will decline and the patients will recover in a few days. Although the use of regular implants in the pterygoid process it is not a new technique [2] the placement of zygoma implants in the pterygoid region has recently been described as a solution for the severely atrophied maxilla. However significant errors can be induced by only a slight deviation in the direction of the drill pathway at this site [3] Reychler and Olszewski gave a case report of intracerebral penetration by a zygoma implant.[4] The pathway of the inserted zygoma implant in the pterygoid region was too cranial and too apical and the implant ended in the temporal fossa (Fig 18-1

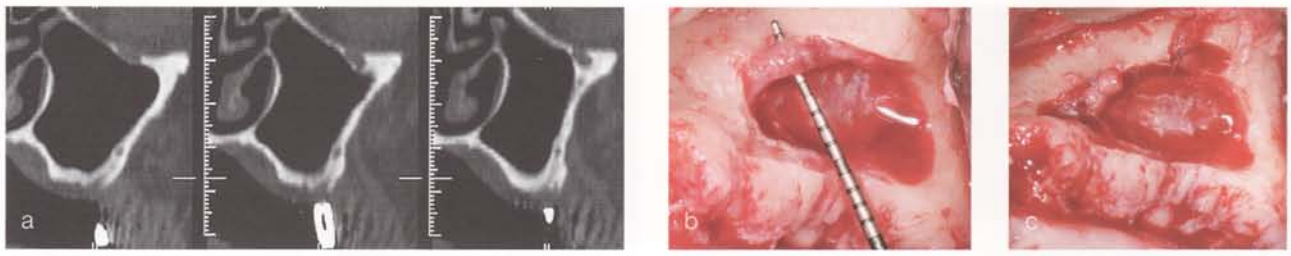


Fig 18-2 Potential bleeding. (a) CT scan showing part of the nose, the left maxillary sinus, and its boundaries. A radiolucency, approximately 2–3 mm in diameter can be seen on the inferior maxillary anterior wall. (b) An unusually large vessel has been dissected during the sinus wall fenestration (c) The vessel has been ligated and the sinus procedure can be continued. (Courtesy of Dr Tiziano Testori

Excessive b eeding

Perforation of the intraosseous anastomoses between the dental branch of the posterior superior alveolar artery and the infraorbital artery (Fig 18-2) can result in excessive bleeding during preparation for the implant This is difficult to foresee in all patients since the anastomoses can be identified in CT scans in only 53% [5]

Care should be taken to avoid incisions and tearing at the insertion of the masseter muscle to the zygomatic arch since this may result in significant bleeding.

Early complications from surgery to final prosthesis delivery

The early period is considered to cover a period of approximately 6 months after the surgery, including the implant healing phase and the abutment connection surgery.

Postoperative phase

- *Facial hematoma* An intense facial hematoma can be expected this resolves in approximately 10 days.
- *Paresthesia* – Sensory disturbances at the cheek and paranasal zones can be experienced as a result of the surgical identification of the infraorbital foramen this normally subsides 3 to 8 weeks after surgery.
- *Labial laceration* – Because of the length of the drills, the lower lip requires protection dur ing the drilling sequence to avoid possible injury or burns. Aparicio and co-workers reported lip laceration caused by friction from rotary surgical instruments in 5 of 69 patients.[6]
- *Nasal bleeding* – Moderate nasal bleeding can be expected for –3 days. To prevent bleeding patients are advised to avoid increases in intrasinus pressure by controlling sneezes and avoiding forced expulsion of air through the nasal cavity.
- *Pain* – Mild to moderate postoperative pain that is effectively treated with conventional analgesics is frequently reported However most authors report that all patients underwent a postoperative period that was similar to that for patients under going conventional implant surgery.

Comp ıcatıons re ated to the penetratıon of the mucosa

- *Fistula related to the placement of the prosthetic abutment screw* – According to Becktor and coworkers, the internal threaded abutment screw chamber of the zygoma implant may create a communication from the oral cavity into the max illary sinus, which could result in sinusitis (Fig 18-3a,b) [7]
- *Inflammation and hyperplasia around the prosthetic abutment* – This occurs frequently when using an intra-sinus path as the abutment emerges through fatty palatal mucosa and this induces

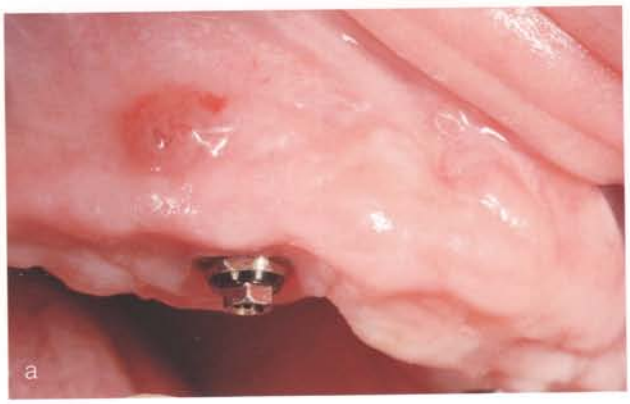


Fig 18-4 Palatal emergence of two standard abutments has led to a chronic mucosal hyperplasia. The possibility that palatal fat tissue is around the abutment surface must be considered.

Fig 18-3 Formation of a fistula. (a) A fistula on the soft tissue, closely related to the implant abutment junction. (b) The trajectory was radiographically explored by first introducing a radiopaque gutta percha tip into the fistula.

inflammation This problem can be eliminated by excision of fatty tissue (Fig 18-4

- *Sinusitis and oroantral communication* – This may occur in the early stage, although it is more frequent in the later stage of the process (see below)

Early loss of implants

Since there are no data available that differentiate early from late failure of zygoma implants, all implant losses will be discussed below

Late complications

Loss of implants

In a literature review of English-written scientific journals, 20 studies presenting clinical outcomes with the zygoma implant were found [8] The publications included 582 patients and 1143 zygoma implants with a follow-up of 6 months to 12 years. A total of 18 implants were reported as failures, giving an overall survival rate of 98.4% However it should be noted that some studies covered in part the same patient groups and therefore, the true numbers of unique patients and implants are not known in detail Nevertheless, the data show that the zygoma implant technique is highly predictable and results in good clinical outcomes. By comparison the additional 1388 conventional implants, placed in the anterior region showed a survival rate of 94.8% n a recent study from the Brånemark group, data from 28 patients treated with 52 zygoma implants and 106 regular implants over a period of 5–10-years were reported Three zygomatic (6% and 29 regular (27% implants were lost during the follow-up [9] Peñarrocha and co-workers reported that patient satisfaction with zygoma implant-supported fixed prostheses was similar to that for fixed prostheses supported by conventional implants.[10] It should be stressed that the implants of these studies had a machined surface. Today, zygoma implants with a roughened oxidized surface are commercially available To the authors' knowledge, no long-term clinical follow-up studies have been published with surface-modified zygoma implants. Figure 18-5 illustrates treatment of implant failure.

Oroantral/nasal communication with or without acute sinusitis

The vast majority of patients treated using zygoma implants do not experience sinus pathology. Zygoma

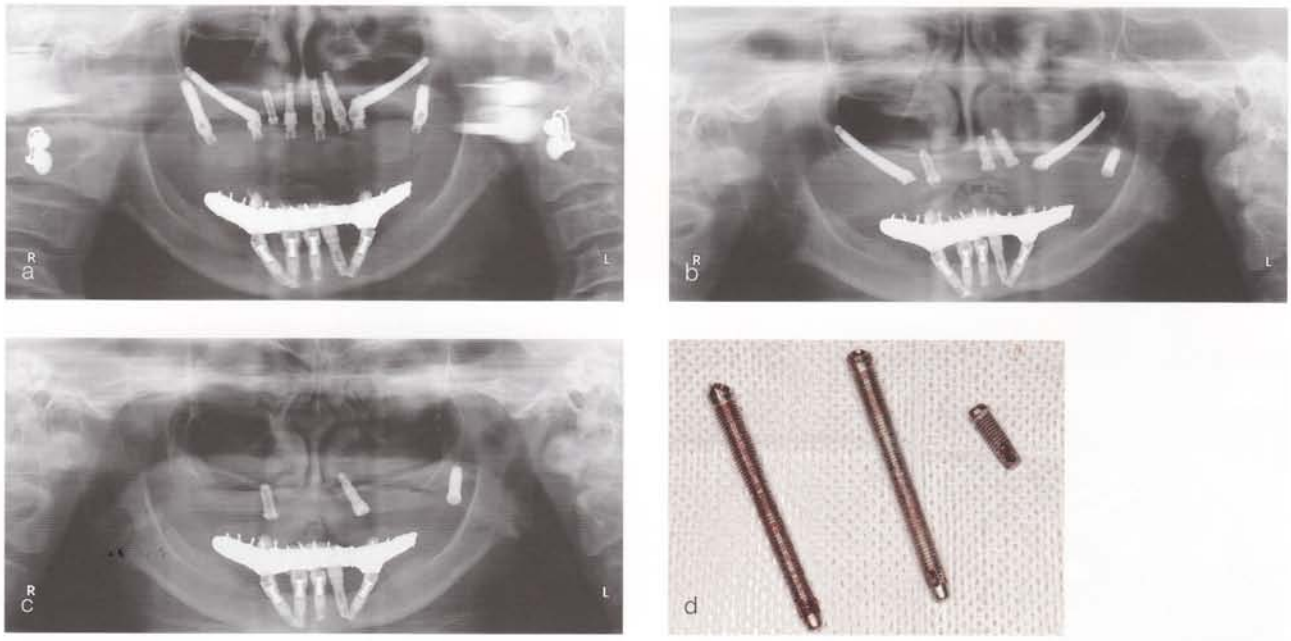
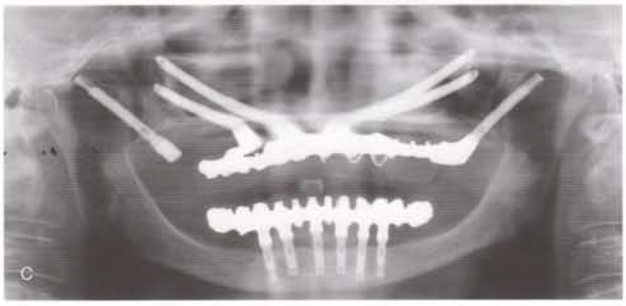


Fig 18-5 Implant failure. (a) Radiograph showing failure of upper implants: just one of the old implants was left. The zygomatic bone was extremely thin. Since the two zygoma implants had rotational movement at insertion, a two-stage surgery was decided. (b) At the second stage, failure of two regular implants was detected. (c) Six months later on delivery of the provisional prosthesis, the failure of integration of one regular and the two zygoma implants was diagnosed. (d) The regular and two zygoma implants just after removal

implants traverse the sinus cavity, without keeping the Schneiderian membrane intact, in order to have anchorage at the level of both the maxillary bone and the zygomatic bone [11] The relationship between the implant and the maxillary sinus structures remains controversial zygoma implants could potentially cause inflammatory problems or infections at the level of the maxillary antrum Nevertheless, there is little evidence-based data concerning the relationship of the zygoma implants and the sinus cavity. A few studies have analyzed sinus reactions to zygoma implants. An oroantral communication is not necessarily related to an infectious process since often soft tissue is able to seal the interface around the implant head (Fig 18-6) This fact is the rationale for advising patients to avoid the use of any water pressure device that could break the biological soft tissue seal This applies also to probing around the zygoma abutment. However a concurrent sinusitis may occur either in the early phase or in the late one (Fig 18-7) A more detailed explanation of these phenomena is given in Chapter 6.

Becktor and co-workers had to remove 3 of 31 implants because of recurrent sinusitis, in spite of the implants being clinically stable.[7] They offered two explanations for their problems. either the internal threaded abutment screw chamber of the zygoma implant created a communication from the oral cavity into the maxillary sinus, which may have resulted in sinusitis, or a lack of osseointegration occurred at the marginal level in the palatal area, which resulted in transverse mobility of the zygoma implant and a pump effect during function To explain the difference in the percentage of sinus complications, it may be that the learning curve of the surgeon was a factor in this study. Maló and co-workers reported early sinusitis within the first year in 13 6% of the sinuses treated with a new technique and a new implant design [12] Other authors, including our group, have reported reduced rates, 4% or less, of delayed unilateral infection of the maxillary sinus apparent after the placement of zygoma implants, which were just treated with antibiotics. The authors agree with the statement of Bedrossian [13] that if the infection does



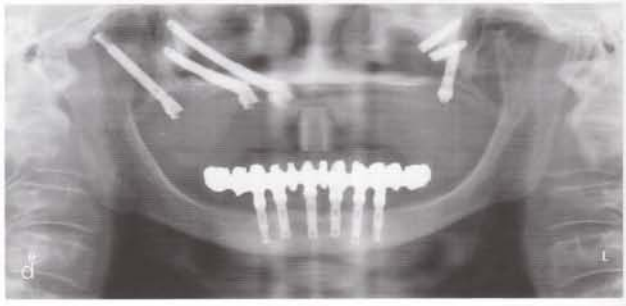


Fig 18-6 A patient complaining about sinus and nasal oral leakage and prosthesis movement when chewing. She was wearing a removable obturator to partially reduce the communication. No acute nasal or sinus reactions were demonstrated. (a) Palatal view. (b) Palatal clinical view without the obturator Note the palatal emergence of the zygoma implants. (c) Maxillary prosthetic rehabilitation directly on four implants. Note that the right pterygoid and the left distal zygoma implants were not used. (d) The right pterygoid implant was found integrated and subsequently connected. The left pterygoid implant was not integrated and a new implant in a mesial and perpendicular position was placed instead. The two mobile left zygoma implants originating the communication were cut off through the original "window·" the nasal and sinus epithelium were raised and sutured. A pediculated soft tissue graft was used to close the palatal defect. Note that angulated abutments were used to reduce the palatal emergence of the original implants. (e) Palatal view after healing.

Fig 18-7 Sinusitis 2 years after implant surgery. Coronal CT image shows no pathology and good permeability of the ostiomeatal complex at the left side whereas the right maxillary and ethmoidal sinuses are fully occupied. The infection was successfully treated with antibiotics.

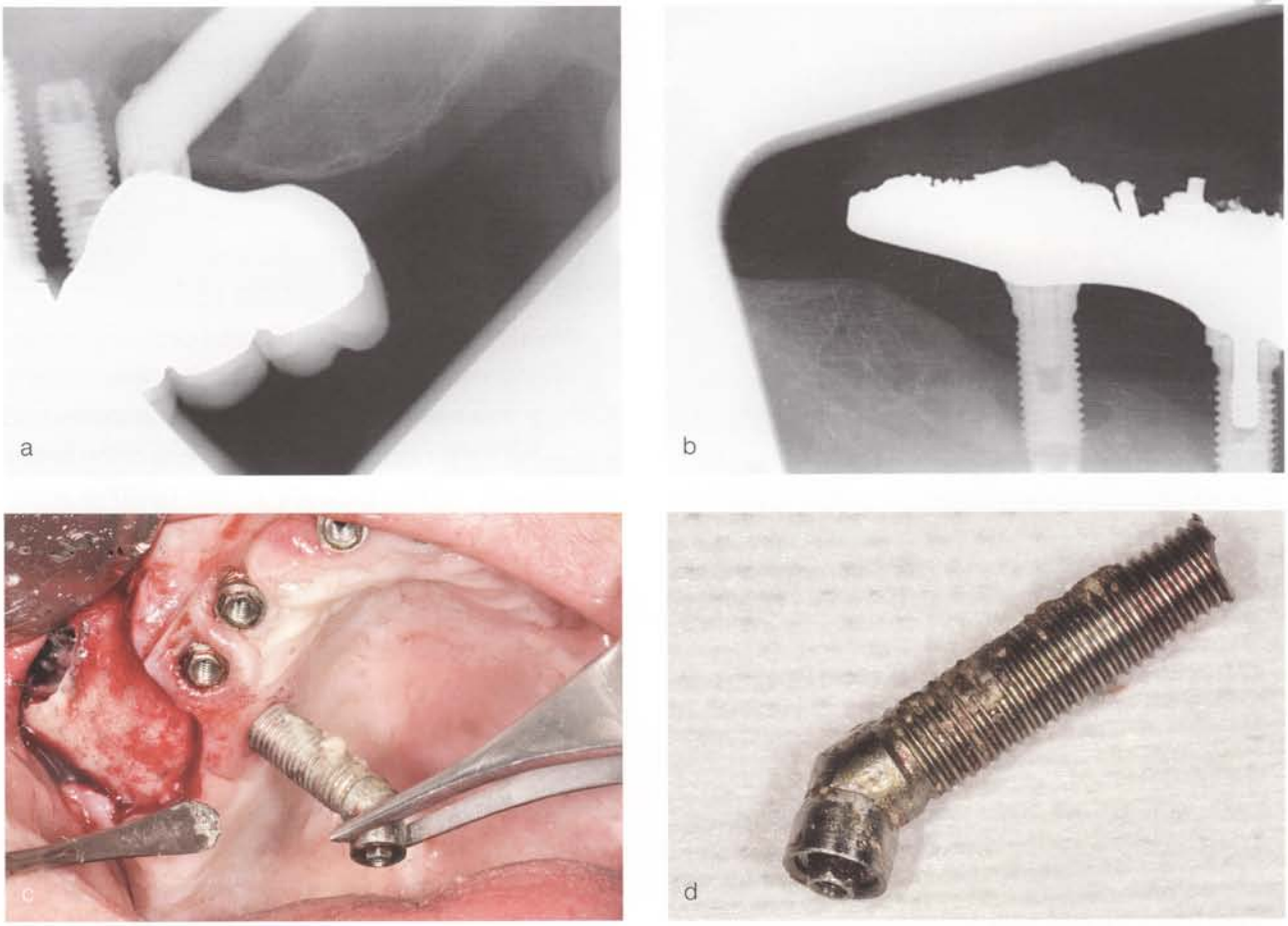


Fig 18-8 Delayed occurrence of sinusitis in a heavy smoker with a drug addiction. (a,b) Intraoral radiographs, taken after 10 years of function showing severe bone loss around the upper and lower implants. Repetitive sinusitis was diagnosed. (c,d) The two zygoma implants were cut off through the original "window." (e) The explanted coronal part of the zygoma implant.

not resolve with one or two rounds of oral antibiotic therapy there may be concern that the implant is acting as a foreign body and is responsible in part for the persistence of the infection (Fig 18-8)

Failure of conservative treatment to resolve these infections with antibiotics warrants consideration of functional endoscopic sinus surgery. The principal goal of this approach is to restore patency to the ostiomeatal complex, the key anatomical area of drainage for the maxillary and anterior ethmoidal sinuses. Surgery should be functional and involve widening the natural drainage openings of the sinuses and preserving the ciliated epithelium as much as possible.

According to Davó and co-workers, it is not clear if sinusitis rates in patients with zygoma implants are higher than rates in the general population [11] From the available data, sinusitis rates for the classic two-stage protocol are approximately 6.6% for immediate function protocols this is approximately 2.8% and if both protocols are considered together the rate is approximately 5.5% (see Chapter 6) The permeability of the ostiomeatal complex should always be checked before implant surgery commences

Peri implantitis

Bone loss is more problematic for zygoma implants than for regular implants because of the limited amount of bone surrounding the implant head (Fig 18-9) When monitoring zygoma implants in a

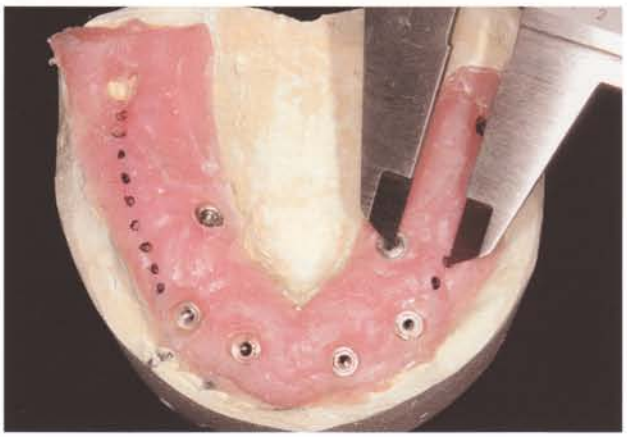


Fig 18-9 Illustration of the mean distance from the zygoma implant to the central part of the residual crest. In a control group treated with the original Brånemark intra-sinus pathway technique, the mean distance was 11.2 mm (SD, 5.3), whereas using the zygoma anatomy-guided approach (ZAGA) produced a mean value of 2.9 mm (SD 0.24). (Data from Aparicio et al[19])

routine way, it is not possible to use a controlled paralleling radiographic technique. The reasons for this are that the palate is almost flat, leaving no place for regular intraoral film and the oblique direction of the zygoma implant in combination with the resorption makes it difficult to utilize a standardized protocol

Prosthetic complications

There are two major groups of complications related to the fixed prosthesis connected to zygoma implants.

- problems derived from the design of the prosthesis. speech oral hygiene, discomfort
- mechanical problems of the components of the prosthesis.

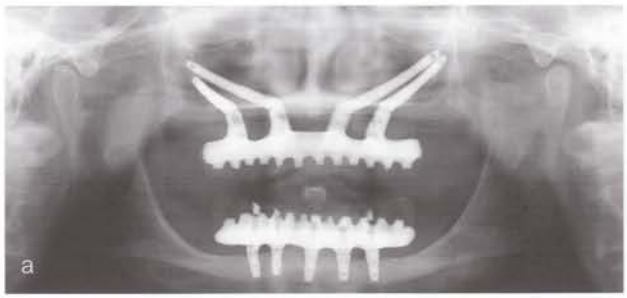
Problems from the bulky design

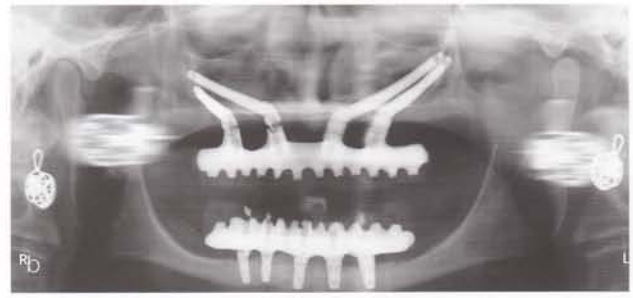
One drawback with the original zygoma implant technique is the palatal emergence of the implant head which is often caused by the desire to maintain the implant body within the boundaries of the maxillary sinus (Fig 18-9) This commonly results in a bulky dental fixed partial denture at the palatal aspect, which sometimes leads to discomfort, speech problems, and problems with oral hygiene. Two other reasons for a bulky prosthetic design are incomplete implant insertion resulting in an extruded position of the implant platform which subsequently influences the design of the fixed partial denture and incorrect or no use of angulated abutments.

When using the original surgical protocol meaning an intra-sinus pathway for the zygoma implant, authors have reported on speech alterations and problems in maintaining correct hygiene of the dental prostheses, largely because of the palatine emergence of the head of the zygoma implant.[14]

Boyes-Varley and co-workers placed 30 zygoma implants in 18 patients, modifying the angulation of the implant head 55 degrees in order to position emergence at the level of the alveolar crest.[15] They considered that this angulation of the implant head reduced the cantilever by about 20% which also improved the space available for tongue movement and allowed the patient better access for adequate maintenance of the dental prosthesis.

Speech is influenced by a number of factors such as length position inclination and thickness of the prosthetic teeth In implant treatment, oral hygiene is often facilitated by increasing the gap between the palate and the superstructure, but again speech can be affected by this modification The palatal space in the premolar region can also affect a patient's ability to articulate. Transverse and sagittal changes are simultaneously introduced in these fixed dental prostheses. Petrovic showed that a sagittal alteration in the maxillary incisors of 2 mm can cause up to 80% distortion of speech in patients wearing a complete denture.[16] To achieve a class occlusion the thickness of the palatal portion of the fixed dental prosthesis is usually increased compared with pretreatment. Speech distortion increases rapidly when the palatal plate is made more than 1 mm thicker Bothur and co-workers investigated the speech ability of patients treated with multiple zygoma implants although the purpose was not to specifically register the changes in prosthesis design for individuals [17]





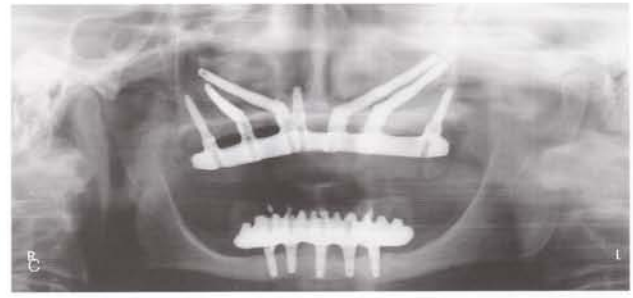


Fig 18-10 Masticatory overload. (a) The extreme composite maxillary defect of this patient was treated by means of four zygoma implants and a CAD/CAM Procera prosthesis. (b) Radiograph illustrating the prosthesis 2 years after final delivery. (c) To increase the implant capacity to withstand the patient's masticatory load, three more implants were added, and a new prosthesis created.

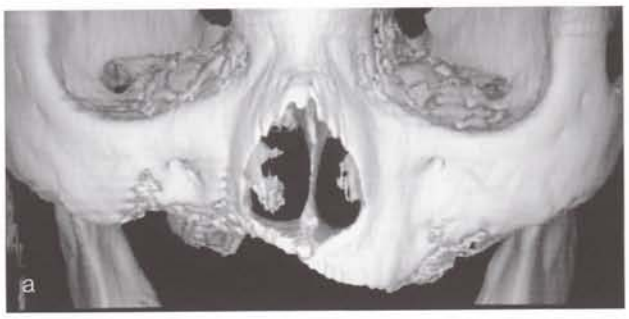
However it is reasonable to assume that many of the unfavorable factors mentioned may be evident in the design of a fixed dental prosthesis supported by multiple zygoma implants. Seven consecutive patients were treated with a total of 28 zygoma implants and five conventional implants All patients received a fixed dental prosthesis. According to the evaluations by professionals and self-evaluation by the patients, Bothur and colleagues concluded that a mild deterioration in speech can be anticipated in patients subjected to treatment with a fixed dental prosthesis supported by multiple zygoma implants.

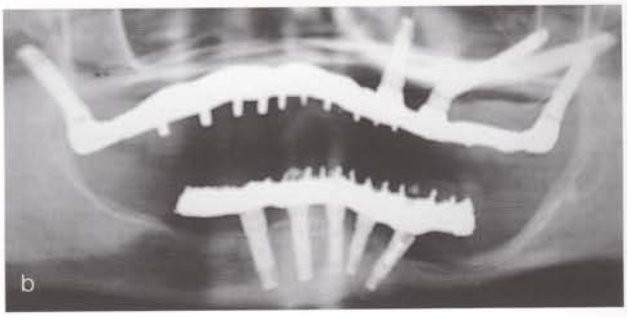
In a recent report, representing the follow-up of a 3-year study, Aparicio et al[18,19] reported the results of a cohort group of 95 consecutive patients treated with zygomatic implants according to the ZAGA surgical and prosthetic principles. All included patients had at least year of prosthetic follow-up, which included the possibility of comparing a pre-surgical to a final cone beam CT The surgery period was from 2004 to 2008, with a mean follow-up of 4.13 years (1 02–7 92 years) In total 502 regular implants and 186 zygomatic implants were placed The position of emergence of the head of zygomatic implants related to the center of the alveolar crest in the horizontal plane was measured and had a mean value of 2.29 mm (SD 0.24

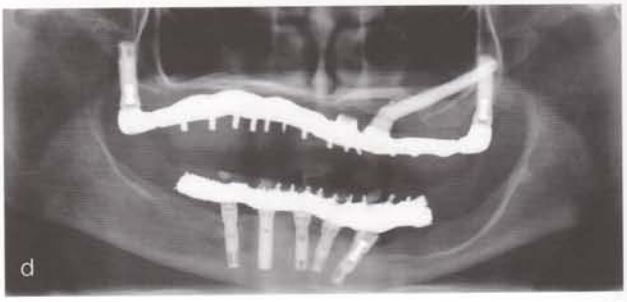
Mechanical prosthetic problems

Not many reports can be found in the literature concerning mechanical prosthetic problems in patients with zygoma implants. Aparicio and co-workers showed few mechanical problems experienced during follow-up study over 6 months to 5 years.[6] Loosening of the zygoma implant gold screws was recorded in nine patients. Fracture of one gold screw as well as the prosthesis occurred twice in one patient who was a bruxer Four patients with metal–resin prostheses showed repeated fracture of the anterior prosthetic teeth The problem was solved by adjusting the occlusion and allowing more space between the maxillary and the mandibular teeth in excursion A metallic occlusal plate had to be used in one patient. The prosthetic unit can fail in any of the different components including

- fracture of the prosthesis screws related to over load (Fig 18-10)
- fracture of the abutment screw· fracture of the prosthesis screw can be related to overload situations (Fig 18-11







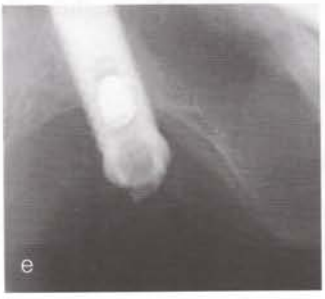


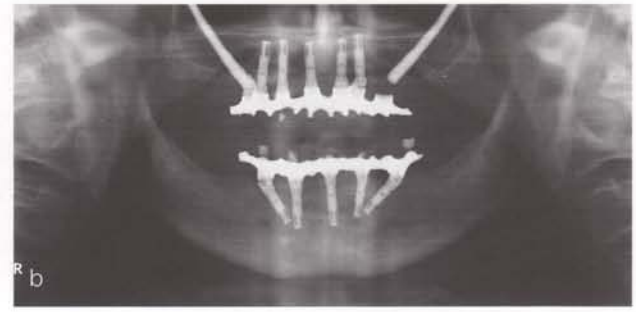
Fig 18-11 Fracture of the abutment screw. (a) Reconstructive three-dimensional view showing the extreme alveolar and basal maxillary bone loss. (b) Postoperative radiograph showing placement of four implants including one zygomatic and two pterygoid. The prosthesis is in place. Since this patient was treated with the original technique, the placement of the right zygoma implant was aborted because of the envisioned extreme palatal emergence. (c) Detail of the cast prosthesis frame for a hybrid, acrylic-to-metal, restoration. Note the extreme cantilevered design. (d) Radiograph illustrating the prosthesis status 2 years after the surgery shown in (b). Note that one regular implant was lost and the pterygoid abutment screws had to be changed because of repetitive screw loosening. (e) Intraoral radiograph showing an abutment screw fracture that happened 11 years after the delivery of the prosthesis. (f) Intraoral radiograph showing a part of the abutment screw still in place and a new customized screw securing the angulated abutment.

- fracture of the structure or occlusal material
- fracture of zygoma implants, no reports of this complication could be found and in the author's experience, just one implant fractured 6 years after surgery (Fig 18-12).

To summarize, most problems with protheses are likely to be related to the palatal implant emergence that occurred with the original zygoma technique. Use of the modified zygoma anatomy-guided approach (ZAGA) allowed a substantial reduction in the mean distance from the zygoma implant to the central part of the residual crest: from 11.2 mm (SD 5.3) with the original technique to a mean value of 2.29 mm (SD 0.24 with ZAGA (Fig 18-9) [19] The more favorable emergence position can minimize these complications.

Soft tissue dehiscences at extra maxi ary imp ants

One concern with the extra-sinus technique may be the long-term effect of having exposed threads against soft tissue at the lateral aspect of the zygoma



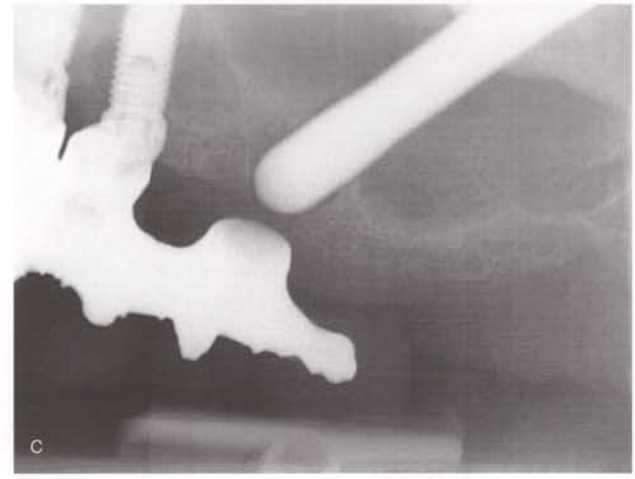


Fig 18-12 Fracture of a zygoma implant. (a) Postoperative radiograph showing seven implants including two zygoma implants in the maxilla. The prosthesis is in place. (b,c) Radiographs illustrating implant status 6 years later Note that the head of the left zygoma implant is fractured.

implants. Rehabilitation using extra-maxillary zygoma implants is new and differs from regular implant treat ment with regard to rationale, biomechanics, and clinical presentation (L Vrielinck, personal communication [LinkedIn] zygoma implants) Consequently, unforeseen problems may appear in the future. A major soft tissue dehiscence around an extra-maxillary zygoma implant has been reported (L Vrielinck, personal communication [LinkedIn zygomatic implants) A small dehiscence (Fig 8-13) does not usually compromise the bone conditions and it is not necessary to remove the implant. Friberg and colleagues did not observe any increased marginal bone loss or failure rate for machined implants with exposed threads at implant surgery compared with fully submerged implants over 5 years of follow-up.[20] This is also our experience. Biomechanically, there is no difference if the implants are covered with soft tissue or not. The anchorage is in the zygoma and has not changed because of the dehiscence. The patients may, however have more difficulties to maintain good oral hygiene and may experience subsequent soft tissue irritation/discomfort (L Stumpel personal communication [LinkedIn zygomatic implants)

In order to avoid soft tissue dehiscences related to extra-maxillary placed implants, we must consider the biotype (thin/thick) amount, and quality of the borders of the mucosa. In addition it is important to keep in mind the type of cutting and placement of incisions, the necessity of a delicate osteotomy in very atrophic maxillae needing extra-maxillary placed implants, and the use of a prophylactic connective/fat tissue graft to increase the quality of the coverage around the implant head

- To achieve the goal of preventing a dehiscence, the placement of the maximum amount of keratinized mucosa at the buccal side of an extra-maxillary implant is strongly recommended This is why a beveled palatal incision line should

Fig 18-13 Soft tissue dehiscence/retraction around an oxidized extra-maxillary placed zygoma implant.

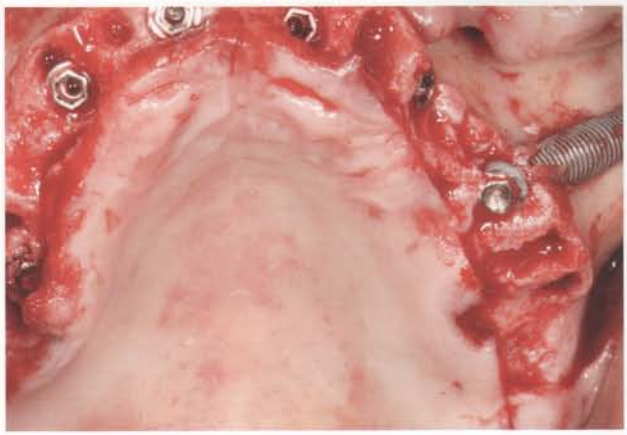


Fig 18-14 A beveled palatal incision was performed. The posterior releasing incision has been placed far away from the implant.

be performed in most cases. Moreover when envisioning the placement of an extra-maxillary zygomatic implant, an eventual posterior releasing incision must be placed far away from the implant placement (Fig 8-14)

- Paradoxically, the osteotomy for an extra-maxillary implant, ZAGA type IV may encounter more difficulties than one performed through the residual alveolar crest. To avoid excessive pressure or tension of the soft tissue due to a protruding implant head a "U"-shaped osteotomy should be performed both on the residual alveolar/basal bone and on the anterior maxillary sinus wall (Figs 18-15 and 18-16) According to ZAGA rationale, a palatal bone perforation is not recommended The difficulty comes from the fact that we are not drilling a bony tunnel but a channel instead. Accordingly, pilot and subsequent drills will show a tendency to buccally escape from the bone. Eventual uncontrolled drilling ends up in an implant body separated from the bone at the crestal level This situation makes it more difficult to achieve stress-free suturing of the surgical flap.
- The scarf graft. Prophylactic mucogingival procedures are advised to cover the implant head with sufficient amounts of keratinized tissue (Figs 18-17 and 18-18) We describe as "the scarf graft," the procedure consisting of the preparation of a pediculated connective or fat tissue graft from the palatal or the Bichart sites, respectively. The graft is secured around the implant neck, like a scarf usually with the help of a suture stabilized in a hole previously made on the alveolar bone (Fig 18-19) Indeed the scarf graft corresponds to the most common and easiest procedure in mucogingival surgery intended to prevent recession around the head of an extra-maxillary zygomatic implant.

Suggested criteria for success of zygoma implants zygomatic success index (ZSI)

A zygomatic success index (ZSI) describing specific criteria to score the success of a rehabilitation anchored on zygomatic implants has been proposed (Table 13-1).[21] ZSI of a specific implant would be represented by the outcome of the following variables.

A. Zygomatic implant stability (individually tested) Mobility of a zygomatic implant comes from the elastic modulus of the anchoring zygomatic bone when bent by a remotely applied force. However the movement must not be rotational, and it will disappear when implants are splinted together A rotational movement should be considered as a sign of implant failure.
B. Associated sinus pathology. The use of the Lund–Mackay staging system [22] a validated scoring system recommended by the Task Force on

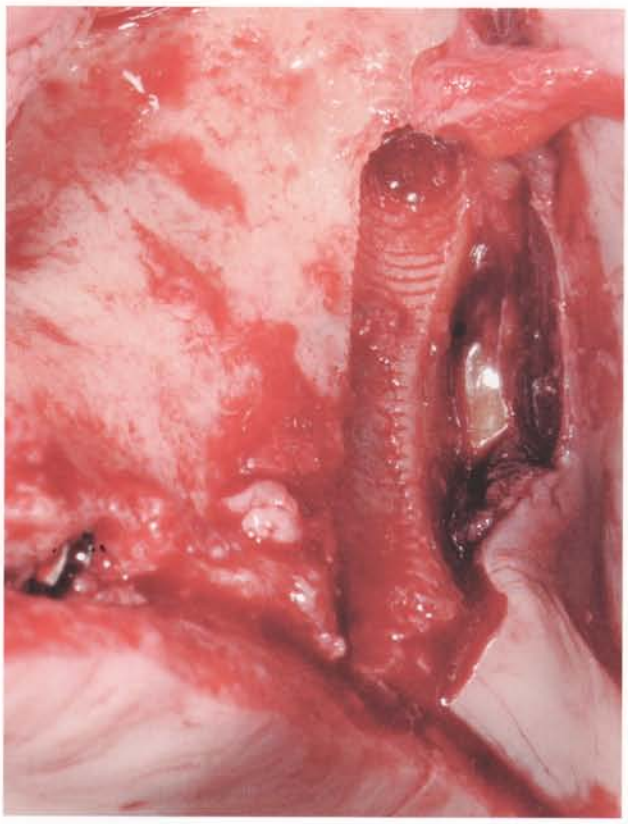


Fig 18-15 The clinical picture obtained right after unscrewing a zygomatic implant because the wrong length was selected. Note the precision of the osteotomy channel/tunnel that has forced the implant threads into the maxillary bone.

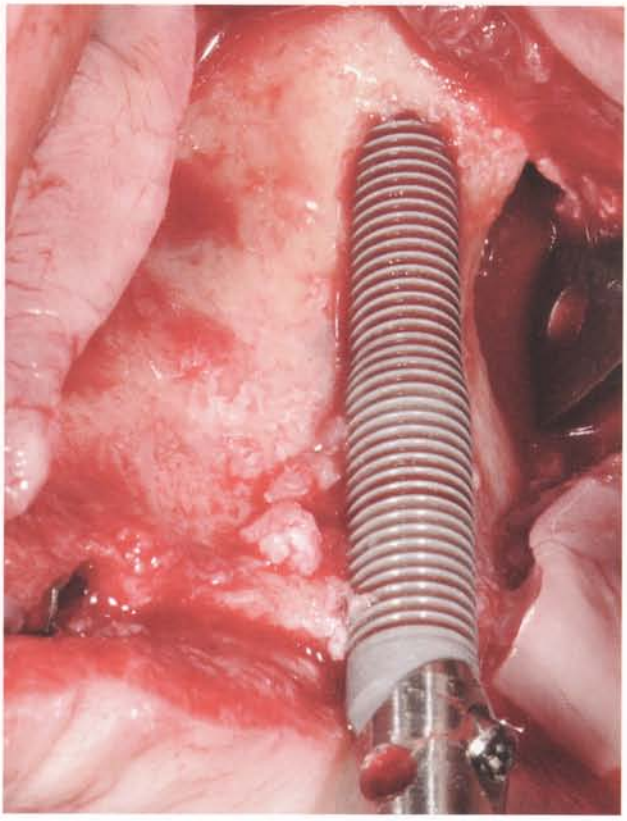


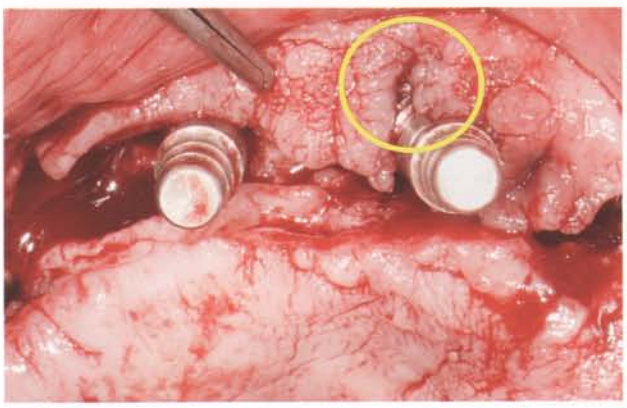
Fig 18-16 To prevent soft tissue dehiscence, the head of the implant is placed in or as close as possible to the crestal bone.

Rhinosinusitis (TFR) for research outcomes is advised The test includes six regions. anterior ethmoid posterior ethmoid maxillary, frontal sphenoid and the ostiomeatal complex. Each region is given a score of 0 1 or 2 (0 represents normality no opacification 1 partial opacification and 2 total opacification) The ostiomeatal complex can only be scored 0 or 2 Total scores range from 0 to 24 (Table 13-2) Any scan with a score >0 would be considered an abnormal or "positive" scan A patient questionnaire developed by Lanza and Kennedy[23] to identify the presence of rhinosinusal symptoms, as specified by the TFR diagnostic criteria (Table 13-3) must be presented to each patient.

C Peri-implant soft tissue conditions. It is recommended to evaluate soft tissue dehiscences on a 4-grade scale based on obtained photographs. The evaluation is negative (success grade I) or positive for thread exposure (up to 7 threads ex posed or more than 7 exposed)

D Specific criteria for zygomatic prosthesis success offset) Prosthetic success would be evaluated based on final positioning of the zygoma implant with respect to the center of the alveolar crest in the horizontal dimension Here, a positive value on implant head position is indicated by a palatal position of the implant whereas a negative value indicates a buccal position (all evaluated on a 4-grade scale)

The ZSI of a specific implant is determined by the addition of the the result of the variables divided by the total number of variables used ((A + B + C + D)/4 An implant unable to be classified into this index would be considered a failure.



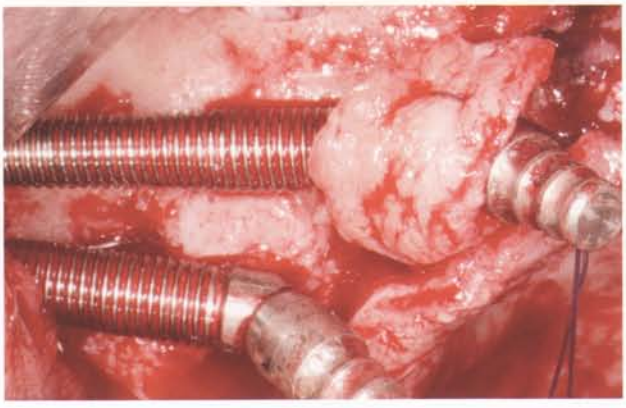


Fig 18-17 Protection of the implant head. (a) A beveled palatal incision has been made but a previous failed implant has left a buccal mucosal defect after its removal (circled). (b) A pediculated soft tissue graft was used to cover the implant head/neck by connective tissue and keratinized gingiva.

Fig 18-18 Recommended prophylactic soft tissue graft around an anterior extra-maxillary zygoma implant.

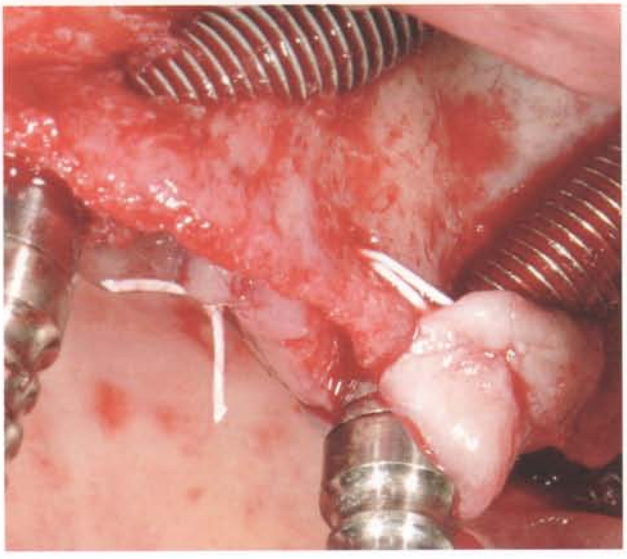


Fig 18-19 The scarf graft around the head of a posterior extramaxillary placed zygoma implant was fixed with the help of a hole in the residual bone.

Table 13-1 The zygomatic success index (ZSI) of a specific implant is determined by the addition of the the result of the variables divided by the total number of variables used ((A + B C D)/4). An implant with a single A to E score unable to be classified into this index will be considered as a failure (from Aparicio et al[21]

	Success Grade I	Success Grade II	Success Grade III	Success Grade IV
A. Zygomatic implant stability (individually tested)	No mobility No pain or associated pathology	No mobility No pain or associated pathology	Slight clinical mobility (no evidence of disintegration of the apical part of the implant or rotation) No pain or associated pathology	Clear clinical mobility (no evidence of disintegration of the apical part of the implant or rotation) No pain or associated pathology
B. Associated sinus pathology	Lanza & Kennedy test (–) Lund–Mackay score = 0	Lanza & Kennedy test (+) Lund–Mackay score = 0	Lanza & Kennedy test (–) Lund–Mackay score > 0	Lanza & Kennedy test (+) Lund–Mackay score > 0
C. Peri-implant soft tissue condition	Surrounded by keratinized tissue No recession	Partially surrounded by keratinized tissue Implant head is visible, but no exposed threads	Surrounded by mobile mucosa Recession: up to 7 threads exposed	Surrounded by mobile mucosa Recession: more than 7 threads are visible
D. Prosthetic offset*	≤3 mm	≤7 mm	≤11 mm	>11 mm

*Prosthetic offset: positive (from palatal to buccal) or negative (from buccal to palatal) distance from the center of the implant head to the center of the residual alveolar ridge.

Table 13-2
Lund–Mackay staging worksheet.[22] Each region is scored 0, 1 or 2 (0 representing no abnormality, 1 partial opacification, and 2 total opacification). The ostiomeatal complex can only be scored 0 or 2. The minimum possible score is 0 (negative CT) and the maximum score is 24.

Major criteria		No abnormality	Partial opacification	Total opacification
Ant. Ethmoid:	R	0	1	2
	L	0	1	2
Post. Ethmoid:	R	0	1	2
	L	0	1	2
Maxillary·	R	0	1	2
	L	0	1	2
Frontal:	R	0	1	2
	L	0	1	2
Sphenoid	R	0	1	2
	L	0	1	2
			Not obstructed	Obstructed
Ostiomeatal complex:	R		0	2
	L		0	2
Total score:	____			

Table 13-3 Task Force on Rhinosinusitis criteria for the diagnosis of rhinosinusitis, from Lanza and Kennedy.[23]

Major criteria	Minor criteria
Facial pain or pressure	Headache
Facial congestion or fullness	Fever (all non-acute)
Nasal obstruction	Halitosis
Purulent discharge	Fatigue
Hyposmia or anosmia	Dental pain
Purulence on examination	Cough
Fever (acute only)	Otalgia or aural fullness
Diagnosis of rhinosinusitis requires: 2 or more major criteria 1 major and 2 or more minor criteria purulence on nasal examination	

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