Currently, there is no consensus on clear criteria to specifically describe zygomatic implant rehabilitation outcomes and assess to what extent they indicate a particular level of success or risk for the treatment. In the same manner, there is a tendency to validate, and subsequently use, the same diagnostic methods to evaluate the status of teeth and oral implants. There is further a tendency to consider and evaluate a zygomatic implant in the same way as a traditional implant placed in pristine alveolar bone. However, the extreme maxillary atrophy that indicates the use of zygomatic implants prevents use of conventional criteria to describe implant success/failure. Currently, results and complications of zygomatic implants reported in the literature are inconsistent and lack a standardized systematic review. Moreover, protocols for the rehabilitation of the atrophic maxilla using zygomatic implants have been in continuous evolution. The current zygomatic approach is relatively new, especially if the head of the zygomatic implant is located in an extramaxillary area with interrupted alveolar bone around its perimeter. Specific criteria to describe success/survival of zygomatic implants are necessary, both to write and to read scientific literature related to zygomatic implant–based oral rehabilitations. The aim of this article was to review the criteria of success used for traditional and zygomatic implants and to propose a revisited Zygomatic Success Code describing specific criteria to score the outcome of a rehabilitation anchored on zygomatic implants. The ORIS acronym is used to name four specific criteria to systematically describe the outcome of zygomatic implant rehabilitation: offset measurement as evaluation of prosthetic positioning; rhino-sinus status report based on a comparison of presurgical and postsurgical cone beam computed tomography in addition to a clinical questionnaire; infection permanence as evaluation of soft tissue status; and stability report, accepting as success some mobility until dis-osseointegration signs appear. Based on these criteria, the assessment of five possible conditions when evaluating zygomatic implants is possible.

Keywords: criteria of success, ORIS, review (narrative), ZAGA, zygomatic implants, zygomatic success code
when the head and part of the body of the implant are located externally to the residual alveolar process or partially externally to the anterior maxillary wall, they do not have bone around their entire perimeter (Figs 1a and 1b), so it does not make sense to assess the success of the implant by measuring the height of the marginal bone since the implant was at least in part intentionally placed outside the osseous limits.

Additionally, success criteria for the zygoma-related rehabilitation should be different from the ones used for traditional implants because zygomatic implants differ from traditional implants in many aspects.7-6 For example, zygomatic implants are used in cases of moderate to severe resorption. The process for maxillary resorption will follow a centripetal model. Meanwhile, a mandibular resorptive model follows an opposite direction. The crest of the bone is probably “palatal” to the prosthetic access holes. This situation makes it difficult for zygomatic implants to be below the screw access hole of the tooth above, which would be the case when there is no resorption of the ridge and the tooth sits immediately above the edentulous crest. Moreover, zygomatic implants are much longer than traditional ones; they may be bone anchored just by their apical portion; and they use different extraosseous paths (intrasinus or extramaxillary) to reach the zygomatic bone (Fig 2). Subsequently, different “like-complications,” such as slight implant movement, or different real complications, such as sinus infection, unfavorable prostheses design, or soft tissue recession, may appear after zygomatic implant placement.

On the other hand, new surgical protocols using zygomatic implants have been proposed to overcome initial shortcomings of the technique. Caution should be taken on the prevalence of new complications related to a relatively new extrammaxillary implant position. An example of the latter complications could be those related to soft tissue infection, inflammation, or maintenance around zygomatic implants (Figs 3a and 3b). Aparicio et al7 suggested specific criteria to describe the success/survival of zygomatic implants, including the following: a standardized way to report on rhinosinus pathology associated with zygomatic implants using both a cone beam computed tomography approach and a clinical questionnaire where “yes” and “no” answers can be given; the evaluation of soft tissue status on a four-point grading scale based on images obtained; and evaluation of prosthetic success based on final positioning of the zygomatic implant with respect to the center of the alveolar crest in the horizontal dimension. However, the use of new implant designs and a better understanding of the procedure and related complications make it advisable to revisit the previous proposal.

In the absence of specific criteria to determine the success or failure of zygomatic implants, it should be understood that authors of current zygomatic scientific papers are reporting results as either “implant failure” or simply “implant survival.” In other words, the permanence of a zygomatic implant–supported prosthesis with no associated pain or infection cannot be associated with “implant success” unless additional specific different criteria are used for zygomatic implants. The aim of this article was to review the criteria of success used for traditional and zygomatic implants. Finally, a revisited Zygomatic Success Code...
describing specific criteria to score the outcome of a rehabilitation anchored on zygomatic implants is introduced.

**CRITERIA OF SUCCESS FOR TRADITIONAL IMPLANTS**

Defining criteria that can be used to evaluate the health of implants has been an arduous task since the beginning of implant dentistry. In this context, one of the first attempts to objectively evaluate the success of implants was introduced by Schnitman and Shulman. Although they failed in the quantification of mobility as a criterion for success, they selected the fundamental parameters that in many cases are still considered today when determining the health of conventional implants: stability, peri-implant radiolucency, crestal bone level with respect to the platform, peri-implant gingival health, and long-term survival rate.

Subsequently, in 1986, Albrektsson et al proposed criteria of success that have been used as references for about three decades. They clearly established that there must be an absence of peri-implant radiolucency. They defined as acceptable a loss of vertical bone height maximally of 0.2 mm per year, but in this initial paper, the authors only addressed bone loss after the implants’ first year in situ. In 1994, Albrektsson and Isidor included, as a criterion of success, they selected the fundamental parameters that in many cases are still considered today when determining the health of conventional implants: stability, peri-implant radiolucency, crestal bone level with respect to the platform, peri-implant gingival health, and long-term survival rate.

In the consensus document of the Toronto Osseointegration Conference in Clinical Dentistry, the criteria proposed by Albrektsson and Isidor in 1994 were maintained, but a subjective criterion was introduced: the need for a functional and esthetic prosthesis that satisfies the patient and the professional. Considerations were made about the need to use a standardized periapical radiologic method to determine and compare the crestal bone levels. In 1998, Esposito et al did a critique of the methods of assessing the success of implants, indicating that the ability to measure losses less than 0.2 mm is very limited and that only what happens in the mesial and distal aspects can be assessed. However, this criticism is, in part, invalid on the condition that a consecutive series of minimally 50 implants are evaluated, since radiologic errors may be overestimating or underestimating the true readings.

In summary, there are some reported studies that analyze the results of treatments after 10 years, which are essential to understand the biologic impact of implants. Wennerberg et al recently summarized such long-term reporting and found that there were 35 prospective and 27 retrospective studies over 10 years, and five different implant systems had been documented over 10 years or more of follow-up, with failure rates of less than 5%. No internationally accepted parameters have yet been agreed upon to determine the success of an implant or for the values of these parameters that give a certain health status to the implant and that reveal its prognosis or the need for clinical intervention. However, it seems that the criteria outlined by Albrektsson et al, the immobility and the crestal bone level determined radiographically, continue to be the more significant parameters when evaluating an implant.
Aparicio et al

REVIEW OF CRITERIA OF SUCCESS USED FOR ZYGOMATIC IMPLANTS

The parameters being used in the literature regarding success assessment in zygomatic rehabilitations are discussed. The most common criteria found in the literature are based on the following aspects.

Implant Stability and Associated Pain
Clinical mobility was manually tested and used as the sole criterion of success in the first follow-up of consecutive patients treated with zygomatic implants reported by Malevez et al in 2004.1 They recognized the impossibility of using parameters of success of conventional implants such as radiographs and highlighted the lack of value of the panoramic radiography. Later, Zwahlen et al in 2006,19 Davó et al in 2008,20 and Bedrossian in 201021 proposed exploration of the absence of rotational movement of the implant as an essential criterion of stability and related it to the survival/success of the implant. The rotational stability has been examined in different ways, such as manual tests, reverse torque, or tightening of the abutment screw at different degrees of torque. Rotation movement is a failure criterion and justifies the removal of the implant.

Numerous publications focus on spontaneous pain at the zygomatic level, associated with lateral or rotational movement when chewing or in response to the percussion of the implant. Frequently, the absence of pain is included as a criterion of success in the evaluation of zygomatic implants.19,21–24

Peri-implant Soft Tissue Status
Attention has been paid to the soft tissue stability around the implant, specifically to extramaxillary placed implants. The presence of inflammation or local soft tissue infection related to the mucosa around zygomatic implants may end up in extensive cellulitis or simply cause local pain and difficulties for the prosthodontic work or for the implant maintenance. Different aspects of the soft tissue issue are discussed as follows (Figs 3a and 3b).

Peri-implant Parameters. Repeated attempts to apply periodontal measurements in the use of zygomatic implants as if they were natural teeth have been conducted. The relevance of the periodontal index applied for the peri-implant evaluation of conventional implants14 has been questioned. Its use in zygomatic implant dentistry may be even less successful. Clinicians must take into account the differences of zygomatic implants compared with traditional implants placed in pristine bone. For different anatomical reasons, the coronal area of the zygomatic implant neck can be completely surrounded by bone or surrounded almost exclusively by mucosa, in the case of extramaxillary implants in maxillary type 4 ZAGA25 (Figs 1 and 2). In addition, bone probing on the buccal side of a zygomatic implant head placed obliquely with medium inclinations of approximately 55 degrees is not possible. The probe will stop at the implant body itself instead of at the bone level. If the implant is placed with a palatal entrance, the measurement of soft tissue height at the palatal position will be deeper than the buccal one with no clinical significance. Additionally, the multiple variations between zygomatic implant designs and surfaces used today, such as no, partially, or totally threaded designs; totally rough or partially machined surfaces; and straight 0-, 45-, or 55-degree head angulations (Fig 4), make it very difficult to compare the significance of probing around the head/body of the zygomatic implants. It is therefore meaningless to associate the gingival height around different zygomatic implant platform angulations with the state of soft tissue health or the diagnosis of peri-implant pathology. Additionally, it may be argued that the amount of bone around the neck of
zygomatic implants may vary depending on the technique used to place the implant. Finally, it has to be considered that on some occasions, zygomatic implants are placed through a residual bone having a thickness of scarcely 1 mm. In that case, probing around a more or less angulated implant head with an irregular hemidesmosomal junction, if any, may lead to a misread of the measurement. More importantly, it could in some cases facilitate oroantral communication.

Al-Nawas et al22 evaluated the soft tissues around zygomatic implants and proposed the inclusion of soft tissue peri-implant alterations as criteria of success. As may be expected on a palatal-entrance positioned implant, deeper probing depths were found at the palatal side compared with the buccal side. The authors stated: “In our study, the pocket probing depth is increased even in absence of bleeding and in absence of pathological microbial colonization. This makes a non-infectious cause of the probable soft tissue alteration.”

Maló et al26 considered as secondary criteria of success the following factors: the modified Bleeding Index (mBI); suppuration (Sup); probing pocket depths (PPDs) assessed with a 0.25-Ncm calibrated plastic periodontal probe; and mucosal signal efficacy evaluation index (MSEE). When implant probing, the probe should follow the implant axis, maintaining surface contact. Zygomatic implants may be straight or have different head angulations, thus affecting the measurements. Indeed, in the case of angulated heads, the probe would hit the implant body, especially if inflammation is present. However, the authors stressed that none of these parameters was different from those found in conventional implants.

**Soft Tissue Inflammation or Local Infection.** Stiévenart and Malevez27 reported patients who presented inflammation around the prosthetic abutments. It must be taken into account that the entrance of the implant was made through the palate, where an inflammatory reaction of the fatty tissues is frequent upon contact with the abutment.

Becktor et al28 found that in a study of 16 patients that included 31 zygomatic implants placed using the original protocol, 9 patients had local peri-implant infection problems. Five out of nine patients had a fistula and local infection around the zygomatic implants, and four out of five had bilateral fistulas. Their study takes into account the evaluation of gingival problems in zygomatic implants and describes the findings of the cases studied but does not propose criteria for the evaluation of success in this clinical aspect.

Landes et al29 proposed soft tissue inflammation as criteria of success when describing the extreme case of five osseointegrated implants that had to be explanted in two patients needing midfacial reconstruction due to the existence of chronic soft tissue inflammation that prevented the connection of the prosthetic abutment.

Maló et al26 proposed, in a retrospective study of zygomatic implants, the absence of complications as a survival criterion. The authors evaluated the presence of three types of complications: esthetic, functional, and biologic complications, including soft tissue inflammation, fistula formation, pain, or maxillary sinus infections.

In that 1-year study, Maló et al reported four patients with sinusitis, out of 18 patients who attended the follow-up of the year, which makes a total of 22.2% of sinus complications with the reported technique. Remarkably, they did not take sinus infection into account for claiming a 98.5% survival rate after the first year.26

**Soft Tissue Stability.** One concern with the extrasinus technique may be the long-term effect of the exposed implant surface toward the soft tissue at the lateral aspect of the zygomatic implants. Lekholm and colleagues30 reported findings from a retrospective study involving 27 subjects with 38 test machined implants (with exposed threads at surgery) and 30 control machined implants (fully submerged with no threads exposed). The results from the clinical and radiographic examinations demonstrated that marginal defects and fenestrations of traditional implants present at the time of implant insertion did not lead to progressive bone loss during the first 5 years of function. However, the study was conducted on traditional implants placed in pristine bone. Carmagnola et al31 examined bone tissue alterations that occurred around implants at which the marginal level of bone support at implant placement was different at buccal and lin-
level, in two implants considered survivors. Of two turns, without signs of inflammation at that.

Radiographic Examination
According to Malevez et al,¹ the frequent decrease of the palatal curvature experienced by the atrophic surfaces. The findings from the histomorphometric measurements demonstrated that the number of bone multicellular units per mm² (n.BMU/mm²) was approximately 10 times larger in the bone tissue at the test than at the control sites. Since BMUs are considered as indicators of bone activity, they demonstrated that even after 7 months of healing, the process of remodeling was much more active in the test than in the control regions. The marginal level of osseointegration tended to become similar at the buccal and lingual surfaces of the test implants. The analysis of the soft tissues at the test and control implants revealed that bone tissue remodeling in the test group was accompanied by a certain recession of the margin of the peri-implant mucosa.

An uncertainty raised by Ouazzani et al and Aparicio et al²²,²³ is the long-term effect the extrasinus implant contacting/compressing the mucosae may have on gingival stability. Another aspect introduced by Aparicio’s group²⁷ is the long-term repercussion on hygiene, and therefore on gingival health, which causes partial exposure of the zygomatic implants. The same group proposed, for the first time, to include the stability of the soft tissues around the implant as a specific parameter when determining the success or failure of a zygomatic implant. The extramaxillary location of the zygomatic implants involves a direct contact of the surface of the implant neck/body with the mucoperiosteal flap. The amount and quality of the keratinized tissue existent at the buccal flap and its eventual compression by the externally placed implant are tightly related to eventual dehiscence of the zygomatic implants. Compression of the soft tissues by the zygomatic implant body would depend on how much residual tension of the soft tissue is created after postsurgery healing, and how significantly the implant is protruding to the buccal side. Aparicio el al²⁷ proposed the use of the ZAGA classification and ZAGA criteria to understand how deep the implant should be placed to minimize buccal protrusion (Figs 1, 2, and 5). The pressure of the soft tissues by the zygomatic implant body may compromise soft tissue vascularization, which entails the risk of fenestration of the mucosa and the exposure of the implant neck/body (Fig 3).

In this regard, Migliorança et al⁵ proposed short-term clinical results of a retrospective follow-up of at least 12 months of 150 extrasinus zygomatic implants in which they indicate the event of vestibular dehiscence at the level of the cervical portion with exposure of two turns, without signs of inflammation at that level, in two implants considered survivors.

Fig 5 Ideal position of a minimally invasive osteotomy intended for zygomatic implant placement according to the ZAGA concept. Note that no previous “window” or slot has been performed. The osteotomy was initiated at the palatal side. Implant head will be finally located on the center of the crest. Bone anatomy/atrophy precludes a “tunnel osteotomy” similar to that used for traditional implants placed in pristine bone. An indentation with the shape of a “channel osteotomy” is created on the residual alveolar/maxillary bone. Indentation depth is decided with the goal of avoiding gingival soft tissue compression by the implant body. Respecting as much bone integrity covering the sinus membrane at the implant head/neck levels as possible is mandatory.

maxilla and the inclined position of the implant makes the periaipal radiologic technique impossible to apply in a standardized way in the zygomatic patient. They also emphasized the little value of the OPG in the determination of the success of the implant. This should question the studies that base their results on the radiographic examination of serial OPGs.

For research purposes, Aparicio et al in 2008³⁶ proposed the use of a preoperative computed tomography or cone beam computed tomography (CBCT) to evaluate the sinus situation, the anatomical shape of the anterior wall of the maxilla, the degree of maxillary atrophy, and any additional pathologies (Fig 6a). Postoperatively, they recommended another CBCT 1 year after surgery and every 5 years thereafter as a condition to be able to report on the health of the maxillary sinus (Fig 6b). The authors did not use the CBCT information to determine the success of achieving/maintaining secondary stability of the implant.

Associated Sinus Pathology
Most authors recognize that rhinosinusitis can be a problem associated with zygomatic implant treatment that emerges at any stage of treatment, even after a long period of follow-up.

Different authors have reported recurrent maxillary sinusitis in patients after placement of zygomatic implants. A variety of reasons have been suggested for this to occur, such as: lack of bone-to-implant contact (BIC) at the level of sinus entry caused by inaccurate osteotomy...
or contamination through the abutment screw; soft tissue infection causing bone remodeling; implant probing destroying a weak hemi-desmosomal junction of the soft tissues; rupture of the sinus membrane at the implant entrance level together with a lack of bone sealing; and sinus access through a thin palatal bone layer later destroyed. Nevertheless, unless a clear sinus-oral communication is present, it is generally not possible to clarify the etiology of maxillary sinusitis or whether or not it is associated with zygomatic implant surgery. Usually, rhinosinusitis responds to medical or specific surgical endoscopic treatment without involving the complete failure of the zygomatic implants.1,19,21,28,34,37–40

Although there is no consensus on how to report rhinosinus status, the term used to describe the sinus pathology in most of the studies using zygomatic implants is “sinusitis,” without clarifying the type, the associated signs and symptoms, or whether a CT scan or endoscopy was performed to confirm the diagnosis. For these reasons, it is not possible to determine sufficient useful details of the sinus status described.

In 2008, Davó et al41 used a computerized postoperative radiologic examination of the sinus including the following observations: radiolucency/sinus opacity, height/level of the osteomeatal complex, or presence/absence of macroscopic oroantral communication.

In 2014, Aparicio et al42 proposed a system to report rhinosinusitis diagnosis in patients with zygomatic implants. Data were reported in the same way as ear, nose, and throat (ENT) literature for conventional patients (Lanza and Kennedy, Lund-Mackay, Tables 1 and 2), with some particularities. According to the “Task Force on Rhinosinusitis Criteria for the Diagnosis of Rhinosinusitis,” two or more clinical symptoms must be
Fig 6b  Snapshot of the postoperative radiologic section where the zygomatic right implant has finally been placed following the planning. Note the zygomatic implant anchorage optimization achieved by the ZAGA concept. According to the Lund-Mackay test, after the intervention, the sinus and the osteum obtained scores of 0 and were evaluated as healthy and permeable, respectively (success grade I for the sinus criteria). The measurements to define the prosthesis offset relate the center of the residual crest to the position of the zygomatic implant head. The distance from the palate middle line to the center of the residual right crest (C-R) minus the distance from the palate middle line to the center of the right implant head (I-R) was –1 mm, indicating the magnitude of the offset (success grade I for the offset criteria). The buccal position of this implant gives a negative result of –1 mm.

Fig 6c  Snapshot of the preoperative inclined radiologic section of the same patient as Fig 7a, where the zygomatic left implant is to be placed. Note the extreme thinness of the zygomatic bone that forces an extremely precise placement of the implant respecting the residual maxillary bone. According to the Lund-Mackay test, before the intervention, the sinus and the osteum obtained total scores of 0, and were evaluated as healthy and permeable, respectively (success grade II for the sinus criteria). The distance from the palate middle line to the center of the residual left crest (C-L) minus the distance from the palate middle line to the center of the left implant head (I-L) was 2 mm, indicating the magnitude of the offset. The palatal position of this implant gives a positive result of 2 mm (success grade I for the offset criteria).

Fig 6d  Snapshot of the postoperative radiologic section where the zygomatic left implant has finally been placed following the planning. According to the Lund-Mackay test, after the intervention, the sinus and the osteum obtained scores of 1 and 0, and were evaluated as positive and permeable, respectively (success grade II for the sinus criteria). The distance from the palate middle line to the center of the residual left crest (C-L) minus the distance from the palate middle line to the center of the left implant head (I-L) was 2 mm, indicating the magnitude of the offset. The palatal position of this implant gives a positive result of 2 mm (success grade I for the offset criteria).

Prosthesis Evaluation
The ultimate justification for the placement of implants is the fastening of a functional prosthesis. As per conventional implants, the successful anchoring of the prosthesis has also been included to assess the success or survival of zygomatic implants in different studies.20,37,44,45

During the period from 2004 through 2008, Bothur and Garsten46 investigated the speech ability of patients treated with a fixed dental prosthesis (FDP) supported by multiple zygomatic implants placed using an intrasinus path. They concluded that a mild deterioration in speech can be anticipated in patients subjected to treatment with an FDP supported by multiple zygomatic implants that emerge in a palatal position. No information is provided about how much palatal positioning is tolerated, if any.

Although authors have considered the esthetic of prostheses as a criterion of success, very few authors have highlighted differences between the evaluation of the prosthetic result in conventional implants and that obtained using zygomatic implants. In this sense, Becktor et al38 measured the palatal position of the zygomatic implants, determining the distance between the nearest buccal cusp of the definitive rehabilitation and the center of the prosthetic screw of the zygomatic implants. All the implants were placed following a trans-sinus technique, and the measurements were taken as descriptive data of the study without including them in the criteria of success. They described an
average distance of 11.2 mm (range: 4 to 15 mm) between the head of the trans-sinus zygomatic implants and the nearest vestibular cusp.

Aparicio et al., in a controlled study, compared the differences and advantages of zygomatic implants placed using the ZAGA criteria for establishing the implant trajectory versus the classical technique approach. Both the control and the test groups were provided with the same type of machined fully threaded titanium implants (Zygoma Implant Brånemark System, Nobel Biocare). The control group was followed for at least 10 years; the minimum prosthetic follow-up of the test group was 3 years. Statistically significant differences ($P = .000$) were found between groups when comparing measurements of the distance from the middle of the zygomatic implant head, with no abutment, to the center of the residual alveolar ridge (Figs 6 and 7) (5.12 ± 2.38 mm vs 2.92 ± 2.30 mm). The fact that the zygomatic implants placed according to the ZAGA criteria for establishing the implant trajectory emerged close to the top of the crest allowed for less bulky constructions, which is beneficial to the hygiene maintenance point of view and allows for better comfort and phonetic adaptation of the patients.

**ORIS CRITERIA AND THE ZYGOMA SUCCESS CODE (REVISITED)**

Considering the criteria of success used in implants placed in pristine alveolar and zygomatic bone, as well as the differences between both types of implants, the authors propose four objective and differential criteria for zygomatic implants with respect to traditional implants. These criteria, which will allow the condition of the implant to be evaluated by establishing the degree of success and distinguishing it from failure or mere survival, are as follows: offset of the definitive prostheses; rhinosinus status at the reporting time; soft tissue infection-condition over time; and stability, individually tested. Based on these criteria, five possible conditions may be assessed when evaluating zygomatic implants:

- **Success condition I**: Represents the optimal stage
- **Success condition II**: Represents an alteration of routine without clinical impact
- **Success condition grade III**: Represents a borderline situation with alterations that are clinically manifested but are still possible to successfully treat
- **Condition IV**: Would represent the surviving implant that supports the prosthesis but has not been measured according to the proposed criteria
- **Condition V**: Reflects implant failure

To classify an implant, the worst of the degrees in one of the criteria will be taken, with grade V being the worst.

**ORIS** is the acronym of offset, rhinosinusitis, infection, and stability. ORIS is also a term from Latin origins with a broad meaning covering the face, the mouth, pronunciation, speech, and facial expression. It was chosen as a mnemonic tool because it somehow covers all four specific criteria expressing the long-term status of a single zygomatic implant.

**Criterion 0: Offset of the Prostheses**

When dealing with concave maxillary wall anatomies, the intrasinus approach for zygomatic implant placement will involve the possibility of the emergence of the zygomatic implants in a palatal position that does not match the bone crest edge. A palatal emergence of zygomatic implants will lead to the construction of bulky prostheses. A bulky dental bridge at the palatal aspect sometimes leads to discomfort, speech
problems, and problems with oral hygiene. For precise reporting on the success of prostheses anchored on zygomatic implants, anatomical measurements to assess the position of the head of the zygomatic implants with regard to the middle of the crest of the alveolar ridge should be included (Figs 6 and 7).

Postsurgery CBCT images, preferably using the coronal plane better matching the implant position, are obtained for each of the zygomatic implants studied. Special emphasis should be paid to assessing and storing the plane relating each zygomatic implant head position to the epicenter of the crest. Using appropriate coronal cuts, distances from the palate halfway point to the implant head center of each side are measured (distances implant right and implant left, respectively [I-R and I-L]). Secondly, the distances from the palate edge to the left and right crest midpoint are obtained (distances crest right and crest left, respectively [C-R and C-L]). Distance C-R minus distance I-R indicates the distance from the middle of the crest to the right implant head epicenter. A positive value on the implant head position to the middle of the alveolar ridge relationship (measurements C-I) indicates a palatal position of the implant, whereas a negative value would indicate a buccal emergence of the implant. This situation will probably induce soft tissue dehiscence (Table 3).

**Criterion R: Rhinosinus Status**

In the dental literature, there is no consensus on how to report a rhinosinusitis diagnosis. A system to report a rhinosinusitis diagnosis in patients with zygomatic implants in the same way as in conventional patients, with some particularities, is proposed by the authors. Essentially, the sinus health should be clinically and radiographically assessed as recommended by the Task Force on Rhinosinusitis for research outcomes according to the Lanza and Kennedy (L-K) survey and the Lund-Mackay (L-M) system.

According to L-M, each CBCT test includes six regions: anterior ethmoid, posterior ethmoid, maxillary, frontal, sphenoid, and osteomeatal complex. Each region is given a score of 0, 1, or 2, with 0 representing normality and no opacification, 1 partial opacification, and 2 total opacification. The osteomeatal complex can only be scored 0 or 2. Total scores range from 0 to 24. A normal or “negative” scan was defined as any scan with an L-M score of 0. Any scan with a score > 0 was considered an abnormal or “positive” scan (Table 1).

The authors have modified the Lund-Mackay (ML-M) Score to report its value over time. The ML-M thus requires at least a presurgical and a postsurgical CBCT. The ML-M final score will be given by the comparison between postsurgical and presurgical CBCT scores. An increase in the score over time is an indication of potential rhinosinus complications and will be classified as ML-M (+). A decrease or a constant value over time will be classified as ML-M (–) (Figs 6a to 6d).

Fitting to L-K clinical criteria, diagnosis of sinusitis requires a “yes” answer in two or more major criteria, one major and two or more minor criteria, or purulence on nasal examination (Table 2). If clinical symptoms or radiologic changes are sporadic and respond positively to treatment, they may still represent an implant in a successful condition.

**Criterion I: Infection Permanence as Evaluation of Soft Tissue Status: Peri-implant Soft Tissue Condition**

Soft tissue dehiscence leads to both partial exposure of the implant and uncovering of the thin bone layer between the neck of the implant and the sinus cavity. The exposed bone remodels more actively over time, although it is usually a painless situation. If the condition is maintained in this critical area of minimum bone thickness, a sinus communication may appear. Due to the retention of bacterial film, which is increased in implants characterized with threads or rough surfaces, chronic soft tissue inflammation might be further added to this situation: bone remodeling and appearance of subsequent complications such as sinus communications, esthetic complaints, mucositis, or cellulitis, which can even reach the orbit, can be accelerated (Figs 3a and 3b).

Currently, there is a tendency for the use of zygomatic implants incorporating mechanized surfaces at the coronal/body parts and rough surfaces at the apex. Newly designed implants have removed or reduced threads in the body and the cervical two-thirds of the implant. Those implant features may prevent or diminish gingival recession, and in any case, facilitate hygiene when the implant is exposed (Figs 1 and 4).

In conclusion, peri-implant soft tissue condition on a rehabilitation related to zygomatic implants may be a key factor for the success of the rehabilitation and must be reported. Soft tissue dehiscence and its evolution should also be reported in prospective studies. Photographs, using a reference scale, are recommended to assess the stability or eventual progression of the soft tissue recession. The presence of visual soft tissue inflammatory or exudative signs must also be reported. As discussed previously, dental probe use is not recommended for different anatomical and technical reasons.

The presence of an asymptomatic peri-implant soft tissue, without visual clinical changes of inflammation or infection, together with the absence of recession at the vestibular level, is classified as success condition I. The presence of a vestibular recession, with
stable implant body exposure in time, in the absence of symptoms or signs of inflammation or soft tissue infection, is considered success condition II. The presence of symptoms related to inflammatory changes or gingival infectious exudates, responding positively to treatment, or the presence of nonstable gingival recession, are considered success grade III. The persistence or recurrence of the inflammatory symptomatology associated with recession implies the consideration of failure or condition V. The complaint of the patient for an unacceptable and persistent esthetic situation due to the exposure of the implant can cause this implant to also be classified as condition V (Table 3).

**Criterion S: Stability (Individually Tested)**

The most accepted way to establish osseointegration is the clinical mobility test. The same criterion has been applied to zygomatic implants. However, different degrees of implant stability can be found when the zygomatic implant is individually tested. Occasionally, applying nonaxial forces to an externally positioned zygomatic implant, remotely anchored in a zygomatic bone of poor quality, may produce a slight movement without it necessarily being associated with clinical symptomatology or pathologic sign. This movement is justified by the modulus of elasticity of the bone in counteracting the lateral force that is exercised remotely on the head of a long implant and subjected to bending stress. This movement should not be considered as a complication in the absence of other symptoms and must disappear with the screw attachment of the superstructure.

In conclusion, certain painless mobility may be assessed due to the elastic modulus of the anchoring zygomatic bone when the implant is laterally loaded by a remotely applied force. Success grade I means no visible movement. Success grade II means slightly visible movement. Success grade III means visible movement with no signs of dis-osseointegration, whereas failure means visible movement accompanied by rotational movement or pain. All rotational implant movements should be considered as a sign of implant

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<tr>
<th>Table 3</th>
<th>Zygomatic Success Code (Revisited)</th>
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<tr>
<td>ORIS criteria</td>
<td>Success</td>
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<tr>
<td>O Prosthetic offset (mm)</td>
<td>0 ≤ d ≤ 6</td>
</tr>
<tr>
<td></td>
<td>−3 ≤ d ≤ 0</td>
</tr>
<tr>
<td>R Rhinosinus-associated pathology</td>
<td>L-K (−) or ML-M (+)</td>
</tr>
<tr>
<td>I Peri-implant soft tissue condition</td>
<td>No recession</td>
</tr>
<tr>
<td></td>
<td>No signs of inflammation or infection</td>
</tr>
<tr>
<td></td>
<td>No rotation</td>
</tr>
<tr>
<td>S Stability (individually tested)</td>
<td>No mobility</td>
</tr>
<tr>
<td></td>
<td>No pain</td>
</tr>
<tr>
<td></td>
<td>No rotation</td>
</tr>
</tbody>
</table>

Description of the specific criteria (ORIS) classifying zygomatic implants as successful in grades I, II, and III (conditions I to III); survival (condition IV); or failed (condition V). Zygomatic implants are evaluated for each criterion of success. The condition of the implant is determined by the worst condition of the four ORIS criteria (ie, O-1/R-3/I-2/S-4 would be classified as survival).

ORN is a term from Latin origins with a broad meaning covering the face, mouth, pronunciation, speech, and facial expression. It was chosen as a mnemonic tool because it covers all four criteria to evaluate the long-term success of single zygomatic implants.

Prosthetic offset: distance from the center of palate to the center of residual alveolar ridge minus distance from the center of palate to the implant head. Positive values correspond to zygomatic implants placed palatally and negative values correspond to zygomatic implants placed buccally to the alveolar crest.

L-K is the Lanza and Kennedy clinical evaluation according to Table 2. ML-M is the Modified Lund-Mackay radiologic test evaluated as negative when no increased opacity is observed between the postsurgical L-M score and the presurgical L-M score (CBCT).

Peri-implant soft tissue examination is performed attending to visual manifestation of recession and/or gingival inflammation (detected on swelling, redness, or bleeding when slightly impressed); probing must be avoided. Peri-implant soft tissue infection is diagnosed when a purulent exudation is observed spontaneously or by means of applying finger pressure to the peri-implant soft tissue complex. Patient nonacceptance of the soft tissue esthetic condition might fall into condition V.
failure (Table 3) whether or not they are accompanied by the presence of pain.

**CONCLUSIONS**

Currently, the way the results and complications of zygomatic implants are reported in the literature is inconsistent and lacks a standardized systematic review. There are no clear criteria to specifically describe zygomatic implant rehabilitation outcomes and assess to what extent they indicate a particular level of success or risk for the treatment. Moreover, there is a tendency to consider and evaluate a zygomatic implant in the same way as a conventional implant placed on pristine alveolar bone. However, zygomatic implants differ from traditional implants in biomechanics, clinical procedures, outcomes, and eventual complications. Zygomatic implants are associated with resorptive changes in both alveolar and basal bone that make the use of conventional criteria not possible to describe implant outcome. Indeed, interdifferences related to the zygomatic surgical protocol and zygomatic implant designs that are used may be found and should be sought and noticed.

The authors propose the use of four specific and objective criteria to systematically describe the outcome of zygomatic implants. The ORIS acronym is suggested to name the following criteria: (1) offset—evaluation of prosthetic success based on final positioning of the zygomatic implant with respect to the center of the alveolar crest; (2) rhinosinus status report—a presurgical and postsurgical CBCT comparative approach to evaluate whether sinuses are healthy; (3) infection permanence related to dehiscence—an evaluation of soft tissue signs of infection or dehiscence on a grading scale based on referenced photographs obtained; (4) stability report—accepting as criteria of success some mobility until dis-osseointegration signs of rotation or apical pain appear.

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**REFERENCES**