

# The SAC Classification in Implant Dentistry

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# The SAC Foreword Classification in Implant Dentistry

The rapid development of clinical techniques and biomaterials in implant dentistry has led to an expansion in the clinical indications for this modality of treatment. Implant dentistry now forms an integral part of everyday dental practice. However, education in implant dentistry for most dentists occurs after graduation with little emphasis on the identification of treatment complexity and risks. Since 2003, the International Team for Implantology (ITI) has recommended the SAC Classification to categorize treatment procedures into three levels of difficulty - *Straightforward, Advanced and Complex*.

In March 2007, the ITI organized a conference involving a multi-disciplinary group of 28 clinicians who met in Mallorca, Spain to standardize the application of the SAC Classification. The ITI is proud to be able to publish the proceedings of the conference in this volume.

The aim of the ITI is to promote and disseminate knowledge in all aspects of implant dentistry and related tissue regeneration. Together with the ITI Treatment Guide series, this book furthers the desire of the ITI to support the development of practical tools for clinicians and educators in dental implantology. The ITI recommends this book to all professionals in this field.



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## 4.6 Implants for Restoration of Single Tooth Spaces in Areas of High Esthetic Risk

L. Cordaro

Table 1 represents the surgical classification for replacement of missing single teeth in regions of high esthetic risk. By definition, any treatment in the esthetic zone involves a risk of esthetic complications. For single tooth replacements, the esthetic outcome depends upon achieving symmetry of tooth form and soft tissue contour with the contralateral natural teeth. In this regard, two factors within the responsibility of the surgeon are critical. First, the implants have to be positioned very precisely from a

three-dimensional point of view to allow for an esthetic treatment outcome. To facilitate this, the concept of the *Comfort* and *Danger Zones* was established by the ITI Consensus Conference in 2003 (Buser et al. 2004). Surgical stents are recommended in these situations. Second, management of the hard and soft tissues with appropriate augmentation procedures at the time of surgery is essential. Adjunctive soft tissue grafting procedures may be necessary even in the presence of adequate bone volume.

Table 1. Surgical Classification of Cases for Single-Tooth Spaces in Areas of High Esthetic Risk.

Areas of High Esthetic Risk		Case Type: Single Tooth				
Risk Assessment					Normative Classification	Notes/Adjunctive Procedures that may be required
Bone Volume	Anatomic Risk	Esthetic Risk	Complexity	Risk of Complications		
<b>Defining Characteristics: One implant</b>						
Sufficient	Low	High	Moderate	Moderate	Advanced	Risk of recession at adjacent teeth Adjunctive soft tissue graft
Deficient horizontally, allowing simultaneous grafting	Low	High	Moderate	Moderate	Advanced	Risk of recession at adjacent teeth Adjunctive soft tissue graft Procedures for simultaneous horizontal bone augmentation
Deficient horizontally, requiring prior grafting	Low	High	Moderate	Moderate	Complex	Risk of recession at adjacent teeth Adjunctive soft tissue graft Procedures for horizontal bone augmentation
Deficient vertically and/or horizontally	High	High	High	High	Complex	Risk of recession at adjacent teeth Adjunctive soft tissue graft Procedures for vertical and/or horizontal bone augmentation

Each case must be assessed comprehensively; a systematic approach to esthetic risk assessment is recommended (Martin et al. 2007). Thus, when implants for single tooth replacements are needed in the esthetic zone, the surgical procedure involved must be considered *Advanced* or *Complex*.

If the available volume of bone is sufficient and an implant of adequate dimensions can be inserted in the correct position and angulation, the normative classification is *Advanced*. The anatomical risk may be regarded as low, but the complexity of the procedure and the risk of esthetic complications are moderate due to the requirement for a precise three-dimensional positioning of the implant. This is of paramount importance for the achievement of an esthetically satisfactory final restoration.

For situations in which the available volume is deficient horizontally and conditions allow for bone augmentation at the time of implant placement, the normative classification is still *Advanced*. Usually, simultaneous horizontal augmentation is achieved with guided bone regenerative procedures that involve the use of allogeneic or xenogeneic grafting materials, autogenous bone chips harvested locally, and barrier membranes. Although the anatomical risk is regarded as low, care should be taken to identify possible complications that may arise from proximity to the nasopalatine canal. The complexity and risk of complications are moderate due to the esthetic demands.

When the horizontal bony deficiency must be corrected with a separate surgical procedure in preparation for implant placement, the complexity of the procedure is high, and consequently the entire procedure must be considered *Complex*. A staged approach is recommended in these cases. The augmentation procedures carried out in the first surgical step may involve the use of autologous bone blocks fixed with screws or autogenous bone chips or xenografts in conjunction with either resorbable or non-resorbable barrier membranes. If there is the need for a second surgical site for bone harvesting, the complexity and the risk of complications of the procedure are increased accordingly. In the second surgical step the implant is inserted after removal of barrier membranes or lag screws. In some instances a submerged approach may be used, and a third very simple surgical procedure to uncover the implant shoulder may be necessary.

Vertical bone deficiency in single tooth spaces in the esthetic zone represents one of the most difficult challenges in implant dentistry. A staged approach is used by most surgeons, and involves alveolar reconstruction and implant placement in separate procedures. Vertical reconstruction is usually achieved with GBR or bone grafting procedures, as in treatment for horizontal augmentations.

It should be noted that specific surgical factors may further increase the complexity of the procedure and risk of complications. For example, accurate soft tissue management is necessary to achieve and maintain soft tissue coverage of the reconstructed alveolus during healing. The coronal limits of the bony reconstruction are the interproximal bony peaks of the adjacent teeth, and this must be taken into consideration for a correct treatment plan. For these reasons, cases with vertical deficiency of a single tooth space in the esthetic zone should be considered *Complex*.

#### 4.6.1 Clinical Case – Missing Upper Central Incisor with Horizontal and Vertical Bony Deficiency

This clinical case illustrates the replacement of a failing upper left central incisor (tooth 21) previously treated with endodontic surgery (Figures 1 and 2). The patient was a young female with high esthetic demands who requested replacement with a fixed restoration. She reported recurrent acute infections of the tooth. Her oral hygiene was acceptable.



Figure 1. Facial view of the maxillary anterior teeth. Tooth 21 had a deep pocket on the mid-facial aspect.



Figure 2. The preoperative panoramic radiograph showed a periapical radiolucency.

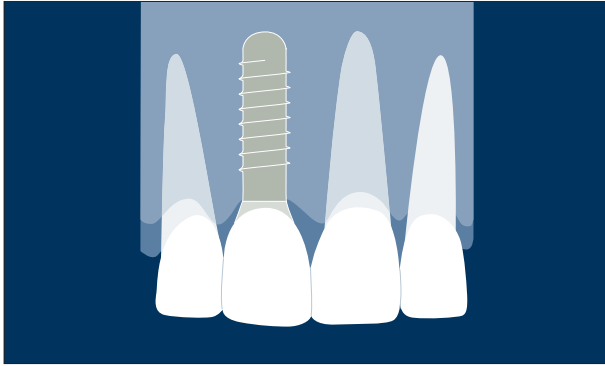


Figure 1a. Diagram of a single tooth implant. The periodontal attachment on the adjacent teeth provides support to the papillae between the implant and adjacent teeth.

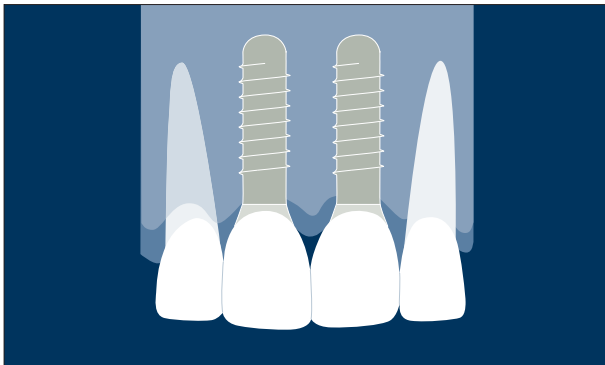


Figure 1b. Diagram of two adjacent implants showing blunting of the papilla between the two implants due to loss of crestal bone height, and formation of a dark triangle apical to the contact area.



Figure 1c and 1d. Adjacent implant restorations in the 11 and 21 sites. Note the blunting of the midline papilla. The radiograph demonstrates the reduced inter-implant bone height.



augmentation, tissue shaping techniques such as ovate pontics, or soft tissue replacements like tissue-colored porcelain will be necessary to imitate papillae between these restorations. Where artificial soft-tissues are used, the need to mask the junction between these and the natural tissues will result in additional complexity. In general, extended edentulous spaces will often require augmentation procedures to enhance the contours of the resorbed ridges in order to achieve esthetically acceptable outcomes. The complexity of these processes, and the difficulty in predicting the treatment outcome, will generally lead to classifications of *Advanced* or *Complex* in cases where there is any discernable esthetic risk.

**Adjacent implants.** It has been demonstrated (Tarnow et al. 2000) that insufficient space between adjacent implants results in decreased papillary height, and subsequently in compromised esthetic outcomes (Figures 1a to 1d). These outcomes can be magnified in situations in which restricted mesio-distal space prevents adequate spacing of implant platforms. A minimum of 3 mm between implant platforms is considered necessary to maintain papilla height when implants are placed adjacent to each other. A commonly used alternative is the cantilevered implant restoration. These are often indicated when a lateral incisor replacement is involved (i.e., canine-lateral or central-lateral) utilizing an ovate pontic (Figures 2a and 2b). Notwithstanding this, cases where adjacent implants may be necessary will normally attract a classification of *Complex* when the esthetic needs of the case are moderate to high.

### 5.5.2 Intermaxillary Relationships

As noted in section 5.3.1, the horizontal and vertical occlusal relationships in anterior sites may restrict the space for restorative components and subject restorations and retentive elements to significant non-axial loads. Angle Class I anterior occlusions with minimal horizontal and vertical overlap, and Angle Class III occlusions with an edge-to-edge incisal relationship, pose the lowest risk of these difficulties, and hence earn a classification of *Straightforward*. Deeper bites, and those with restricted horizontal space such as Angle Class II division 2 malocclusions, are at much greater risk of treatment difficulty and of technical complications, and thus should be classified as at least *Advanced*.

### 5.5.3 Restorative Space Issues

In the anterior segment, there will generally be a need to achieve symmetry of tooth width irrespective of the lip line at smile, as the incisal edges of anterior teeth are usually visible during speech and at rest. Thus, the mesio-distal width necessary for a symmetrical restoration to the

adjacent or contra-lateral teeth will generally be dictated by this need. When a minor asymmetry is present compared with contralateral teeth, restorations may need to be designed that incorporate minor modifications to give the appearance of symmetry. These situations will normally be identified during the completion of trial set-ups and interim restorations for these cases. The final tooth positions can then be reproduced in the final restoration. In severe cases of space mismatch, adjunctive treatments such as orthodontics or adjusting the contours of adjacent teeth through odontoplasty, or placing bonded restorations or crowns, may be necessary (Figure 3). *Straightforward* cases will be those in which little additional planning or treatment is needed to achieve an acceptable result. An increased need for additional intervention, or an increased risk of a compromised esthetic result, will lead to classifications of *Advanced* or *Complex*.

#### 5.5.4 Occlusion/Articulation

Harmonious tooth arrangements in these segments will generally carry a lower risk of esthetic compromise and will normally be classed as *Straightforward*. When there is a need for tooth replacements to fit into complex occlusal schemes where crowding, wear, cross-bites, tilting of teeth, or irregular occlusal planes exist, the risk of compromised esthetic outcomes is increased. As such, the SAC Classification level will also increase in complexity. More complex occlusal situations are also more likely to provide insufficient space for components. Additionally, these arrangements may result in non-axial loading of implants. These factors will generally be associated with greater risk of technical complications. In cases where the occlusion is severely compromised, additional treatment steps, such as orthodontics or more extensive restorative rehabilitation, may be necessary. In these cases, a classification of *Complex* is appropriate.

#### 5.5.5 Interim Restorations During Healing

In most esthetic cases, some form of interim tooth replacement will be necessary during the healing period. These restorations can be used to trial the esthetic outcomes planned for the case, assist in shaping of the tissues during healing, and serve as a template for the final restorations. However, the risk of such provisional restorations placing uncontrolled loads on integrating implants cannot be discounted, and care must be taken to minimize this risk.

RDPs provide the simplest provisional restorations for these cases, assuming care is taken to ensure that the pontic does not load the implants underneath it during healing. Vacuum-formed retainers offer the ability to keep

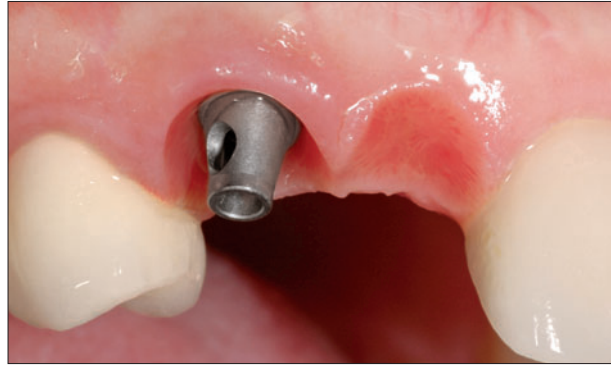


Figure 2a. A dental implant in site 13 to support a restoration replacing 12 and 13.



Figure 2b. A restoration on implant 13 utilizing a mesial cantilever in site 12.



Figure 3. A provisional implant restoration on 11 creating symmetry with 21. The patient desires to close the diastema. A restoration on the mesial aspect of 21 will be needed, in addition to a wider definitive restoration on 11, to maintain symmetry.