

Esthetic Implant Site Development



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KEYWORDS

- Implant position • Implant angulation • Horizontal augmentation • Vertical augmentation
- Soft tissue augmentation • Emergence profile

KEY POINTS

- Bony support is critical for creating and maintaining esthetic and natural-appearing peri-implant soft tissue profiles.
- A variety of techniques have been shown to be effective for augmenting bone and soft tissue.
- Ideal implant position and angulation is critical for a natural-appearing outcome.
- Achieving an ideal esthetic result in the compromised site is often elusive and in many cases, impossible.

INTRODUCTION

The high predictability of implant-supported restorations has led to a shift in focus from success being solely equated with implant survival, yet most studies on implants fail to include criteria for esthetic success. It is reported that up to 16% of single-implant restorations in the esthetic zone fail for esthetic reasons,¹⁻³ with gingival recession and a lack of interdental papilla being the most common complications.⁴ With proper treatment planning and execution, most complications can be avoided.

COMPREHENSIVE ESTHETIC EVALUATION

The pathway to esthetic success begins with an understanding of the features of an esthetic smile and an accurate diagnosis and treatment plan. The diagnostic process not only includes a thorough clinical and radiographic examination, but also an accurate determination of the patient's expectations.

Patient Expectations

The initial evaluation of the patient must include an understanding of the patient's expectations and a determination of whether these expectations can be met before treatment. Achieving an ideal esthetic result in the compromised site is often elusive and in many cases, impossible.⁵ If the patient is found to have unrealistic expectations, a frank discussion is necessary to tailor their expectations to more realistic levels. An assessment of risk factors for implant failure and complications should be made. The potential for unexpected complications that can compromise the final result always exists with any surgical procedure and should be a part of the initial discussion on expectations.

It is also important to note that the esthetic outcomes perceived by the dental professionals and the patients do not always match.⁶⁻⁹ Kokich and colleagues⁹ compared the esthetic perception of dentists, orthodontist, and the layperson on various parameters. They did this by altering

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various parameters and asking each group to judge the esthetic perception of these altered parameters (eg, teeth length, gingival margin level, papilla height). According to Kokich and colleagues,⁹ patients consider a discrepancy in gingival margin of more than 2 mm to be unesthetic, similar to those of general dentists. Conversely, the investigators found that although dentists had very low tolerance for any discrepancy in papilla height, most laypersons were not able to differentiate a severely compromised papilla height. Tymstra and colleagues⁵ reported the results of placing 2 adjacent maxillary implants after autogenous block grafts in 10 consecutive patients. The investigators reported that in 40% of their cases, there was an absence of the interdental papilla. Interestingly, all the patients in this study reported that their results were “acceptable” or better, supporting the findings of the study by Kokich and colleagues.⁹

The Esthetic Smile

A variety of parameters exist when defining the esthetic smile. These requirements exist for both the static and dynamic states.¹⁰ Some of the general guidelines include the following:

- Maxillary incisor show at rest of 2 to 4 mm¹⁰
- Full animation displays 75% to 100% of maxillary incisors with 1 to 2 mm of gingival display^{10,11}
- Maxillary anterior teeth follow the Golden Proportion: when viewed from the facial aspect, the width of each subsequent tooth should be 60% of the adjacent, mesial tooth¹²
- The Recurring Esthetic Dental Proportion: when viewed from the facial aspect, the successive width proportion should remain constant while moving away from the midline^{13,14}
- Maxillary central incisors should have a length of 10 to 11 mm and their width should be 75% to 80% of the length
- Maxillary central incisor widths should be 2 to 3 mm greater than the lateral incisor and 1.0 to 1.5 mm greater than the canine
- Maxillary central incisors and canines are longer than the lateral incisor by 1.0 to 1.5 mm
- The gingival zenith of central incisors and canines should coincide, and that of the lateral incisors should be located 0.5 to 1.0 mm more coronal¹¹
- The outline of maxillary anterior teeth incisal edges should mirror the lower lip line
- The gingival margin of the maxillary anterior teeth runs parallel with the upper lip line¹¹
- Adequate quality and quantity of keratinized soft tissue must be present¹¹

- Natural sulcular and papilla forms around teeth are present with no black triangles^{15,16}
- The vermilion border is most highly defined centrally near the philtrum and is supported by the dentoalveolar anatomy of the anterior maxilla¹¹

During treatment planning, each of the parameters contributing to an esthetic smile should be considered when the restorative dentist fabricates a diagnostic wax-up with teeth in ideal positions. The starting point for determining tooth position is the maxillary central incisor edge position. Once incisor edge position is determined, it is possible to determine the desired gingival levels based on appropriate teeth length. In evaluating the compromised edentulous or partially edentulous segment, an existing removable partial denture or a clear radiographic and/or surgical guide may be used to determine the ideal maxillary incisal edge position (**Fig. 1**).

Establishing the appropriate gingival level during the diagnostic examination will determine if any hard or soft tissue augmentation or reduction will be required to achieve ideal teeth length and proportion in the final restoration.

Radiographic Examination

Cone-beam computed tomography (CBCT) has become an integral part in 3-dimensional dental implant treatment planning. It allows evaluation of bone quality, alveolar ridge topography, soft tissue thickness, proximity to vital anatomic structures, and fabrication of surgical guides. CBCT is preferably done with the patient wearing a surgical guide with radiopaque markers to indicate the ideal position and angulation of the planned implant fixtures and restorations. The imaging will reveal the relationship between the existing alveolar housing and the ideal position of the final restoration. This will help determine whether or not hard tissue augmentation is required, and in which dimension. **Table 1** provides a summary of techniques for evaluating ideal tooth position in relation to existing bone and soft tissue level.

Clinical Examination

A comprehensive clinical examination is primarily aimed at determining the hard and soft tissue status at the planned implant site. The examination should consist of an assessment of the soft tissues and alveolar width and height in the facial-lingual and vertical dimensions. The soft tissue evaluation includes measurements of soft tissue thickness, papilla height, gingival margin level, and width of the keratinized tissue band. Evaluate for collapse of the facial plate or tissue loss in the vertical

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