



Dental Implants in the Esthetic Zone

Considerations for Form and Function

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Abstract

Successful esthetic results of dental implant placement in the esthetic zone require knowledge of various concepts and techniques. Careful preoperative treatment planning, augmentation of hard and soft tissues, and attention to the details of implant surgical and prosthetic techniques are areas that must be addressed when treating the anterior maxilla. This article will address the fundamental considerations related to implant treatment in the anterior maxillary esthetic zone, using both theory and case examples.

PLACEMENT OF DENTAL IMPLANTS in the maxillary esthetic zone demands exacting planning and technical skills to achieve successful results. Through treatment planning from the perspective of the prosthetic end result, surgery can be curtailed to fulfill pre-planned objectives. Unless the position of the final prosthesis is visualized prior to surgery, placement of dental implants to achieve the end result cannot be performed. Treatment planning information that must be obtained includes probing depths, assessment of current soft tissue architecture, radiographic studies, study casts, diagnostic wax ups and a comprehensive medical history.

Preoperative planning at times indicates the need for an improved hard and soft tissue foundation prior to implant placement. The techniques necessary to create an ideal preoperative situation are atraumatic extractions, formation of papillae with ovate pontics, bone grafting with membranes and connective tissue grafting. An understanding of the principles for maintaining a healthy biological width is also necessary.

Once the ideal site for implant placement has been created,

certain principles of dental implant surgery and prosthetics must be utilized. These implant principles include the following:

- Conservative flap design
- Evaluation of existing bony architecture
- Esthetic osteotomy preparation
- Knowledge of timing for implant placement
- Correct spacing between adjacent implants or teeth
- Understanding the time needed for implant loading and soft tissue healing
- Formation of the emergence profile
- Knowledge of abutment selection, occlusal forces relating to progressive loading and occlusal forces on the final restoration.

This article will explore these concepts, which allow for ideal esthetics with dental implants. Case examples will be illustrated.

Treatment Planning

Dental implants ideally should be treatment planned from the perspective of the end prosthetic result.¹ This assures that the correct esthetic and functional loading positioning will be obtained. It is only when the final prosthetic result is realized that the clinician can take the appropriate steps to create the desired results. The importance of this treatment planning philosophy is even more evident in the anterior maxillary esthetic zone. The final result of implant prosthetic treatment is clearly seen and dependent upon every surgical step taken. Information about the existing bony architecture must be obtained to plan for ideal esthetic results with dental implants.

The first step in treatment planning is a comprehensive medical history.² Any uncontrolled medical conditions should negate grafting or implant placement. Habits such as smoking, alcohol or

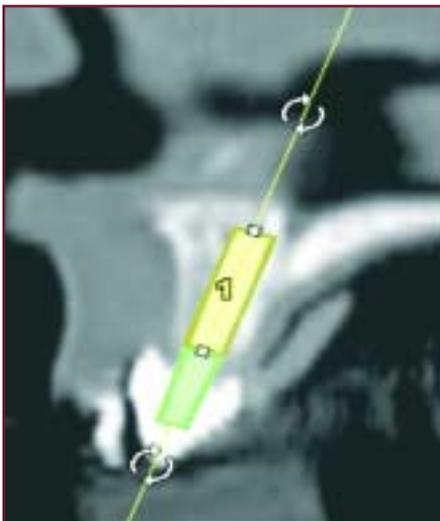


Figure 1. Interactive computerized tomography showing correct position for implant esthetics.

drug use should be addressed and taken into consideration prior to commencement of treatment. Documentation of force factors pertaining to occlusion need to be recognized. Bruxism, parafunctional activity, muscular dynamics and surrounding tooth mobility should be taken into consideration.

Study casts should be taken to access the occlusal dynamics of the patient. They can also offer information on tooth position that might require orthodontic movement to create correct spacing for implant placement.³ Radiographic analysis via panoraphs, peri-

apicals and computerized tomography relays important information pertaining to the osseous architecture and tooth position. Interactive computerized tomography (CT) can be especially helpful to treatment planning by providing a three-dimensional perspective with respect to a final prosthetic result⁴ (Figure 1). This often necessitates a diagnostic wax up or existing prosthesis duplication to communicate a desired result. The CT can also indicate whether bone grafting is needed.

Assessment of the soft tissue architecture character is important. If the existing soft tissue is thin and less keratinized, it is more prone to recession. Analysis of the patient's lip line should be taken into consideration.⁵ The amount of exposure of the esthetic zone by the patient's upper lip will dictate the amount of tooth surface normally visualized or if crown lengthening or connective tissue grafting is needed.

Accurate documentation of probing depths is one of the most important tools used. The existing bony architecture dictates the existing and future soft tissue support. This bony support becomes extremely important in the esthetic zone since papillae formation will be dictated by the osseous support around a dental implant (Figure 2). Tarnow suggests, unless there is a relationship of 5 mm or less to the interproximal bone height and the final prosthetic contact point, papillae formation for a crown could be compromised.⁶ This documented research often makes it necessary to graft bone prior to implant placement to achieve a more predictable esthetic result.

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Figure 2. Osseous support for papillae formation.



Figure 3. Adequate keratin development prior to grafting, after extraction.



Figure 4. Ideal form from ovate pontic prior to implant placement.

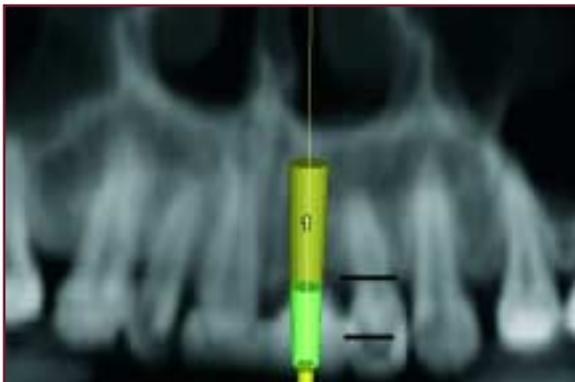


Figure 5. CT with superimposed lines showing less than 5 mm from contact point to osseous crest to create papillae formation.

Tissue Grafting

Once treatment planning has been completed, the next step is to assess the implant recipient site for an osteotomy preparation. If a CT scan has been done, determination of the need for hard tissue grafting can be seen.⁷ The amount of available bone and the presence of a buccal plate will determine the amount and type of grafting needed. The decision on placement of a dental implant at the time of extraction will also be determined by the amount of bone present. If there is deficient osseous architecture, the chance of esthetic soft tissue compromises increases.⁸

The presence of infection in an extraction site is another factor in deciding whether to place an implant immediately after extraction. An acute infection would create the need to wait for dental implant placement. Preservation of the bony architecture through an atraumatic extraction technique is an important step toward a favorable final esthetic outcome. The use of periostomes, forcep rotation and orthodontic extrusion are some techniques used to extract a tooth while preserving the surrounding bony walls.⁹ The presence of adjacent walls of bone is important to contain graft material and to offer a graft osteoprogenitor cells.

If a tooth is extracted, there are many advantages to waiting two to three weeks before grafting an extraction site. Reduction of infection, improved primary closure and obtaining adequate informed consent are good reasons to delay (Figure 3). If grafting an extraction site is delayed for two to three weeks, it is important to form the papillae with an ovate shaped pontic (Figure 4). This can be done with a bonded tooth, pontic or a stable removable appliance. Failure to support adjacent papillae early after an extraction could create long-term esthetic compromises.¹⁰

Implant Placement

After proper treatment planning and tissue grafting, a recipient site is prepared for implant placement. Prior to implant placement, various things should be considered to increase the chances of an ideal implant esthetic result.

The interproximal bony architecture should be within 5 mm of the proposed contact point, and adequate soft tissue should be present⁶ (Figure 5). Having ideal bony and soft tissue architecture to support the soft tissue of an implant recipient site is a key step to obtaining ultimate implant esthetic results.

If a tooth is being extracted, there might be consideration to placing an implant immediately into the tooth socket. Immediate placement of an implant into an extraction socket requires adequate buccal bone and the absence of any infection.

The literature supports the advantage of both hard and soft tissue support from immediate implant placement into a tooth socket when performed under the correct circumstances.¹¹

If implant placement requires a flap to access the underlying bone, consideration to flap design should be given. In the anterior esthetic zone, minimal flap reflection that includes papillae sparing incisions is recommended. In certain circumstances, where

osseous anatomy is abundant, a tissue punch can be used (Figure 6). The underlying concept is to preserve the blood supply to the adjacent papillae and soft tissue to minimize any recession.

Once the underlying bone is accessed, contouring is sometimes needed to create an ideal concave form. Since the underlying bone supports the soft tissue above, contouring can create a more ideal esthetic form for papillae support.

The osteotomy preparation of the implant site must be done in a manner that does not overheat the bone and cause necrosis.¹² In softer bone, osteotomes can be used to expand the site. Bone grafting can be done during implant placement if a perforation occurs during an osteotomy or if a few threads are exposed after seating of an implant. Primary closure of the soft tissue should be obtained if grafting procedures are done during implant placement.

During osteotomy preparation, care should be taken to adequately space the implants from adjacent teeth or other implants. A minimum of 1.5 mm should be allowed for the space to an adjacent tooth and a minimum of 3 mm should be allowed to an adjacent implant.¹³ A slight lingual angulation of an implant is preferred in the anterior region, to allow for increased soft tissue bulk. These measurements allow for adequate blood supply to support the overlying papillae. Careful consideration to angulations of adjacent structures should also be made, to avoid perforations. Detailed treatment planning that includes guide stents should avoid spacing and perforation problems (Figure 7).

After implant placement, the decision to submerge the implant or leave it exposed transmucosally must be made. A submerged implant requires uncovering at some point after implant osteointegration. Leaving an implant submerged is usually done in softer bone when there is simultaneous grafting being done, or if the pressures of a provisional restoration could create overloading on an implant (Figure 8).

An advantage to leaving an implant exposed with a transmucosal extension (healing abutment) is the ability to form the surrounding soft tissue and to create an emergence profile.¹ A healing abutment can be used if the bone is stable and if provisional prosthetic pressures allow for it.

The concept of emergence profile is important when dealing with implant esthetics. The emergence profile can be obtained three different ways. One way is for the healing abutment to form the surrounding soft tissue. The second way to sculpt the tissue around an implant is to have the implant abutment create ideal form.¹⁵ This can be done with a custom abutment at either first or second stage. If the abutment is used to create the emergence profile at first stage, then the criteria for immediate loading must be considered.

The third way to create the emergence profile is to allow a provisional restoration to sculpt it¹⁶ (Figure 9). This can be done either with an ovate pontic or with the contours of a cemented restoration at either first- or second-stage surgery.



Figure 6. Use of tissue punch to preserve papillae form.



Figure 7. CT-generated surgical guide stent allowing for adequate spacing and angulation of implants.



Figure 8. Submerged implant with ovate pontic forming papillae.



Figure 9. Clinical picture of Figure 8 showing ovate provisional forming papillae.

Conclusion

This article reviews the different facets of treatment planning, grafting and placement of dental implants for ideal dental implant esthetics. Through careful planning from the prosthetic end result, various steps can be taken to guide toward a good esthetic result for dental implants.

Unless the hard and soft tissue is created correctly, papillae formation may not be ideal. Once careful planning and grafting have occurred, implants can be carefully placed with respect to spacing and angulation.

By using a combination of these concepts, better predictability for esthetics with dental implants can be achieved. ■

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