

Planning for esthetics – Part II: adjacent implant restorations

William C Martin,¹ Emma Lewis,² Dean Morton³

Predictable esthetic replacement of single missing teeth in the esthetic zone is made possible by a number of clinical factors. One important factor is related to the bone crests on the proximal surfaces of teeth adjacent to the edentulous space.¹⁻⁵ In conjunction with the coronal anatomy and inter-coronal contact points, these bone crests directly influence the presence, morphology and predictability of the inter-dental papilla, and hence the quality of the esthetic outcome.⁶ Restoration of adjacent implants in the esthetic zone is made more challenging because the inter-implant space is characterized by an absence of these bone crests, resulting in a comparative deficit in vertical bone height when compared to natural teeth.⁷⁻¹¹ When adjacent implants are placed, the deficiency in the inter-implant vertical bone height results in a consequent loss of support for the inter-implant papilla, and an esthetic compromise between dental implants (Figure 1).

While more difficult to achieve, successful esthetic outcomes can be made possible in extended edentulous situations (Figures 2-3). In order to achieve these results it is important to understand that a cumulation of negative pretreatment factors can influence esthetic outcomes. As the number of “high risk” factors increase in a given clinical situation, the more difficult the challenge in achieving an esthetic result. The utilization of the Esthetic Risk Assessment analysis can be a key diagnostic aid in determining the potential for an esthetic result (Table 1). This method takes into account various factors such as medical status and smoking habit of the patient, lip line, gingival biotype, width of the gap, bone level at adjacent teeth, restorative status of neighboring teeth, soft tissue and bone anatomy, and the patient’s esthetic expectations.

In extended edentulous

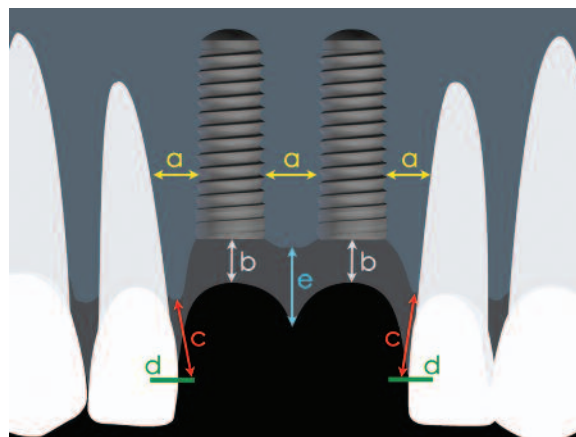


Figure 1: Various clinical dimensions of importance with adjacent implants in the esthetic zone. (a) horizontal dimensions: implant-root and implant-implant, (b) vertical dimension related to planned restorative mucosal margin, (c) distance from interproximal bone on adjacent teeth to restorative contact point, (d) restorative contact points, (e) inter-implant crest height to mucosal margin.

¹ DMD, MS, Associate Professor & Clinical Director, Center for Implant Dentistry, Department of Oral and Maxillofacial Surgery, University of Florida, College of Dentistry, USA

² DDS, Department of Oral and Maxillo-Facial Surgery, University of Florida, College of Dentistry, Gainesville

³ DDS, University of Florida College of Dentistry, Center for Implant Dentistry, Gainesville, USA

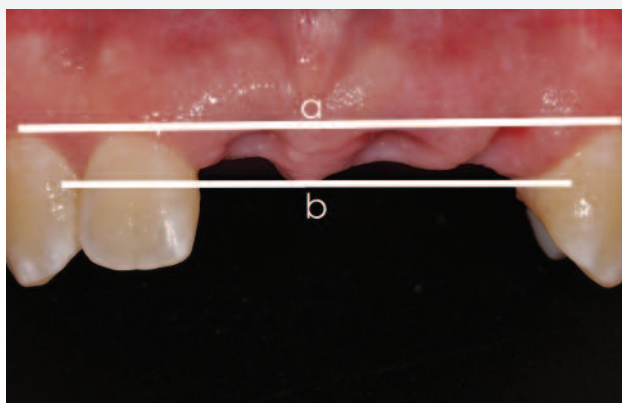


Figure 2: Frontal view of extended edentulous space. (a) gingival margin position, (b) height of existing papillae.

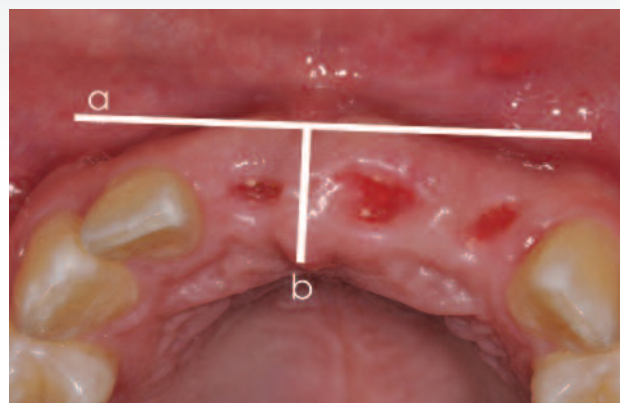


Figure 3: Occlusal view of extended edentulous space. (a) facial contours of soft tissue, (b) width of edentulous ridge.

situations, the potential for an esthetic result is reliant on meticulous planning, proper site enhancement procedures and detailed restoration-driven surgical and restorative procedures (as noted in Part I of this series). The evaluation of the proposed sites is restoration-specific and based upon the diagnostic wax-up, diagnostic casts and pre-treatment radiographs that will assist in identifying the presence of vertical ridge deficiencies and residual pathoses. Prior to pre-treatment radiographic evaluation, a diagnostic waxing which accurately identifies the proposed mucosal zenith (highest point of the free mucosal margin), and the desired coronal extension of the papillae is mandatory (Figure 4). The wax-up relates the proposed implant margin to the oral tissues, and must recognize the emergence of the planned restorations from the tissues. Together, these factors position the implant margin in the three dimensions. Because bone height (and ultimately papillary presence and morphology) is directly related to the position of this margin, every effort should be made to plan for implant positions as coronal as the mucosal architecture and emergence profile will allow. Radiographic evaluation of the vertical and horizontal extension of the bone crests on the teeth adjacent to and within the edentulous space should be undertaken to determine the need for augmentation procedures (Figures 5-6).

Examination of hard tissues should determine the facial-palatal dimension of the bone site, and relate this to the proposed restorations. It should be noted that residual ridge anatomy is unreliable as an indicator of bone dimension, and clinical procedures (e.g. sounding, CBCT's) should be



Figure 4: Diagnostic try-in with radio-opaque teeth for cone-beam computed tomography planning.

employed to accurately map the osseous contour. The projection of the mucosal zenith will facilitate comprehensive assessment of soft tissues. The thickness and morphology of the mucosal tissues is significant as it influences the position of the implant shoulder in both a apico-coronal and oro-facial position. The final position of the implant shoulder will influence the inter-implant vertical height of bone achievable around the implant as well as dictate the initiation of the emergence profile of the abutment and restoration. Therefore, in the case of the bone-level implant design, it is critical to place the implant shoulder at a minimum of 3mm apical to the planned mucosal margin. This will allow for optimum maintenance of inter-implant bone crests as well as allow for establishment of ideal emergence profile contours of the abutment and restoration. Surgical placement of the implants requires

Table 1. Esthetic Risk Analysis – Ref. ITI Treatment Guide Volume I

Esthetic Risk Factor	Level of Risk		
	Low	Moderate	High
Medical Status	Healthy, co-operative patient with an intact immune system		Reduced immune system
Smoking habit	Non-smoker	Light smoker (<10 cigs/day)	Heavy smoker (>10 cigs/day)
Patient's esthetic expectations	Low	Medium	High
Lip line	Low	Medium	High
Gingival biotype	Low scalloped, thick	Medium scalloped, medium thick	High scalloped, thin
Shape of tooth crowns	Rectangular		Triangular
Infection at implant site	None	Chronic	Acute
Bone level at adjacent teeth	≤ 5mm to contact point	5.5 to 6.5 mm to contact point	≥ 7mm to contact point
Restorative status of neighboring teeth	Virgin		Restored
Width of edentulous span	1 tooth (≥ 7mm)	1 tooth (≤ 7mm)	2 teeth or more
Soft tissue anatomy	Intact soft tissue		Soft tissue defects
Bone anatomy of alveolar crest	Alveolar crest without bone deficiency	Horizontal bone deficiency	Vertical bone deficiency

© 2009 International Team for Implantology

careful attention to adjacent structures, particularly teeth. Further, surgical templates can be fabricated using the radiographic information, facilitating effective transfer of

clinical information. The horizontal distance between implants and teeth should approximate 1.5mm.⁷ This dimension will help prevent significant resorption of the

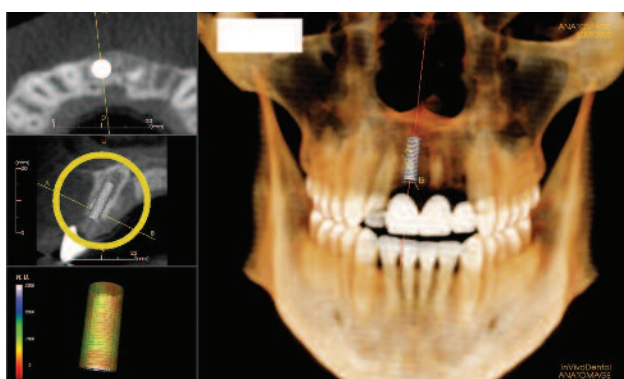


Figure 5: Three dimensional view of site #8.

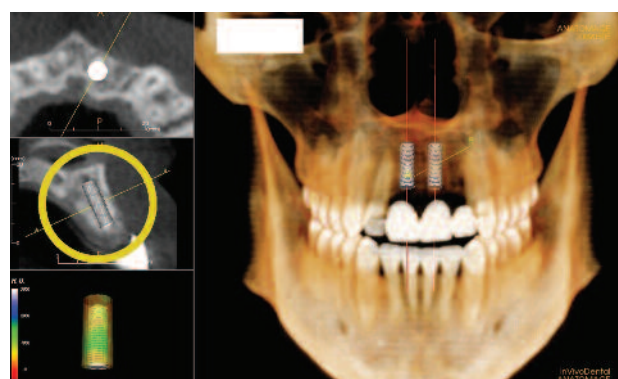


Figure 6: Three dimensional view of site #9.

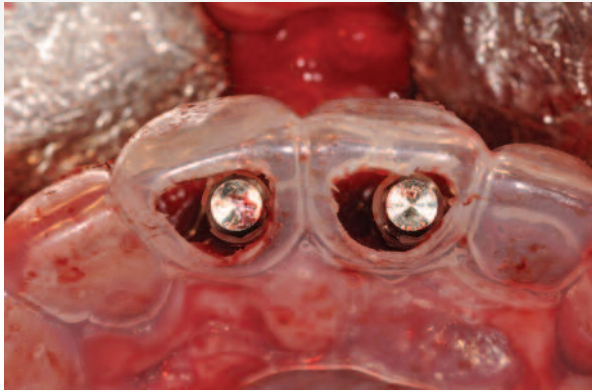


Figure 7a: Occlusal view of the surgical template post-implant placement.

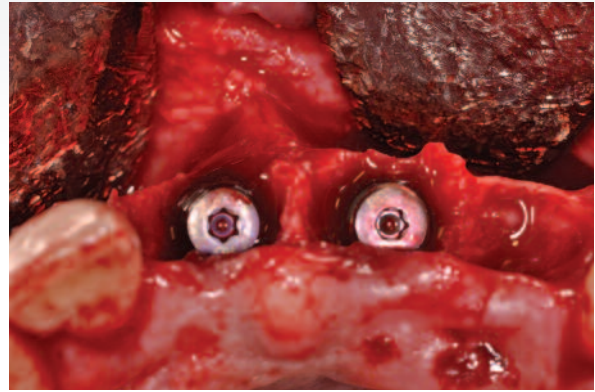


Figure 7b: Occlusal view of the final implant positions.



Figure 8a: Unshaped transition zone immediately following removal of the healing abutments.



Figure 8b: Provisional restoration exhibiting ideal contours to assist in shaping the transition zone and providing support for papillae formation.



Figure 8c: Provisional restorations after four-weeks of function.

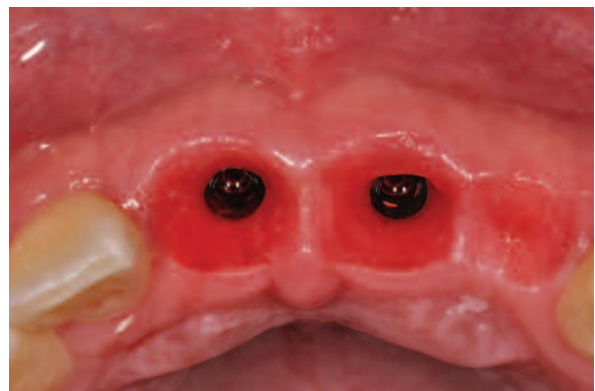


Figure 8d: Occlusal view of the implant transition zones and ovate pontic formation after four-weeks of provisional use.

bone crests during healing. An inter-implant distance of 3mm has been advocated by Tarnow et.al. to reduce the likelihood of bone loss between implants (Figures. 7a-b).⁷ Submucosal tissue support from adjacent structures is also

required for the development of papillae. This is achieved by the placement of provisional restorations with appropriate emergence and anatomy to shape the transition zone (area between the implant shoulder and



Figure 9a: Customized impression coping generated from the provisional restorations.



Figure 9b: Customized impression copings in place prior to the final impression.



Figure 10a: Prefabricated ZrO₂ abutments and veneered copings.



Figure 10b: Final restorations prior to placement.

mucosal margin). The provisional restorations (and subsequent definitive restorations) should provide proximal contacts which extend to within 5–6mm of the inter-implant bone and remaining bone crests if developed papillae are to be viable in the long term (Figures 8a-d). Attention to detail is required through custom-impression procedures which transfer the contours of the subgingival region to the dental technician for duplication in the final restorations (Figures 9a-b).¹²

Prior to the final impression, shade selection is performed and photographed for communication with the laboratory. Utilizing CAD/CAM technology, prefabricated ZrO₂ abutments (Ivoclar, Buffalo, NY) were utilized, followed by fabrication of ZrO₂ copings (CAD/CAM by Straumann®) which were then veneered with porcelain (VITA VM® 9, VITA Zahnfabrik, D-Bad Säckingen) (Figures 10a-b).

Conclusion

Effective communication of the planned implant positions is required if planning is to be translated into clinical success. The use of surgical templates is required if this goal is to be routinely satisfied. Subsequent to accurate, three-dimensional implant placement, provisional restorations are required to facilitate maturation of the connective and epithelial tissues prior to definitive restorations being fabricated. Effective planning and execution, in conjunction with the choice of appropriate implants, can lead to stability of the soft-tissue response and successful restoration of adjacent implants in the esthetic zone (Figures 11a-d).

The authors would like to thank Mr. Mitchell Jim for the laboratory support and ceramics used on the patients shown in Parts I and II of the Planning for Esthetics Series highlighted in this publication.



Figure 11a: One-year follow-up – frontal view.



Figure 11b: One-year follow-up – occlusal view.

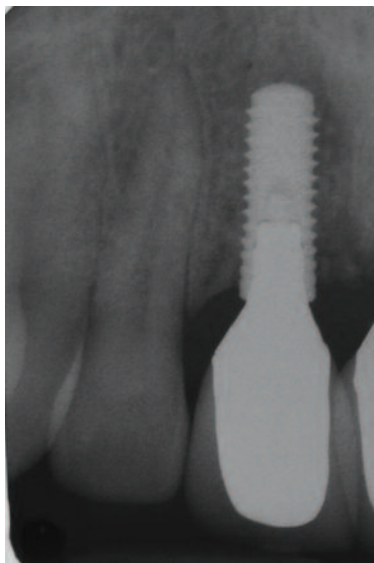


Figure 11c: One-year follow-up peri-apical radiograph.

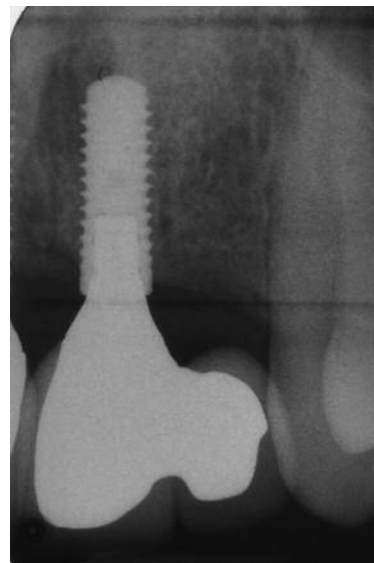


Figure 11d: One-year follow-up peri-apical radiograph.

References

1. Choquet V, Hermans M, Adriaenssens P, Daelemans P, Tarnow DP, Malevez C. Clinical and radiographic evaluation of the papilla level adjacent to single-tooth dental implants. A retrospective study in the maxillary anterior region. *J Periodontol.* 2001 Oct;72(10):1364-71.
2. Kan JY, Rungcharassaeng K, Umezu K, Kois JC. Dimensions of peri-implant mucosa: an evaluation of maxillary anterior single implants in humans. *J Periodontol.* 2003 Apr;74(4):557-62.
3. Belser UC, Schmid B, Higginbottom F, Buser D. Outcome analysis of implant restorations located in the

anterior maxilla: a review of the recent literature. *Int J Oral Maxillofac Implants.* 2004;19 Suppl:30-42.

4. Degidi M, Nardi D, Piattelli A. Peri-implant tissue and radiographic bone levels in the immediately restored single-tooth implant: a retrospective analysis. *J Periodontol.* 2008 Feb;79(2):252-9.

5. Lops D, Chiapasco M, Rossi A, Bressan E, Romeo E. Incidence of inter-proximal papilla between a tooth and an adjacent immediate implant placed into a fresh extraction socket: 1-year prospective study. *Clin Oral Implants Res.* 2008 Nov;19(11):1135-40.

6. Tarnow DP. The effect of the distance from the contact

point to the crest of bone on the presence or absence of the interproximal dental papilla. *J Periodontol* 1992; 63 (12): 995-996.

7. Tarnow DP., Cho SC., Wallace SS. The effect of inter-implant distance on the height of inter-implant bone crest. *J Periodontol* 2000; 71 (4): 546-549.

8. Cardaropoli G, Wennström JL, Lekholm U. Peri-implant bone alterations in relation to inter-unit distances. A 3-year retrospective study. *Clin Oral Implants Res.* 2003 Aug;14(4):430-6.

9. Tarnow D, Elian N, Fletcher P, Froum S, Magner A, Cho SC, Salama M, Salama H, Garber DA. Vertical distance from the crest of bone to the height of the interproximal papilla between adjacent implants. *J Periodontol.* 2003 Dec;74(12):1785-8.

10. Gastaldo JF, Cury PR, Sendyk WR. Effect of the

vertical and horizontal distances between adjacent implants and between a tooth and an implant on the incidence of interproximal papilla. *J Periodontol.* 2004 Sep;75(9):1242-6.

11. Degidi M, Novaes AB Jr, Nardi D, Piattelli A. Outcome analysis of immediately placed, immediately restored implants in the esthetic area: the clinical relevance of different interimplant distances. *J Periodontol.* 2008 Jun;79(6):1056-61.

12. Hinds, KF. Custom impression coping for an exact registration of the healed tissue in the esthetic implant restoration. *Int. J Perio Rest Dent.* 1997 Dec;17(6):584-91.

Dr William C Martin will be a keynote speaker at the 2016 ITI National Congress, "Another Brick in the Wall", 16-17th July 2016, Pretoria.