Planning for esthetics – Part II: Adjacent implant restorations

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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

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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.
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 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 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

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

<table>
<thead>
<tr>
<th>Esthetic Risk Factor</th>
<th>Level of Risk</th>
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<tbody>
<tr>
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<td>Low</td>
</tr>
<tr>
<td>Medical status</td>
<td>Healthy, co-operative patient with an intact immune system</td>
</tr>
<tr>
<td>Smoking habit</td>
<td>Non-smoker (≤ 10 cigs/day)</td>
</tr>
<tr>
<td>Patient's esthetic expectations</td>
<td>Low</td>
</tr>
<tr>
<td>Lip line</td>
<td>Low</td>
</tr>
<tr>
<td>Gingival biotype</td>
<td>Low scalloped, thick</td>
</tr>
<tr>
<td>Shape of tooth crowns</td>
<td>Rectangular</td>
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<tr>
<td>Infection at implant site</td>
<td>None</td>
</tr>
<tr>
<td>Bone level at adjacent teeth</td>
<td>≤ 5mm to contact point</td>
</tr>
<tr>
<td>Restorative status of neighboring teeth</td>
<td>Virgin</td>
</tr>
<tr>
<td>Width of edentulous span</td>
<td>1 tooth (≥ 7mm)</td>
</tr>
<tr>
<td>Soft tissue anatomy</td>
<td>Intact soft tissue</td>
</tr>
<tr>
<td>Bone anatomy of alveolar crest</td>
<td>Alveolar crest without bone deficiency</td>
</tr>
</tbody>
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Figure 5. Three dimensional view of site #8.

Figure 6. Three dimensional view of site #9.
implants requires 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 1.5 mm. This dimension will help prevent significant resorption of the bone crests during healing. An inter-implant distance of 3 mm has been advocated by Tarnow.
et al to reduce the likelihood of bone loss between implants (Figures 7a-b). 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 mucosal margin). The provisional restorations (and subsequent definitive restorations) should provide proximal contacts which extend to within 5–6 mm 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). 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).

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