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Three-Dimensional Bone and Soft Tissue Requirements for Optimizing Esthetic Results in Compromised Cases with Multiple Implants



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Achieving an esthetic outcome in tooth replacement and implant treatment requires a proper tooth shape and stable surrounding soft tissue profiles. Bone augmentation is considered vital to support the esthetic soft tissue profile around definitive restorations. To prevent recession of the peri-implant soft tissue in cases with multiple implants, buccal bone augmentation of more than 2 mm from the implant platform is necessary to overcome the normal pattern of bone remodeling. Drawing an imaginary horizontal line spanning the space between the remaining healthy interproximal bone peaks is the most reliable vertical augmentation target to create esthetic papillae around an implant prosthesis. Provided that the adjacent bone peaks are at an ideal height and the bone is augmented vertically up to this line, the accepted general guideline of 2 to 3 mm of interproximal vertical bone augmentation from ideally placed implant platforms will invariably also be achieved. In addition, placing pontics in strategic positions to avoid consecutively placed implants has been suggested to facilitate vertical bone height preservation after bone augmentation. Even with esthetically successful results, there have been very few long-term studies on compromised cases with multiple implants. This will become more and more critical over time and must be remedied. (Int J Periodontics Restorative Dent 2010;30:503–511.)

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Dental implant treatment should always be performed with esthetics in mind¹; this requires proper tooth shape and stable surrounding soft tissue profiles. In single-tooth implants, interdental papillae are restored predictably by maintaining the health of the adjacent periodontium.² Alternatively, in cases with multiple implants, the peri-implant soft tissue is guided and shaped by the restoration and supported by the bone foundation. Restoring soft tissue esthetics in cases with multiple implants remains a great challenge,³ since bone remodeling and resorption occur at the implant-abutment junction and peri-implant soft tissue does not share the natural tooth's attachment apparatus and blood supply.⁴ In this article, the concepts behind achieving esthetic and functional implant restorations and the necessary three-dimensional peri-implant hard and soft tissue management required to realize these goals are discussed.

Fig 2 (left) The maxillary right central incisor and left central incisor, lateral incisor, and canine were lost because of infection, resulting in significant vertical and horizontal tissue loss.



Fig 3 (right) Periapical radiograph showing the degree of vertical bone loss. Because of limited space, the four lost teeth were to be replaced with three crowns.

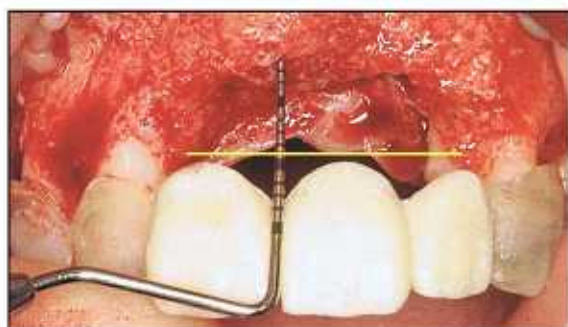
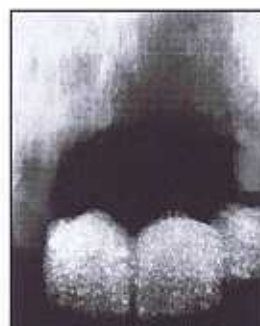


Fig 4 Nine millimeters of bone augmentation was necessary to reconstruct a bone ridge up to the imagined horizontal line connecting the adjacent bone peaks (yellow).



Fig 5 Three implants (Prevail 4/3 x 13 mm, Biomet 3i) were placed in their ideal positions, maintaining interimplant distances of more than 3 mm.

guideline of 2 to 3 mm of interproximal vertical bone augmentation from ideally placed implant platforms will invariably also be achieved.

Unfortunately, some degree of resorption will always be experienced clinically. Dahlin et al¹⁷ found that using a combination of 3-mm abutments, bovine hydroxyapatite, and membranes to augment interproximal bone

and optimize the papillae appearance ultimately preserved an esthetic result at 5 years, even after the unavoidable ridge resorption (Figs 2 to 10).

When there is significant attachment loss present, restoring the bone level on adjacent teeth through orthodontic extrusion may be required prior to vertical bone augmentation.¹⁸



Fig 12 Final treatment outcome. This patient had a high smile line, so establishing a truly esthetic soft tissue frame necessitated the creation of natural tissue over the entire restoration area.



Fig 13 A natural-looking keratinized soft tissue frame was achieved using a subepithelial connective tissue graft.

Tarnow et al²² measured the height of interimplant papillae and reported the mean papillae height between two implants was 3.4 mm, with 3- and 4-mm-high papillae representing 72.8% of the total sites evaluated.

To create adequate papillae form between adjacent implants, the ideally augmented interproximal bone height should be 3.5 mm from the projected final restorative contact area, although this is impossible to maintain clinically.

In cases with multiple implants, it is suggested that placing a pontic in a strategic position is better than placing adjoining implants, since this would minimize the loss of vertical bone height resulting from crestal bone remodeling and facilitate greater soft tissue height in the proximal area.^{21,23}

Even if papillae heights between varied restorative environments are different, the clinician can merely aim to achieve the vertical bone augmentation standard of a solid bone frame connecting the two adjacent bone peaks. Therefore, in a clinical reality, the papillae must be adjusted using manipulation of the subgingival contour of the abutment and the crown. The crown contour can also be modified supragingivally to create acceptable embrasure spaces (Figs 12 to 14).

Platform switching,²⁴⁻²⁶ Laser-Lok microchannels,²⁷ one-piece implants, and reducing the numbers of abutment try-ins²⁸ has also been postulated to reduce bone resorption at the implant-abutment junction and maintain long-term soft tissue stability.