INTRODUCTION

Dental implants have enabled clinicians to replace missing teeth and return function and harmony to patients owing to their high predictability. However, it can be challenging to create implant-supported restorations that emulate the natural dentition. Among the guidelines that have been proposed for achieving esthetic excellence, many focus on maintaining or enhancing the volume of periimplant soft and hard tissue. This paper describes five keys to achieving and maintaining dentogingival harmony and obtaining highly esthetic anterior implant restorations. Use of an implant that facilitates adherence to several of these principles is illustrated with a case description.

The five keys

— 1. Tissue optimization (Fig. 1a)

Several studies have documented post-extraction resorption patterns that demonstrate horizontal and vertical bone loss during the first year after extraction. Some bone resorption has been described at sites where the extracted teeth were immediately replaced with implants. The objectives of tissue optimization are to diagnose the volume of soft and hard tissue and, in the absence of an adequate amount, prepare for augmentation of the volume. Augmentation procedures may be beneficial in preventing black triangles and creating natural emergence profiles. An early implant placement protocol should be applied when tooth extraction is required at a site with a thin gingival phenotype. Although this approach does not allow adequate time for bone to form in the extracted site, it provides a soft-tissue seal by primary intention.

— 2. Gingival remodeling (Fig. 1b)

Once the volume of the gingival tissue above or adjacent to the implant has been optimized, some reshaping of the tissue should be considered. Use of an ovate pontic has been suggested to support the gingival tissue coronal to the implant shoulder, creating pseudopapillae and a natural emergence profile. The ovate pontic may also expose the submerged implant and avoid the need for a second surgery to obtain access to the cover screw. Avoiding a second surgery will help to preserve the gingival architecture and minimize soft-tissue scar retraction.

The use of provisional restorations to sculpt the soft tissue without causing recession or retraction is fundamental. Most fixed and removable prostheses can accomplish this goal. Another technique is to use cemented fixed provisional restorations and minimally invasive palatal preparations. Pressure should gradually be imposed on the soft tissue from the palatal to the labial aspect and the mesial to the distal aspect in order to displace tissue volume toward the areas adjacent to the prosthetic crown, where papillae and convex contours are desired for a natural emergence profile.

— 3. Handling reduction (Fig. 1c)

Once an ideal tissue form has been obtained, it must be preserved and stabilized. Frequent disconnection and reconnection...
Figs. 1a–e

Schematic view of the five-key protocol. Tissue optimization (a). Gingival remodeling (b). Handling reduction (c). Effective component design (d). Abutment surface cleanliness (e).

of the abutment has been associated with detrimental effects on the periimplant bone. It creates a soft-tissue wound and triggers subsequent bone resorption as a proper biologic dimension of the mucosal barrier attachment to the stable implant surface is re-established. In order to avoid disturbing the mucosal periimplant seal that preserves the crestal bone level, a customized abutment for a cement-retained prosthesis should be placed with the objective of avoiding repeated implant-level impressions and try-ins. An abutment-level impression should be taken. When impressions are taken at the time of implant placement and further abutment manipulation can be avoided, less bone resorption has been shown to result. 

— 4. Effective component design (Fig. 1d)

The implant macrodesign and, in particular, the design of the implant–abutment junction (IAJ) are critical in preventing the loss of crestal bone. Numerous publications have demonstrated that some alveolar bone resorption occurs around the IAJ of platform-matched implants when they are exposed to the oral environment. It has been postulated that the first bone-to-implant contact begins around 1.5–2 mm apical to the IAJ or to the first implant thread. About 1.4 mm of horizontal resorption occurs. A different bone response has been documented when platform-switched implants are used. A recent systematic review and meta-analysis showed that significantly less bone resorption occurred when this IAJ design was employed. Use of the 4/3 T3 tapered implant (BIOMET 3i) facilitates following several of these keys to achieve more predictable esthetic restoration of anterior implants. The design incorporates platform switching, with a 3.4 mm platform dimension in order not to impinge on the interdental space.

Histological investigation has found that platform switching appears to affect the location of the circularly oriented collagen fibers that surround implant abutments and apparently stabilize the connective tissue and underlying alveolar crest. While these fibers have been found at the level of the first thread of nonplatform-switched implants, they have developed at the IAJ of platform-switched implants. The horizontal platform of the platform-switched implants appeared to provide mechanical retention for the circular fibers, allowing them to develop more coronally than in standard implants. The abutment design too can help to stabilize the connective tissue above the IAJ and preserve alveolar bone at the platform level. One concave design has been proposed that features a circumferential macrogroove that creates space for soft tissue. It arguably creates a ringlike seal that, after tissue maturation, may stabilize the connective tissue adhesion. Connective tissue stabilization has also been demonstrated when using a narrow laser microgrooved cylindrical abutment.

The implant–abutment connection too appears to have a significant impact on periimplant crestal bone levels. Internal connections have been demonstrated to better maintain bone. Finally, the design of the prosthetic crown and its relationship to the implant abutment are essential factors for restoring tooth anatomy and function. The crown should provide space for fiber stabilization between the cervical contours and the implant platform.

— 5. Abutment surface cleanliness (Fig. 1e)

Implant abutments are transgingival devices that interact in their most cervical region with the surrounding tissue, mainly connective tissue underneath the gingiva. Abutments allow for the re-establishment of the biologic width: as cells attach, the
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The abutment material may influence cellular attachment processes.22–24 Surface contamination occurring after laboratory or clinician manipulation or reuse of the abutments has been shown to have a detrimental effect on cellular attachment.25, 26 Multiple protocols, including rinsing with saline solution or hydrogen peroxide,27 autoclave sterilization 28 and ultrasonic treatment,25 have been devised to restore the original biocompatible abutment surface composition without changing the surface topography. Most have failed to eliminate the contaminants, and some have worsened the cell adhesion.28, 29 However, exposure to ozone has been demonstrated to eliminate plaque film completely,27 and the ability of chlorhexidine to decontaminate abutment surfaces has also been demonstrated.30 Providing a biocompatible environment before abutments are placed.
in contact with the gingival tissue can promote earlier tissue stabilization. Eliminating or reducing the role of disturbing agents is thus an important goal. Figures 1 to 16 illustrate the use of a 4/3 3i Tapered Implant (platform-switched) to implement several of the five keys in two compromised and esthetically demanding sites.

**Conclusion**

Management of anterior implant restorations demands a highly esthetic approach in order to obtain successful outcomes. Multiple interrelated factors influence the relationship between the white esthetics of the restoration and the pink esthetics of the surrounding gingival tissue. None of these factors should be considered in isolation. Only by coordinating their application can more predictable and harmonious esthetic restorations be created. The use of the 3i T3 Tapered Implant and the marginless abutment can help clinicians to follow the five steps explained in this article in order to obtain better esthetic results for implant-supported restorations.

**Fig. 11**
Four months after being placed, the implants were uncovered. Gingihue Abutments (BIOMET 3i), modified in the laboratory to achieve a 6° taper and margin-free restoration, were placed. This is the first and only abutment swap (handling reduction).

**Fig. 12**
The definitive abutment screws were tightened to 20 N cm, and the screw access openings were restored with composite in preparation for placing the cement-retained provisional bridge.

**Fig. 13**
The patient wore the implant-supported fixed resin bridge for three months, enabling further maturation of the soft tissue.

**Fig. 14**
Eight months after placement of the implants, the soft tissue had further matured and stabilized, and the definitive two-unit full-ceramic bridge was fabricated.

**Fig. 15**
Nine months after placement of the implants, the definitive zirconia bridge was cemented in place.

**Fig. 16**
Radiograph of the definitive two-unit bridge.

*Editorial note: A list of references is available from the publisher.*