As the discipline of implant prosthodontics continues to evolve, additional emphasis has been focused on the role of adequate emergence profiles and peri-implant soft tissue contours. Despite the development of anatomically shaped healing abutments, currently advocated techniques exhibit clinical limitations. This article introduces the transitional custom abutment technique as a method of manipulating the suprarestimplant soft tissue contours so that optimal emergence profiles and increased restorative flexibility can be achieved in the treatment of patients with compromised fixture angulation.

Key Words: custom, transitional, abutment, implant, gingiva

The widespread adoption of the osseointegration technique and its subsequent application in an expanded array of clinical circumstances has resulted in an understanding of the prosthetic-dependent nature of implantology. This prosthetically centered nature of implantology has required the perpetual refinement of modern restorative objectives. Consequently, the discipline of implant prosthodontics is measured by the aesthetic and functional standards that are presently applied to contemporary restoration of the natural dentition.

Traditionally, limitations at the restorative/implant connection have posed obstacles in the achievement of superior treatment outcomes. Complications often resulted in aberrant contours that were unaesthetic and difficult to maintain — particularly when managing compromised fixture placement. Several prosthetic components have been developed in an effort to optimize the emergence profile of implant-supported restorations by improving the relationships at the tissue-restorative interface.

As experience with metal-ceramic implant-supported prostheses increased, further enhancement of treatment outcomes required that optimum emergence profiles be initiated at the fixture level. This clinical realization resulted in the development of alternative implant diameters and thus allowed individualized fixture selection to specifically match the cervical widths of the replaced teeth. In addition, various restorative components (e.g., Emergence Profile System, Gingi-Sculpt Abutments, 3i, Palm Beach Gardens, FL) have been designed to guide the healing of the suprarestimplant soft tissue contours. Despite their efficacy, however, it is impossible for any prefabricated abutment system to compensate for the infinite variations in gingival topography that may be encountered intraorally.

Figure 1. Case 1. Fractured central incisors were extracted 8 weeks prior to presentation. Note the overall blunting of papillary forms and severe collapse of the central incisor papilla.
The use of customized abutments has been suggested as an alternative to circumvent the limitations of prefabricated components.²¹,²² Although this technique represents a significant improvement, the design of the custom abutment remains confined within the supraimplant soft tissue contours generated through the use of prefabricated healing abutments and subsequently transferred with standard impression posts. This article introduces the transitional custom abutment technique as a prosthetic adjunct to increase restorative flexibility and improve emergence profiles — particularly in the presence of compromised fixture placement, angulation, or selection.

**Treatment Rationale**

Optimum emergence profiles can be predictably achieved only through the use of techniques that allow maximum manipulation of the available supraimplant soft tissue contours. It would, therefore, be advantageous to utilize intraorally modifiable implant restorative components to fully exploit the potential afforded by the dynamic remodeling ability of the gingival tissues. One frequently employed method utilizes a provisional fixed prosthesis that is gradually modified to develop the soft tissue contours.²³,²⁴ This technique, however, is limited to patients where implant placement is adequate. Its application in areas where compromised fixture angulation is present will often cause the screw access to exit through the buccal surface or at the incisal edge of the provisional restoration. Additional limitations include difficulty in overcoming tissue resistance during seating and the introduction of residual cement at excessively subgingival levels.

The use of transitional custom abutments may provide enhanced restorative flexibility and optimal emergence profiles in situations where mesiodistal positioning, buccolingual angulation, or fixture diameter selection have been compromised. This technique allows simple and controlled modification of the abutment profile to optimally manipulate the supraimplant tissue contours. The tissue resistance generated by gingival expansion during seating of the abutment is effectively overcome by the screw-retained transitional custom abutment. In addition, excessively subgingival restorative margins are avoided and can instead be placed according to aesthetic and
functional demands. A significant advantage of the transitional custom abutment technique is its ability to compensate for inadequate implant angulation as a result of rotational deviation from the optimal axial orientation either in a mesiodistal or buccolingual direction. Translatory deviations from the ideal fixture location can also be addressed, although to a lesser extent. Once the optimum contours have been developed, an exact replica of the transitional custom abutment — along with the definitive restoration — can be fabricated in the laboratory.

The term “transitional custom abutment” underscores the role of these components in the manipulation of the soft tissues to prosthetically induce the remodeling of the supraimplant gingival contours. It similarly emphasizes the dynamic nature of the process through which the abutments are initially customized and sequentially modified, and the manner in which the desired emergence profiles are progressively achieved. The transitional custom abutment differs from a temporary custom abutment in that the latter is utilized exclusively to compensate for compromised implant angulation and it is not designed to effect gingival modeling.

Clinical Technique
On a diagnostic model, a fully contoured waxup of the teeth to be restored is developed with the desired functional and aesthetic anatomy. A vacuum-formed stent and a silicone index are fabricated from a duplicate of the diagnostic waxup (Figures 1 and 2). A pickup impression is made at the implant level utilizing internally hexed UCLA-type impression copings (3i, Palm Beach Gardens, FL). This is followed by the fabrication of a master model that incorporates laboratory implant analogs. Although this impression can be obtained during implant placement or at exposure, the most predictable results are achieved following adequate gingival healing, in which case fabrication of a soft tissue model is recommended.

Internally hexed UCLA-type temporary cylinders (3i, Palm Beach Gardens, FL) are connected to the implant analogs and modified until they resemble full-coverage crown preparations. Coarse- or medium-grit diamonds and carbide burs are recommended to increase surface roughness and mechanical retention. The vacuum-formed
template is utilized as a guide throughout the preparation, while the silicone index aids in verifying adequate reduction at the incisal third (Figures 3 and 4). Exposure of the screw access cavity will occur depending on the degree of angulation to be corrected. Nevertheless, longitudinal exposure of the screw access cavity as a result of excessive axial wall reduction should be avoided.

Once the preparation is completed, the temporary cylinders are washed and dried. A 35% phosphoric acid gel is applied for 10 seconds as a cleansing agent. The prepared surfaces are treated with a metal primer (GC Metal Primer, GC America, Alsip, IL), and a coat of bonding agent is subsequently applied and light cured. This is followed by the incremental addition of a light-cured hybrid composite with low flow characteristics until a core that displays the preliminary emergence profile is developed. A layer of opaque composite may be utilized to mask the metal surface prior to core buildup in aesthetically demanding situations (Figure 5). The composite core is modified through reduction or addition of material until the desired contours are achieved. A flowable composite may alternatively be used at this stage.

The vacuum-formed template and silicone index are valuable aids in determining the optimum compensation for compromised implant angulation or position, as well as verifying the existence of adequate space for the definitive restorative materials within the confines of the diagnostic waxup.

The transitional custom abutments are subsequently transferred to the mouth, where additional modifications are performed as necessary. Once all tissue-borne surfaces have been polished, the transitional custom abutment is installed while pressure is applied on the supraimplant tissues. Complete seating is achieved by gradually tightening the retaining screw as resistance from the expanding tissue is overcome. A chamfer or shoulder finish line — which generally follows the gingival margin topography — is subsequently established according to the site-specific aesthetic demands of the area being treated.

Once installed intraorally, the transitional custom abutments may be progressively modified until the optimum supraimplant tissue contours and emergence profiles are established. The implant-supported provisional restoration is modified concomitantly to achieve the

Figure 8. View of the optimized suprainplant soft tissue topography. Note the prosthetically induced pseudoalveolar ridge contours.

Figure 9. The recommended technique for accurately transferring the peri-implant gingival topography utilizes the transitional custom abutments as pickup-type impression copings.

Figure 10. Internal aspect of the transfer impression with the transitional custom abutments in situ. The model must be poured in the office so that the abutments can be replaced intraorally.
desired effect. Gingival contours that mimic pseudo-alveolar ridge forms can be established with this technique (Figures 6 through 8).

In order to fabricate the definitive prosthesis, the finalized tissue-restorative contours must be reproduced. The accurate transfer of the optimally developed soft tissue topography requires that collapse of the peri-implant sulcus be prevented. The transfer impression technique advocated by the author utilizes the transitional custom abutment as an impression coping with the aid of retaining screws for pickup impression posts (3i, Palm Beach Gardens, FL), and an open tray technique. This allows retrieval of the transitional custom abutment within the impression. A soft tissue model is then poured with the transitional custom abutments in situ, which yields an exact replica of the prosthetically induced peri-implant sulcus topography (Figures 9 through 11).

Once an accurate soft tissue model is obtained, wax can be flowed into the peri-implant sulci and around UCLA castable abutment patterns (3i, Palm Beach Gardens, FL) to fabricate cast metal custom abutments that replicate the contours of the transitional custom abutments (Figures 12 and 13). Once the custom abutments are tried intraorally, fabrication of the definitive restoration is initiated. Although the use of zirconium oxide abutments has been suggested in aesthetically demanding areas, the technology does not presently exist to scan and three-dimensionally image the soft tissue model for subsequent machining of the transitional custom abutment by a computerized industrial lathe (P. Schärer, personal communication, 1998).

Although certain high-strength nonmetallic crowns may be a consideration in single-unit applications as a result of their ability to conceal the underlying metal abutment, caution must be exercised since temporary cement, which is traditionally recommended to preserve the retrievability of implant-supported restorations, may not adequately support the nonmetallic substrate. Composite-gold alloy frameworks (Captek, Precious Chemicals Inc., Longwood, FL) are an excellent alternative in aesthetically demanding regions, as they offer a balance between strength and aesthetics (Figures 14 and 15). More extensive splinted prostheses require the use of traditional metal-ceramic materials.
Treatment Sequence and Surgical Considerations

Transitional custom abutments perform optimally when generated from an integrated treatment approach where the definitive prosthetic outcome has been preestablished. This would encompass prosthetically driven site development, augmentation, and implant placement.25

An initial transfer impression must be taken prior to fabrication of the transitional custom abutments. Although this procedure may be performed simultaneously with implant placement or at exposure, it is advantageous to delay until adequate healing has occurred. This allows stable gingival margins to be transferred and reproduced, which improves the accuracy of the transitional custom abutment and, therefore, the adaptation of the attendant provisional prosthesis.

Prosthetic modeling of the supraimplant tissues requires the presence of sufficient attached gingiva. It is therefore necessary to adopt a surgical protocol that will yield maximum quantities of tissue. Generally speaking, any required soft tissue augmentation procedures should be performed prior to implant exposure. Conservative second-stage surgical techniques are subsequently utilized and complemented with the use of undersized healing abutments.

Installation of the transitional custom abutments is accomplished in the presence of sufficient mature attached gingiva that is amenable to stretching. Gradual expansion of the tissues will be accomplished through pressure generated by tightening of the retaining screw as the abutment is seated. At this stage, procedures that involve flap elevation are contraindicated. The increased circumference of a transitional custom abutment is difficult to adequately overcome regardless of flap design and seldom results in primary flap closure without excessive pressure and compromised soft tissue contours.

Discussion

The aesthetic restoration of endosseous implants is a demanding endeavor that relies on the successful integration of treatment planning and clinical execution. Therefore, no effort should be spared to ensure that implants are optimally placed into appropriate receptor sites. Once fixture selection or position is compromised,
the achievement of an acceptable treatment outcome will depend on the capacity of the restorative components to overcome implant-related limitations. It is thus essential to identify the degree of compromise from which an acceptable result is recoverable.

Transitional custom abutments increase restorative flexibility since they can be progressively modified to address specific site requisites. With the use of this technique, tissue sculpting is prosthetically induced rather than surgically created. This requires revision of the technique and sequence of implant-related surgical procedures for maximum preservation of the attached gingiva.

Once the desired emergence profiles are achieved, the recommended transfer impression protocol ensures an accurate replication of the gingival contours and, therefore, constitutes an integral component of the transitional custom abutment technique.

**Conclusion**

This technique utilizes a temporary cylinder abutment that is prepared according to implant angulation and interocclusal space. Light-cured composite resin is subsequently added to develop the customized abutment form. Once installed, the transitional custom abutment is gradually modified until the desired suprapiant tissue contours are achieved. This technique is not limited to the development of an adequate emergence profile, but may also include aesthetic enhancements to the tissue-restorative interface, eg, control of gingival margin position, creation of interdental papillae, and camouflage of compromised mesiodistal as well as buccolingual implant placement (Figures 16 through 22).

The term transitional custom abutment accurately describes the progressive contour modifications and consequent dynamic gingival remodeling process through which the desired emergence profile and suprapiant gingival ridge forms are ultimately attained. Adequate position and proper fixture selection are essential in achieving predictable implant-supported restorations. The utilization of transitional custom abutments further enhances restorative flexibility while allowing the optimization of emergence profiles in situations that involve compromised fixture position, angulation, and selection. The technique's versatility allows its application in simple as well as extensive restorations.

Figure 17. Treatment planning included diagnostic waxup at the appropriate occlusal relationship and projected adjunctive orthodontic movement of the maxillary teeth.

Figure 18. Temporary cylinders in place accentuate inadequate implant placement. Note landmark dynamics between mesial implant and anterior teeth retracted on model.

Figure 19. Transitional custom abutments in place. Composite was not placed on the coronal aspect of #6(13) to demonstrate the degree of subgingival compensation required.
Figure 20. Supraimplant gingival topography prosthetically induced with transitional custom abutments on #6(13) and #7(12). Note pseudopalaeal ridge form developed around implant #6(13).

Figure 21. Completed custom abutments reflect site-specific compensations for inadequate implant placement, as achieved intraorally with the transitional custom abutments.

Figure 22. Postoperative buccal view of full-arch splinted prosthesis exhibits acceptable emergence profiles and aesthetics. Compromised fixture angulation limited subgingival margin placement.

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References
1. Significant obstacles in achieving superior treatment outcomes in implant-supported restorations have traditionally been a result of:
   a. Selection of improper fixture length.
   b. Lack of adequate laboratory support.
   c. Difficulties at the restorative-implant connection.
   d. Subgingival fixture placement.

2. The following are frequently utilized methods to improve the emergence profiles of implant-supported restorations EXCEPT:
   a. Utilization of anatomically shaped healing abutments.
   b. Appropriate selection of implant surface coating.
   c. Use of customized abutments with the definitive restoration.
   d. Selection of alternative implant diameters.

3. The emergence profiles of implant-supported restorations must be developed from the fixture level to:
   a. Avoid ridge laps and aberrant restorative contours.
   b. Expedite the completion of restorative treatment.
   c. Simplify the transfer impression procedure.
   d. Control the expense of implant restorative components.

4. The clinical technique described in this article requires fabrication of all the following EXCEPT:
   a. A vacuum-formed stent.
   b. A metal-plated model.
   c. A pickup impression.
   d. A silicone index.

5. The technique for fabrication of transitional custom abutments does NOT include:
   a. A transfer impression made at the fixture level with internally hexed impression posts.
   b. Preparation of internally hexed temporary cylinders affixed to laboratory analogs.
   c. Addition of low-fusing solder material to compensate for implant angulation.
   d. Buildup with light-cured composite resin to develop the preliminary abutment form.

6. Difficulties associated with utilization of a provisional fixed prosthesis include all of the following EXCEPT:
   a. Compromised fixed angulation may result in screw placement at the incisal edge.
   b. Introduction of cement residue at excessively subgingival levels.
   c. Inadequate fit of the restorative components.
   d. Enhanced tissue resistance during seating.

7. Progressive modification of transitional custom abutments:
   a. Prosthetically induces tissue sculpting.
   b. Requires flap elevation.
   c. Surgically induces tissue sculpting.
   d. Limits the manipulation and expansion of mucosal tissue.

8. In order to achieve gingival contours that mimic pseudoalveolar ridge forms, the clinician can:
   a. Concomitantly adjust the provisional restoration.
   b. Perform a flap elevation procedure.
   c. Apply a vacuum-formed stent.
   d. Utilize a standard preangled abutment.

9. An integrated treatment approach to ensure optimal transitional custom abutment performance would encompass all of the following EXCEPT:
   a. Prosthetically driven site development.
   b. Prosthetically driven augmentation.
   c. Prosthetically driven implant placement.
   d. Prosthetically driven gingival exposure.

10. Optimal supraimplant tissue modeling can be achieved with transitional custom abutments provided that:
    a. Adequate mature attached gingiva is present.
    b. Clean incisions and primary flap closure are achieved during abutment installation.
    c. All excess tissue is precisely excised during implant placement and exposure.
    d. Augmentation procedures are performed concomitantly with abutment installation.