CE CONTINUING EDUCATION

Esthetic Restoration of the Anterior Edentulous Area

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ABSTRACT

True art form significantly involves the peripheral. In esthetic dentistry, the appearance of the teeth cannot be properly enhanced without consideration of their proportion and the soft tissue curtain that surrounds them. Establishment of the interdental papilla and correct gingival contours in anterior edentulous areas are critical to esthetic success and must be considered paramount in esthetic treatment planning.

LEARNING OBJECTIVES

After reading this article, the reader should be able to:

- identify the different methods and their applications in anterior edentulous space restoration.
- understand the importance and methods of creating soft tissue architecture surrounding anterior pontic and implant sites.
- reproduce an ovate pontic receptor site using chairside electrosurgical method and laboratory model alteration.

Restoration of an edentulous space within the smile zone can create a tremendous esthetic challenge. It can be accomplished through the placement of implants, traditional metal-ceramic bridge design, all-ceramic bridge design, and more conservative modalities such as a Maryland "winged" bridge design using Targis® Vectris® (Ivoclar Vivadent® Inc.), sculpture fibre-core, and fiber reinforced belle-Glass™ (Kerr Corporation).

In each of the above, the common denominator is the difficulty in making the replacement restoration blend not only with the shades of the adjacent teeth but also to create soft tissue architecture consistent with those teeth. The choice of method and material differs with the demands of each case and also with the desires of the patient. There are those cases where the patient does not want to involve the adjacent teeth and therefore may opt for implant placement and restoration. There are also cases where, anatomically, implant placement would be contraindicated, and a more traditional approach would be desired in the form of a bridge design.

The purpose of this article is to study the aforementioned treatment modalities and their applications in esthetic edentulous space restoration. Cases involving anterior/smile zone restoration through the use of implants, metal-ceramic bridges, all-ceramic bridges, and Maryland "winged" bridges will be examined in detail.

CASE STUDY 1

Restoration of ITI Implant in Edentulous Maxillary Central Incisor Position

A 45-year-old man presented with a fractured post and root underlying a defective crown on tooth No. 9 (Figure 1). Adjacent teeth within the smile zone were also in need of esthetic and structural restoration. Treatment planning involved the need to extract the nonrestorable tooth No. 8 and to determine the method by which to esthetically restore the edentulous area. Choices included a bridge or implant placement along with restoration and ceramic crowns of the involved adjacent teeth. The patient opted for restoration of the edentulous area with an implant rather than a bridge, because he felt a single tooth approach would be more natural and more easily cleansable.

Considerations for temporization during the implant healing phase presented some concerns. Typically, single tooth replacement with implants in the posterior region does not pose an esthetic problem. The implant site can be left void while healing takes place. However, in the anterior or smile zone region esthetic temporization can be difficult. An acrylic flipper or some sort of provisional fixed bridge are two treatment possibilities. In this case, because the adjacent teeth were involved, a temporary fixed bridge could be designed, eliminating the need for an uncomfortable and unstable acrylic flipper design. A custom temporary bridge was designed from the diagnostic wax-up.

The patient was scheduled for extraction of the fractured root/crown and immediate placement of the implant.

A 10-mm × 4.8-mm sand blasted/large grit/acid etched solid screw ITI implant with a 2-mm esthetic plus closure screw was placed. The adjacent teeth had been prepared in advance of the implant placement. When the implant was placed the patient was retemporized with the custom temporary bridge. The pontic of the temporary bridge was modified on the tissue side, ensuring there would be no contact between it and the underlying implant healing screw. This is important so as not to induce any stress on the implant, which could adversely affect osseointegration.[1]

At 12 weeks, a 3-mm extension-healing cap was placed by the implantologist and the patient was then referred back for restoration. Osseointegration was complete and restoration was implemented.[2] The temporary bridge was removed along with the healing cap, exposing a cuff of gingival tissues and a reproduced interdental papilla design. The implant head was screwed to place using a torque wrench tightened to 35 Ncm (Figure 2). An impression sleeve was then placed over the implant head and an impression was taken of the implant and adjacent preparations with Honigum® (Zenith™/DMG Foremost) light and heavy body. When the impression was verified an ITI temporary cap was cemented with TempoCem® (Zenith™/DMG Foremost). The temporary bridge was further modified to accommodate the ITI temporary cap and cemented with TempoCem®.

Procera® (Nobel Biocare USA Inc.) was selected as the material of choice for restoration for vari-

Figure 1—Fractured post and root underlying a defective crown on tooth No. 9.

Figure 2—Preps and implant head.

Figures 3 and 4—Four units on table.

ous reasons. First, it provided excellent esthetics and second, because of the subgingival location of the crown margins, a cementable crown or material was indicated (Figures 3 and 4).

Delivery of the four all-ceramic units involved removal of the temporaries and cleansing of all preparations. Teeth Nos. 7, 8, and 10 were cleansed and prepared for the cementation of the ceramic units using the Dr. William Strupp method of Consepsis® soap (Ultradent Products Inc.) (scrub, rinse, and dry), Tublicid Red (Dental Therapeutics AB) (scrub, rinse, and dry), and Clorox (Clorox Co.) (scrub, rinse, and dry).[3]

Cementation of the ceramic restorations involved placement of ED Primer® (Kuraray America Inc.) on all surfaces for 60 seconds followed by light drying.[4] Panavia® 21 (Kuraray America Inc.) resin cement was then mixed and placed internally in the Procera® units. They were pushed to place one at a time, allowing the excess to slowly exude until the units were fully seated. Excess cement was removed before full set and DeOx®/glycerin (Ultradent Products Inc.) placed on all margins (Figure 5).

Although this case involved four teeth (Nos. 7, 8, 9, and 10), the challenge of creating a natural emergence profile and interdental tissue in the form of papilla around the implant was the most significant ingredient in the success of this anterior esthetic case. The expertise of Dr. Jay Beagle (periodontist/implantologist) in the placement of this ITI implant provided this author with the opportunity to predictably create an all-ceramic crown that emerged from the soft tissues as though it were this patient's natural tooth (Figures 6 and 7).[5]

Figure 5—Units placed immediately postinsertion.

this area with long-term predictability along with providing the maximum esthetic benefit.

Soft tissue considerations in the pontic positions Nos. 7 and 10 involved the need for gingivoplasty (Figure 11). Lengthening of the lateral incisor pontics was needed incisally and cervically to be consistent with the laws of the Golden Proportion in their relationship with the adjacent teeth.[7] Cervical recontouring of the gingival tissues to create an ovate pontic design and thus the reproduction of the interdental papilla was critical in accomplishing the optimum esthetic result in this highly visible area.[5] Preparation of teeth Nos. 6, 8, 9, and 11 for abutments entailed the full coverage

The addition of the adjacent all-ceramic crowns provided a finished natural look to this patient's smile.

Figures 6 and 7—Preoperative and postoperative smile.

The addition of the adjacent all-ceramic crowns provided a finished natural look to this patient's smile.

Case Study 2

Restoration of Edentulous Areas Nos. 7 and 10 Using All-Ceramic Bridges

In this patient, teeth Nos. 7 and 10 had been lost and ultimately restored with an old Maryland Bridge design. The patient was unhappy with the esthetics of the existing Maryland Bridge and the overlying composite bonding on the facials of Nos. 6, 8, 9, and 11 (Figures 8 through 10). She did not want to undergo surgical placement of implants and specifically requested a more traditional approach through bridging the edentulous areas. The proposed pontic site areas were small dimensionally and fell within the guidelines for consideration of using the new 3G Jeneric/Pentron ceramic systems (Pentron® Laboratory Technologies).[6] It was believed that an all-ceramic bridge design could function in



Figures 8 through 10—Before and after views.

Figure 11—Preps of ovate pontic receptor sites.

Figures 12 through 14—Before and after views.

reduction guidelines for the 3G Jeneric/Pentron ceramic system. Impression of the prepared areas was accomplished using Aquasil™ Light and Regular Body (Dentsply®/Caulk).

Temporization of the two anterior bridge preparations was accomplished through the use of Integrity™ temporary composite material (Dentsply®/Caulk). An impression of the preoperative diagnostic wax-up of this case had been taken with putty (Aquasil™, Dentsply®/Caulk), a simple and accurate system using catalyst and base putty that is easily and neatly mixed. The Integrity™ temporary material was placed into the putty matrix and the matrix seated over and just posterior to

the prepared areas. The matrix was then pulled with the temporary bridges still within the matrix. The temporary bridges were removed from the matrix and trimmed to fit and conform accurately to the abutments. The cervical aspect of the pontics was rounded and polished to fit snugly into the ovate receptor areas in the previously prepared gingival tissues. The bridges were then temporarily cemented using Durelon® (3M ESPE) polycarboxalate cement.

Communication with the laboratory (Dental Arts Laboratory, Peoria, IL) involved specific directions to more aggressively prepare the pontic sites on the stone model. This ensures tight soft tissue adaptation at delivery, eliminating any chance of a void existing at the cervical of the pontics between the pontic and the gingival tissues.

Figures 15 and 16—Preoperative view of patient, full face and close-up.

Delivery of the all-ceramic bridges was accomplished first by verification of fit. Often, as was the case here, further modification of the pontic ovate sites is required. A round ball tip insert is used in the electrosurgical unit to accomplish the necessary deepening to allow the bridge to seat fully. When this is confirmed, cleansing of all the abutments with Consepsis soap, Tublicid Red, and Clorox provides a clean surface in which to cement or bond the bridges to place.[3] The abutments were then prepared for cementation by etching with phosphoric acid for 15 to 20 seconds, then rinsed and coated with Gluma® Desensitizer followed by Prime and Bond NT (Heraeus Kulzer Inc.), light drying, and then light-cured for 40 seconds each. This leaves a uniformed glossy surface, verifying a thorough and proper coat of bonding agent. The internal surfaces of the bridges were cleansed and acidified using phosphoric acid and then silanated to enhance the bond. The bridges were then loaded with Calibra® (Dentsply®/Caulk) dual cure resin and seated over the prepared abutments. Excess resin was removed using sable brushes and rubber tips and then light-cured to completion. All margins were then coated with glycerin to eliminate formation of the oxygen-inhibited layer.

Single Tooth Replacement

Single tooth replacement in this situation required significant attention to detail of a properly created emergence profile of the pontic of the all-ceramic bridges. The properly designed provisional bridge, the adjustment of the stone model during the laboratory phase, the remodification of the pontic site with the electrosurgical unit, and the rounded ovate pontic design on the ceramic bridge all play important roles in the highly esthetic end result accomplished in Figures 8 through 14.

Case Study 3

Replacement of Tooth No. 9 Using a Metal-Ceramic "Hybrid Bridge" Design

This patient had worn an acrylic flipper for the past 8 years to fill the edentulous space existing where tooth No. 8 had been

This design provides for excellent esthetics in its significant ceramic layering and strength in the underlying metal support.

(Figures 15 and 16). His desire was to restore this permanently and improve the overall esthetics. The restorative choices again were implant and/or fixed bridge. Anatomically there was a slight bony defect on the labial aspect of the alveolus. This rendered the buccal palatal width of bone undesirable for implant placement without involvement of significant bony reconstruction. The patient opted for the fixed-bridge design along with esthetic enhancement of the adjacent teeth to improve his smile.

An all-ceramic bridge design was eliminated in this case because of strength concerns. This author and his laboratory technician believed the mesial

distal dimension of the edentulous space (12 mm) was too large to consider all-ceramic design.[1] Therefore, a metal-ceramic "hybrid bridge" design was used. The term "hybrid bridge" was coined by its designer, Adrian Jurim of Jurim Dental Studios in New York.[8] This is a design that involves the construction of a metal substructure, which covers the lingual and incisal aspect of the preparation. The remaining areas are covered with ceramic and in this case Ceramco II (Dentsply®/Ceramco). The margin is a 360-degree porcelain butt joint margin. This design provides for excellent esthetics in its significant ceramic layering and strength in the underlying metal support (Figures 17 and 18).

Figures 17 and 18—Units lying on tabletop.

Delivery of this three-unit bridge and the adjacent lateral entailed confirmation of fit of the units both marginally and at the soft tissue juncture of the pontic. Minor modification of the soft tissue pontic site was needed to provide close adaptation of the ovate pontic. The preparations were, as always, cleaned through the three-step process of Consepsis®, Tublicid Red, and Clorox.[3] The units were then cemented with Panavia® 21 after the process of placing the self-etching primer (ED Primer®) on the preparations.

Replacement of tooth No. 8 with this "hybrid bridge" required the same consideration of esthetic soft tissue concerns as did the previous all-ceramic bridge. Creation of an ovate pontic site to reproduce interdental papilla was attained again with the use of the electrosurgical unit and appropriate round tip. The selection of material differed, however, because of the strength needed to substantially obturate the space between teeth Nos. 7 and 9. The modified metal-ceramic bridge design in the form of the "hybrid bridge" provided for outstanding and naturally occurring esthetics while providing superior strength that an all-ceramic design would not (Figures 19 through 21).

Figures 19 through 21—Modified metal-ceramic bridge design in the form of the "hybrid bridge."

Case Study 4

Replacement of Tooth No. 7 on a 14-Year-Old Using the Conservative Approach of a "Winged" Fiber Reinforced belleGlass™ Bridge

Because of this patient's age, consideration of the least invasive procedure was paramount. This patient was a competitive hockey player whose parents wanted improved esthetics for their son without having to rely on a removable flipper-type prosthesis but did not want to spend a significant amount of money or subject their son to involved treatment. Obviously, implant placement was contraindicated because of age and development.[2] Fixed, full coverage bridge design, too, was contraindicated because of age, development, and cost. The decision was made to refer to the old Maryland Bridge design, but with the use of modern-day materials, which could more accurately depict a natural look.

Possible treatment choices included Targis® Vectris®, sculpture fibrecore, or fiber reinforced through enamel, thus providing the optimum-bonding environment for strength and stability of the belleGlass™ bridge.

Soft tissue modification was indicated to provide a pontic receptor site that would mimic a naturally erupting lateral incisor (Figures 22 and 23). This would be created again through the use of the electrosurgical unit with a round-end tip. The pontic would be designed with a rounded or ovate cervical contour (Figure 24). The dished or scooped out gingival design will accommodate the cervically rounded ovate pontic, thereby attaining the desired effect of a natural emergence profile and interdental papilla.

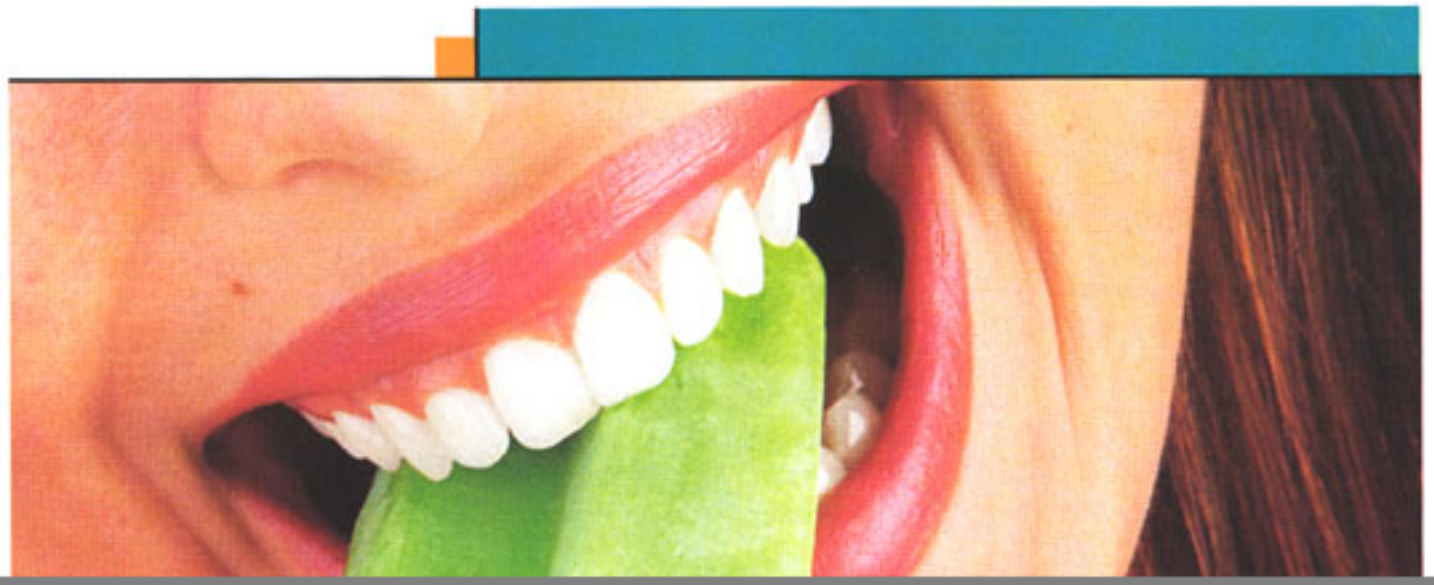
Delivery of the belleGlass™ winged bridge required the prepared enamel surface to be etched with phosphoric acid 35% for 60 seconds and thoroughly rinsed, followed by the application of Prime and Bond NT and light-curing. The inter-

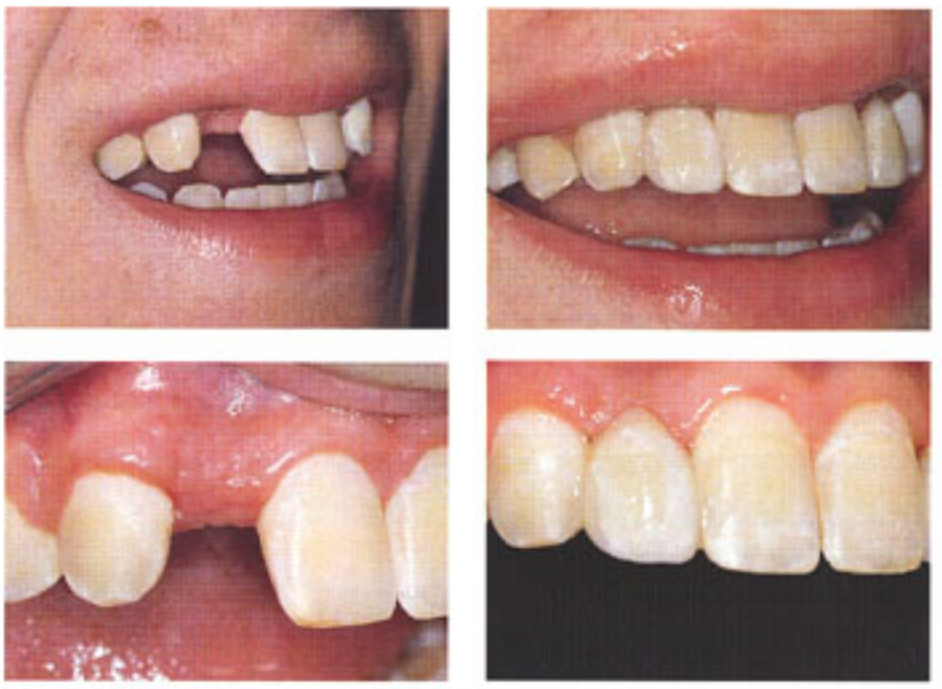
applied to the internal surface of the wings. The bridge was gently seated and held in position while excess cement was removed with a rubber tip and sable brush. The belleGlass™ winged bridge was tacked using the tacking tip on the plasma arc curing light. Interproximal clean up was accomplished with Glide® Floss (W.L. Gore & Associates Inc.). Light-curing was then completed. All exposed margins were lightly coated with DeOx®/glycerin.

Replacement of tooth No. 7 required consideration of many things that the previous bridge designs did not. Soft tissue concerns were consistent but the choice of material and the preparation design differed extensively. Because this case did not involve the facial aspect of the abutment teeth or any of the adjacent teeth, reproducing the natural staining and characterizations facially was difficult. Communication with the laboratory tech

Figures 22 and 23—Preoperative smile, lateral and close-up.

Figure 24—Pontic bridge being inserted.





Figures 25 through 28—Preoperative and postoperative lateral smile along with preoperative and postoperative close-up.

by the soft tissue that surrounds it as the material that comprises the prosthesis within it. Both are important, but the most beautifully sculpted bridge or implant crown will fail in its appearance if the soft tissue surrounding it is inaccurate in its anatomic form and health.

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Product References

Product:	Targis® Vectris®
Manufacturer:	Ivoclar Vivadent® Inc.
Address:	175 Pineview Drive Amherst, NY 14224
Phone:	800.533.6825
Fax:	716.691.2285
Product:	belleGlass™
Manufacturer:	Kerr Corporation
Address:	1717 West Collins Avenue Orange, CA 92867
Phone:	800.537.7123
Fax:	800.537.7345
Product:	Honigum®, TempoCem®
Manufacturer:	Zenith®/DMG Foremost
Address:	242 South Dean Street Englewood, NJ 07631
Phone:	800.662.5383
Fax:	201.894.0213
Products:	Consepsis® soap, DeOx®/glycerin
Manufacturer:	Ultradent Products Inc.
Address:	505 West 10200 South South Jordan, UT 84095
Phone:	800.552.5512
Fax:	801.572.0600
Products:	ED Primer®, Panavia® 21
Manufacturer:	Kuraray America Inc.
Address:	200 Park Avenue New York, NY 10166
Phone:	800.879.1675
Fax:	212.867.3543
Product:	Procera®
Manufacturer:	Nobel Biocare USA Inc.
Address:	22695 Eastpark Drive Yorba Linda, CA 92887
Phone:	800.993.8100
Fax:	800.451.9047
Products:	Aquasil™ Light and Regular Body, Integrity™ temporary composite material, Aquasil™, Caliber®
Manufacturer:	Dentsply®/Caulk
Address:	38 West Clark Avenue P.O. Box 359 Milford, DE 19963
Phone:	800.LDCAULK
Fax:	302.422.4511
Product:	Duralon®
Manufacturer:	3M ESPE
Address:	Bldg. 275-2SE-03 St. Paul, MN 55144
Phone:	800.634.2249
Fax:	612.733.2481
Product:	Gluma® Desensitizer Primer Bond
Manufacturer:	Heraeus Kulzer Inc.
Address:	99 Business Park Drive Armonk, NY 10504
Phone:	800.343.5335
Fax:	219.291.0729
Product:	Ceramco II
Manufacturer:	Dentsply®/Ceramco
Address:	6 Terri Lane Suite 100 Burlington, NJ 08016
Phone:	800.487.0100
Fax:	609.386.8909
Product:	Clorox
Manufacturer:	Clorox Company
Address:	1221 Broadway Oakland, CA 94612
Phone:	510.271.7000
Product:	Tubicid Red
Manufacturer:	Dental Therapeutics AB
Address:	Gillevagen 5 S-12133 Nacka, Sweden
Phone:	0046-8-7168141
Fax:	0046-8-7182175
Product:	3G Jeneric/Pentron ceramic systems
Manufacturer:	Pentron® Laboratory Technologies
Address:	53 North Plains Industrial Road Wallingford, CT 06492
Phone:	800.551.0283
Product:	Glide® Floss
Manufacturer:	W.L. Gore & Associates Inc.
Address:	201 Airport Road P.O. Box 1488 Elkton, MD 21922
Phone:	800.645.4337
Fax:	410.998.8585

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1. **Restoration of an edentulous space within the smile zone can be accomplished through:**
   a. placement of implants.
   b. traditional metal-ceramic bridge design.
   c. all-ceramic bridge design.
   d. all of the above.

2. **In Case Study 1, how can the implant site be kept while healing takes place in the posterior region?**
   a. with a periodontal dressing for 6 weeks
   b. void
   c. with a nonresorbable barrier for 12 weeks
   d. with a resorbable barrier only for maxillary implants

3. **In Case Study 1, a custom temporary bridge was designed from the:**
   a. diagnostic wax-up.
   b. alginate impression.
   c. hydrocolloid impression.
   d. final wax-up.

4. **In Case Study 1, the implant head was screwed in place with a torque wrench tightened to:**
   a. 20 Ncm.
   b. 25 Ncm.
   c. 35 Ncm.
   d. 50 Ncm.

5. **In Case Study 2, soft tissue considerations in the pontic positions Nos. 7 and 10 involved the need for:**
   a. osseous build-up.
   b. Caldwell-Luc procedure.
   c. gingivoplasty.
   d. phosphoric acid etching.

6. **In Case Study 2, communication with the laboratory involved specific directions to more aggressively prepare:**
   a. the mesial margin.
   b. the pontic sites on the stone model.
   c. the interproximal margin.
   d. the occlusal reduction.

7. **In Case Study 3, an all-ceramic bridge design was eliminated because of:**
   a. periodontal disease.
   b. the presence of posts.
   c. esthetic disproportions.
   d. strength concerns.

8. **In Case Study 4, consideration of the least invasive procedure was paramount because of:**
   a. the patient's height.
   b. the patient's weight.
   c. the patient's age.
   d. the patient's gender.

9. **In Case Study 4, conservative lingual preposition design on teeth Nos. 6 and 8 was possible because of:**
   a. an inherent open bite.
   b. a group function on right.
   c. a group function on left.
   d. a low lip line (smile line).

10. **All cases had to have reproduction of what for them to be esthetically successful?**
    a. distal marginal ridge
    b. mesial marginal ridge
    c. interdental papilla
    d. cingulum