The Perio-Aesthetic–Restorative Approach for Anterior Reconstruction — Part II: Restorative Treatment

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Inherent differences have been identified between multidisciplinary and interdisciplinary treatment approaches. This article demonstrates the restorative techniques used for the treatment of a patient with congenitally missing lateral incisors according to the interdisciplinary concept outlined in Part I. The restorative design and material selection were based on the size and shape of the existing ridge, occlusion, evaluation of previous treatment, the ability of the restoration to mimic the natural dentition and the supporting gingival tissues, and the patient's expectations and finances.

Key Words: interdisciplinary, aesthetic, fiber-reinforced, composite

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The incorporation of an interdisciplinary treatment approach facilitates precise communication between each member of the restorative team. The first part of this article addressed the differences between the use of a multidisciplinary and interdisciplinary treatment approach, as well as the need for precise communication during initial treatment planning, surgical intervention, and subsequent restoration. This part demonstrates the aesthetic restoration of a patient who presented with congenitally missing lateral incisors following orthodontic and periodontal treatment. A fiber-reinforced, composite framework, resin-bonded fixed partial denture (FPD) was selected for the aesthetic restoration of this clinical situation. This restorative design concept involves minimal tooth preparation, nonmetallic materials for improved aesthetics,[1,2] and a reduced risk of metal allergy. The durability provided by the flexure of the FPD allows mobility without fracture and favorable load transfer to the abutment teeth and supporting bone[1]; separate placement of a porcelain veneering material eliminates overcontouring of the pontic design and a more conservative preparation design for the path of insertion.[2] An increased bond strength is also provided by the etched resin framework of the FPD to enamel and porcelain,[2] and the use of aesthetic restorative materials allows improved shade matching of the pontic,[2] maximum strength of the resin framework from the polymerization process, and optimal control of pontic adaptation.[2] The opaciousness of the wing is controlled by the selection of an aesthetic restorative material (eg, translucent enamel with clear, unidirectional fibers).

Mucogingival health is reflected in the periodontal aesthetic outcome and is also responsible for the restorative result. Insufficient healing time does not allow for complete collagen maturation, gingival shrinkage, and alteration in gingival form and contour. Consequently, inaccurate assessment of the margin relationships of the restorations to the gingival architecture can result in compromised prosthetic results. Periodontal health should, therefore, be present prior to the initiation of any restorative procedure that requires the restoration to be in contact with the periodontium or that influences plaque control. Since gingival health is established prior to any prosthetic procedures, it is possible to manipulate soft tissues for adequate preparation design without bleeding and traumatic injury.[3]

Figure 1. Following creation of a sufficient ovate pontic receptor site, the lingual surfaces of the abutment teeth were prepared with slight proximal extensions for the retentive wings of the restoration.

Figure 2. Following polymerization of the resin cement, excess material was removed from the gingival margin using a scalpel, and the veneer preparations were completed.

Figure 3. The interproximal region was finished using a fine diamond bur and polishing points, and the facial surfaces of the pontics were refined.

Case Presentation

Tooth Preparation

Once anesthesia had been administered, the teeth were isolated with a rubber dam using a modified technique. This process involved the creation of an elongated opening that allowed placement of the rubber dam over the

Figure 4. Provisional restorations were fabricated using a vacuum-formed template that was constructed based on the information transferred via the diagnostic waxup.

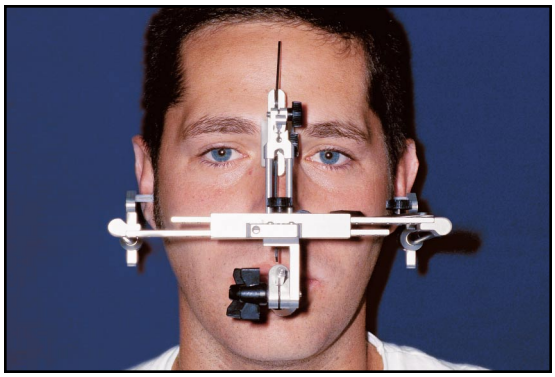

Figure 5. The functional and aesthetic plane of occlusion was translated to the articulator (Stratos 200, Ivoclar Vivadent, Amherst, NY) using a face-bow recorder.

retainers to achieve adequate field control.[4,5] The abutment teeth were prepared using a long, tapered diamond on the lingual surface to allow adhesion of the retentive wings of the FPD with slight proximal extensions (Figure 1). The preparation began from the lingual marginal ridge distant to the edentulous region and continued with slight proximal extensions midway into the interproximal zone and approximately 1 mm incisal of the gingival crest or the cementoenamel junction, extending approximately 1 mm from the incisal edge. A definitive cervical chamfer line was placed supragingivally following the free gingival margin from papilla tip to papilla tip to ensure a proper transition between restorative material and tooth interface. The occlusogingival dimension of each abutment was prepared with a football-shaped diamond to approximately 0.5 mm to 0.75 mm in depth, which provided an adequate restorative material thickness for the wing design. A centric stop was placed in the cingilum region of each abutment to maintain a correct orientation during the placement and seating of the composite resin substructure. A 0.5-mm horizontal groove was placed with a diamond bur to increase the retention and resistance form and transfer the load force of the FPD to the long axis of the tooth. This groove was placed midway on the lingual between the incisal and gingival extension of the preparations parallel to the incisal edge. The preparation was completed with a finishing disk and polished with rubber cups that contained a premixed slurry of pumice and 2% chlorhexidine (Consepsis, Ultradent Products, South Jordan, UT).

Laboratory Communication

An accurate full-arch polyether impression was obtained to define all cavosurface margins. A model of the opposing dentition, an interarch occlusal bite registration, and a laboratory narrative were conveyed to the laboratory along with 35-mm photographs of the shade tab comparison. Digital photography provided another method for the instant transmission of information from the clinician to the laboratory via the Internet. A provisional acrylic appliance was provided during the fabrication of the composite resin substructure. During this period, the restorative clinician was available for consultation with the ceramist to ensure that parameters initially determined by the team were achieved.

Substructure Adaptation and Provisionalization

Upon arrival from the laboratory, the composite resin substructures were visually inspected on an unaltered master model and their margins inspected under enhanced magnification. The pontic receptor site was inspected

Figure 6. Shade tab comparison was performed to communicate the existing shade of the natural dentition to ensure proper integration with the definitive restorations.

Figure 7. The prepared dentition were also evaluated to determine the existing shade of the underlying tooth structures. This information was then communicated to the laboratory technician for restoration fabrication.

Figure 8. Bite registration was subsequently evaluated to ensure development of the proper plane of occlusion.

at the initial try-in to determine the integrity of the margins of the FPD and the adaptation of the convex gingival surface of the ovate pontic to the concavity in the edentulous ridge. Anesthesia was administered, and modification of the pontic receptor site was accomplished by applying indelible ink on the tissue surface of the pontic to indicate where the tissue required additional contour for the seating of the FPD. The tissue was contoured utilizing electrosurgery to allow precise creation of a nonhemorrhagic bed.[6] Once the ridge was contoured to the pontic, the teeth were isolated and the preparation was cleaned with the 2% chlorhexidine solution. Using the "total-etch" technique to minimize the potential of microleakage and enhance bond strength to dentin and enamel,[7-9] the preparation was etched for 15 seconds with 37.5% phosphoric acid (Gel-Etchant, Kerr/Sybron, Orange, CA), rinsed for 5 seconds, and lightly air-thinned to avoid desiccation. A soft metal strip was placed interproximally to isolate the prepared teeth from the adjacent dentition. The dentin primer and activator were applied separately and air-thinned, and the adhesive agent (Nexus 1, Kerr/Sybron, Orange, CA) was placed in the same fashion. The internal aspect of the wings of the FPD were etched, silane was applied, and the structures were lightly air-thinned and placed in a lightproof box. The resin in the silane precluded the need to place a bonding agent on the internal surface of the composite wings.

The internal aspects of the resin wings were lined with a dual-cured resin cement, and the framework was seated. A blunt-tipped instrument was used to seat the restoration, and any excess resin cement was removed with a sable brush, and dental floss was used to smooth the interproximal aspects and the pontic area. A small increment of cement remained at the margin to prevent voids and to compensate for polymerization shrinkage. The framework was initially polymerized for 20 seconds while held in place with the blunt-tipped instrument. A thin application of glycerin was placed on all the margins to prevent the formation of an oxygen-inhibiting layer on the resin cement.[10] The framework was subsequently polymerized from all aspects (eg, facial, incisal, lingual, proximal) for 60 seconds, respectively. Once the resin cement was polymerized, the residual excess at the gingival margin was removed with a

Figure 9. The veneer restorations were polymerized and excess resin cement was carefully removed using a #12 blade.

Figure 10A. Finishing diamonds were used for the gingival margins and polishing points, cups, and paste were incorporated.

Figure 10B. Equilibration was accomplished with an egg-shaped diamond bur.

scalpel. The interproximal region was finished with #12 and #30 fluted needle-shaped finishing burs and the lingual anatomy was refined with #12 and #30 fluted egg-shaped finishing burs. The framework was polished with rubber points, cups, and polishing paste. The veneer preparations were accomplished using diamonds with gauged depths to create horizontal grooves, which were connected along the facial surface with a long, tapered diamond to simultaneously create a chamfer edge at the cervical margin (Figures 2 and 3).

Provisional restorations were fabricated from a vacuum-formed template that was constructed from the waxup and spot bonded in place, and occlusion was evaluated (Figure 4). The patient was given postoperative instructions, dismissed, and evaluated at 2-week intervals for 6 weeks to allow any modifications, alterations, or adjustments that were expressed by the patient or visualized by the individual disciplines. The only difference between the provisional restorations and the definitive prosthesis was the restorative material used.[11] This customized prototype concept also allowed for proper integration between the definitive restoration and the soft tissue.

Impression Transfer

On the next appointment, the maxillary and mandibular polyvinylsiloxane impressions were taken, from which models were obtained to function as the approved prototypes for the definitive restorations. The functional plane of occlusion was translated to the articulator (Stratos 200, Ivoclar Vivadent, Amherst, NY) with a face-bow transfer (Figure 5). Once anesthesia had been administered to the patient, the provisional restorations were removed and comparison shade tab photographs were taken of the abutments and the opposing dentition (Figures 6 and 7). The teeth were again isolated, the margins of the preparations were evaluated (in relationship to the gingival crest), and any necessary modifications were made. A nonmedicated retraction cord was placed around each preparation and allowed to remain in position for 5 minutes. The cords were moistened and removed, and the area was rinsed and lightly air-dried. The rubber dam was removed and a polyether full-arch impression was obtained using a standard injection wash technique followed by placement of the tray material. The impression was rinsed, dried, and carefully inspected. An additional interocclusal and aesthetic

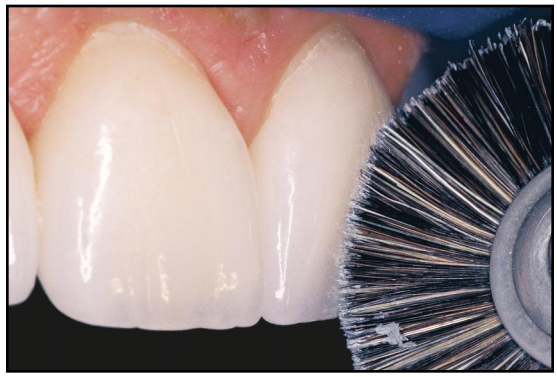

Figure 11. Definitive luster was achieved using polishing wheels on the facial aspect of the restorations.

Figure 12. Occlusal view of the definitive restorations demonstrates aesthetic integration and light transmission.

Figure 13. Buccal view demonstrates periodontal and restorative harmony.

bite registration was taken (Figure 8), and the provisional restorations were spot bonded in place. The occlusion was evaluated, and the patient was dismissed.

The laboratory narrative for the definitive restorations included a comprehensive description of the patient's existing condition and expectations, preoperative models, diagnostic waxup, models of the provisional restorations, an accurate final impression, trimmed working model, preoperative photographs, photographs of the preparations with the corresponding shade tabs for comparison, handdrawn diagrams, and interocclusal records with a face-bow transfer and bite registration of the aesthetic plane of occlusion.

Definitive Restoration

Upon return from the laboratory, a visual inspection of the veneers was performed on the unaltered master model using a surgical microscope. The internal surfaces were inspected for a uniform frosted appearance, the shade was confirmed to be that of the selected shade tab, and the laboratory diagram was reviewed. Prior to the administration of anesthesia, the provisionals were removed, and the preparations were cleaned with pumice to facilitate veneer try-in with a neutral-shade paste. The patient was seated in an upright position for the patient and clinician to evaluate color, contour, shape, marginal adaptation of the veneers, and the aesthetic plane of occlusion prior to bonding.

Anesthesia was administered and the teeth were isolated prior to tissue retraction.[4,5] The central incisors were bonded simultaneously to ensure proper midline position, and each tooth was then individually restored. A soft metal strip was placed interproximally to isolate the prepared tooth from the adjacent dentition. Using the "total-etch" technique to minimize the potential of microleakage and enhance bond strength to dentin and enamel,[7-9] the preparation was etched for 15 seconds with 37.5% phosphoric acid (Gel-Etchant, Kerr/Sybron, Orange, CA), rinsed for 5 seconds, and lightly air-dried to avoid desiccation. The dentin was lightly remoistened, and the adhesive was applied, air-thinned, then light cured for 20 seconds. A neutral-shaded luting resin was then applied to the internal surface of each veneer and the restorations were seated. A sable brush was used to remove the excess resin cement. It was imperative to leave some residual cement at the margins to prevent voids and compensate for polymerization shrinkage. The restoration was initially polymerized for 10 seconds with a 2-mm curing tip in the center of the facial surface. The margins were inspected with an explorer to ensure correct positioning. The veneer was cured using two curing lights (Optilux, Kerr/Sybron, Orange, CA) with an 8-mm diameter curing tip for 120 seconds on the facial and the lingual aspects. The excess resin was carefully removed with a #12 Bard Parker blade (Figure 9). This procedure was repeated on each of the 8 natural teeth preparations. The composite resin substructure was microetched in the pontic region and silane was applied prior to definitive cementation.

Finishing and Polishing

During the finishing procedure, the gingiva was gently retracted with an 8A instrument, and the gingival margins were refined with finishing diamonds (DET 3F and 3EF, Brasseler USA, Savannah, GA) (Figure 10). Finishing strips were used with polishing paste (Diamond Restoration, Vident, Brea, CA) to refine the interproximal regions and ensure adequate contact without gingival overhangs.

Figure 14. The natural integration of the restorations and pontic receptor site was evident upon postoperative evaluation.

Figure 15. Postoperative facial view reflects the harmonious integration of form, function, biocompatibility, and aesthetics that can occur when an interdisciplinary restorative approach is incorporated

Final polishing was achieved with rubber porcelain polishing wheels, cups, points, and diamond polishing paste (Diamond Restoration, Vident, Brea, CA) (Figure 11). Polishing paste was carried to the interproximals and the tissue-contact surface of the pontic with floss. The interproximal areas were subsequently examined with dental floss to verify adequate contacts and the absence of gingival overhangs. The rubber dam was removed and closure was evaluated without force and then centric, protrusive, and lateral excursions. It was crucial that the restorations provide the proper anterior guidance and not cause fremitus in centric occlusion. Any necessary equilibration was accomplished with egg-shaped diamonds (379F and EF, Brasseler USA, Savannah, GA), and the final polishing was repeated. The postoperative result reflects the harmonious integration of form, function, biocompatibility, and aesthetics that may occur utilizing an interdisciplinary approach (Figures 12 through 15).[12]

Conclusion

While the ultimate objective of reconstructive dentistry is to diagnose and treat the oral hard and soft tissues with proper form and aesthetics to function within physiologic limits and restore health, the utilization of various disciplines to achieve these goals has been shown to provide different results. Although multidisciplinary and interdisciplinary therapies are based on a collaboration of disciplines to develop and implement a comprehensive treatment plan, the interdisciplinary perspective requires the restorative team (specialist, restorative clinician, laboratory technician) to communicate, integrate, coordinate, and delegate responsibilities through a multilateral understanding and mutual respect for each member's interests, goals, desires, values, and capabilities.[13]

Consequently, this interdisciplinary approach provides a timeless blueprint for integrated diagnosis, treatment planning, and therapy[14] between all members of the restorative team and provides a superior perio-aesthetic result for the patient.

Acknowledgment

The authors declare no financial interest in any of the products cited herein.

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Continuing Education (CE) Exercise No. 14

To submit your CE Exercise answers, please use the answer sheet found within the CE Editorial Section of this issue and complete as follows: 1) Identify the article; 2) Place an X in the appropriate box for each question of each exercise; 3) Clip answer sheet from the page and mail it to the CE Department at Montage Media Corporation. For further instructions, please refer to the CE Editorial Section.

The 10 multiple-choice questions for this Continuing Education (CE) exercise are based on the article "The perio-aesthetic–restorative approach for anterior reconstruction — Part II: Restorative treatment" by Douglas A. Terry, DDS, and Michael McGuire, DDS. This article is on Pages 363-369.

Learning Objectives:

This article demonstrates the restorative approach used to treat a patient with congenitally missing lateral incisors with a fiber-reinforced composite framework resin-bonded FPD veneered with a porcelain material. Upon reading this article and completing this exercise, the reader should:

- Understand the tooth preparation guidelines required for this type of treatment.
- Be aware of the various biological parameters that must be communicated for precise, successful interdisciplinary restoration.

1. Why must sufficient mucogingival healing be obtained prior to the initiation of any restorative procedure that requires the restoration to be in contact with the periodontium?
a. To allow complete collagen maturation.
b. To facilitate sufficient gingival shrinkage.
c. To enable alteration in gingival form and contour.
d. All of the above.

2. According to this article, which laboratory communication tools were critical to allow clear, concise transfer of critical information?
a. An accurate, full-arch impression that defined all cavosurface margins and 35-mm photographs of the shade tab comparison.
b. A model of the opposing dentition, an interarch occlusal bite registration, digital images, provisionalization information, and a laboratory narrative.
c. Both a and b.
d. Neither a nor b.

3. In order to provide an adequate restorative material thickness for the wing design, the occluso-gingival dimension of each abutment was prepared using a football-shaped diamond to approximately:
a. 0.25 mm to 0.5 mm in depth.
b. 0.5 mm to 0.75 mm in depth.
c. 0.75 mm to 1 mm in depth.
d. 1 mm to 1.5 mm in depth.

4. What type of preparation design was used to increase the retention and resistance form and transfer the load force of the FPD to the long axis of the tooth?
a. A 0.5-mm vertical groove.
b. A 0.5-mm horizontal groove.
c. A 1-mm vertical groove.
d. A 1-mm horizontal groove.

5. Residual cement was left at the margins of the framework to compensate for polymerization shrinkage and prevent voids in the restoration. A thin application of glycerin was placed on all the margins to prevent the formation of an oxygen-inhibiting layer on the resin cement.
a. Both statements are true.
b. Both statements are false.
c. The first statement is true, the second statement is false.
d. The first statement is false, the second statement is true.

6. The provisional restorations allowed for proper integration between the definitive restoration and the soft tissue. Due to several adjustments and modifications required during the provisionalization phase, the provisional restorations and definitive prostheses differed greatly.
a. Both statements are true.
b. Both statements are false.
c. The first statement is true, the second statement is false.
d. The first statement is false, the second statement is true.

7. Gingival retraction was facilitated prior to impression capture:
a. Following rubber dam isolation.
b. Using nonmedicated retraction cords.
c. And was allowed to remain in position for 5 minutes prior to removal.
d. All of the above.

8. During placement of the definitive restorations, why was silane applied following microetching with a silicate ceramic sand?
a. To ensure proper midline position.
b. To prevent voids and compensate for polymerization shrinkage.
c. To restore any coating on the original fillers that may have been removed by sandblasting.
d. All of the above.

9. Following seating of the definitive restorations, closure was evaluated:
a. Without force, and then centric, protrusive, and lateral excursions were reviewed.
b. To ensure that the restorations provided proper anterior guidance and did not cause fremitus in centric occlusion.
c. Both a and b.
d. Neither a nor b.

10. The ultimate objective of reconstructive dentistry is to diagnose and treat the oral hard and soft tissues with proper form and aesthetics to function within physiological limits and restore health. Interdisciplinary principles require the restorative team to communicate integrate, coordinate, and delegate responsibilities through a multilateral understanding and mutual respect.
a. Both statements are true.
b. Both statements are false.
c. The first statement is true, the second statement is false.
d. The first statement is false, the second statement is true.