Replacement of Missing Mandibular Lateral Incisors With a Single Pontic All-Ceramic Prosthesis: A Case Report

Joyce L. Bassett, DDS

The conventional approach for replacing congenitally missing mandibular lateral incisors dictates the placement of either a conventional porcelain-fused-to-metal (PFM) bridge, Maryland bridge, or fiber-reinforced composite veneer bridge. However, several appearance-related disadvantages have been reported in the use of a prosthesis which incorporates a metal substructure. To address these limitations, metal-free restorative alternatives have been recently developed to expand the clinical options when fabrication of these prostheses is indicated. The learning objective of this article is to present the utilization of a single pontic all-ceramic resin-bonded bridge to replace congenitally missing mandibular lateral incisors, where the existing mesiodistal spaces were narrow and the abutment teeth exhibited insufficient substance for the conventional treatment modality.

While there are a variety of short- and long-span prosthetic options available in the restorative spectrum, three styles of prosthetic bridges have emerged as optimal treatment alternatives — the conventional porcelain-fused-to-metal (PFM) bridge, the Maryland bridge, and the fiber-reinforced resin-bonded bridge. Each type has its advantages and disadvantages.

THE CONVENTIONAL PFM BRIDGE

This restorative prosthesis exhibits strength, durability, and long-term clinical function, and it is generally accepted as the standard in dentistry. Its disadvantages include excess removal of sound tooth structure when preparing the abutments, lack of soft tissue biocompatibility around margins, and often inadequate aesthetics, due to the opacity of the substructure material.

THE MARYLAND BRIDGE

This prosthesis incorporates a metal substrate to fabricate a multiple abutment prostheses, and its advantages include reduced tooth preparation when compared with the conventional PFM bridge and cost-effectiveness. A disadvantage of the Maryland bridge is that the underlying metal substructure radiates through the adjoining abutment teeth, imparting a lower color value which results in an aesthetic compromise of the prosthesis.[1] As a result, the abutment teeth exhibit a gray appearance even with the use of opaquing bonding agents, since these agents are unable to adequately lighten the optical effects created by the metal substructure.[2] This particular disadvantage is a contraindication for its use in mandibular incisors, since the buccolingual dimensions of mandibular incisors are thin. In addition, debonding has frequently occurred at the metal/resin interface due to inadequate micromechanical retention of resin cements to the oxide on the etched metal framework.[3,4]

THE FIBER-REINFORCED COMPOSITE BRIDGE

To address these inadequacies, metal-free prostheses have been designed and fabricated. The fiber-reinforced composite bridge is fabricated in the laboratory and strengthened by the addition of an ultrahigh molecular weight polyethylene fiber (eg, Ribbond, Seattle, WA; The

Figure 1. Preoperative facial view of the maxillary and mandibular dentition. (Tooth #9 was traumatized at the age of 8; the canal is calcified with no radiographic pathology.)

Joyce L. Bassett, DDS, maintains a private practice, emphasizing Restorative and Aesthetic Dentistry, Scottsdale, Arizona.

Address correspondence to:

Joyce L. Bassett, DDS
4921 E. Bell Road, Suite 206
Scottsdale, AZ 85254

Tel: 602-867-2898
Fax: 602-867-9465

Targis System, Ivoclar Williams, Amherst, NY). Since this material does not polish well, it must be completely covered by a composite resin material; therefore, minimal thickness and height of the abutment teeth are of paramount importance. A porcelain veneer restoration can be bonded to a reinforced composite substructure to enhance the aesthetic properties of the prosthesis. The advantages of the fiber-reinforced indirect bridge include cost-effectiveness, minimal preparation, excellent aesthetic appearance, and marginal accuracy. The disadvantages include inadequate long-term validation, reduced fracture resistance, and increased potential of debonding. Clinicians may avoid this treatment modality as a result of these limitations.

THE SINGLE PONTIC ALL-CERAMIC BRIDGE

It is recommended that single-pontic all-ceramic resin-bonded bridges[2] be fabricated of softened ceramic ingots with controlled crystallization and a leucite concentration of 85%, producing a material with high flexural strength (200 MPa) and improved fracture resistance (IPS Empress, Ivoclar Williams, Amherst, NY). Using pressed ceramic and the lost wax technique, marginal accuracy to 25 μm can be achieved.[4] Additional advantages of a single pontic all-ceramic resin-bonded prosthesis include minimal preparation of the abutment teeth, reduced treatment time, easy impression taking, and improved optical characteristics and aesthetics.[6-8] The disadvantages include limited long-term performance evaluation and the potential of fracture; due to the absence of a supporting substrate, the restoration, when exposed to the stresses of masication and occlusion, may precipitate debonding.

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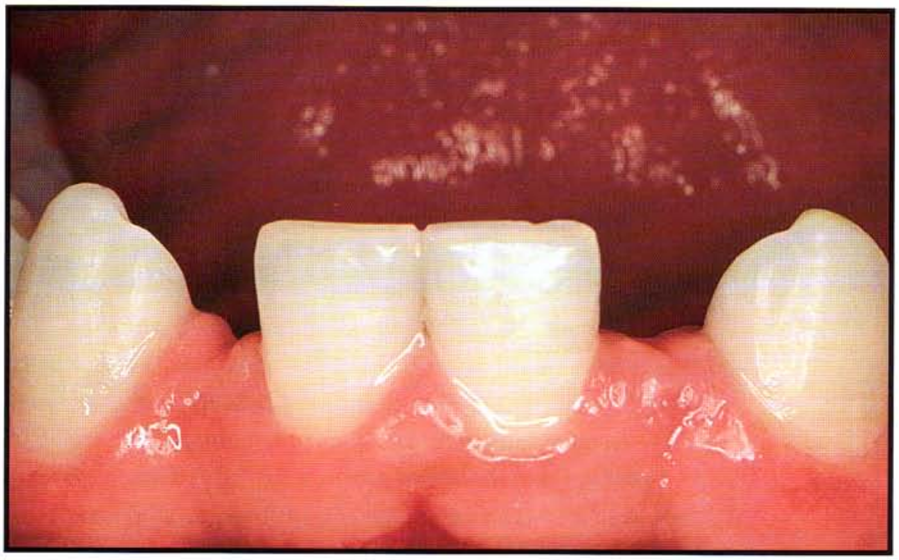

Figure 2. Preoperative close-up of the sites of missing mandibular lateral incisors. Edentulous spaces are uneven; gingival tissue on the mesial aspect of tooth #27 is hyperplastic.

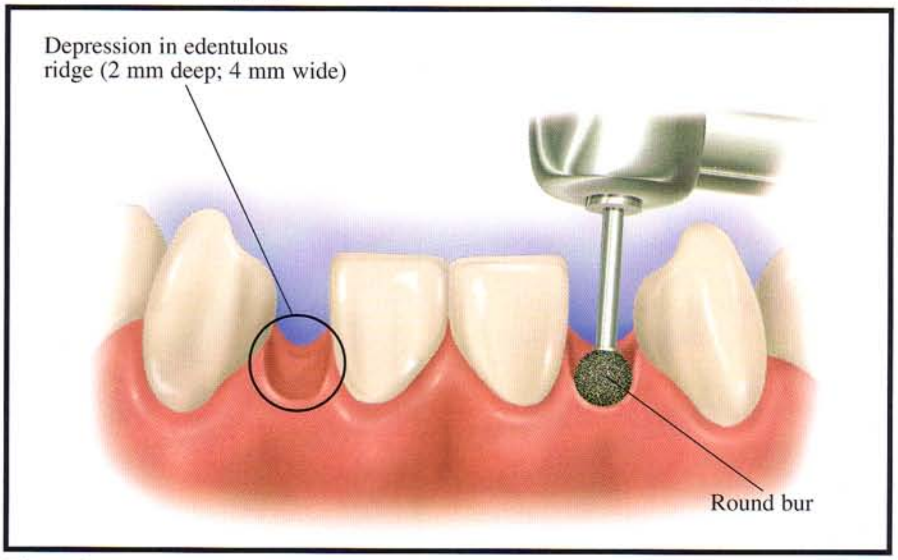

Figure 3. Drawing indicates that the gingival zenith of the ovate pontic receptor sites should be equal to that of the adjacent central incisors.

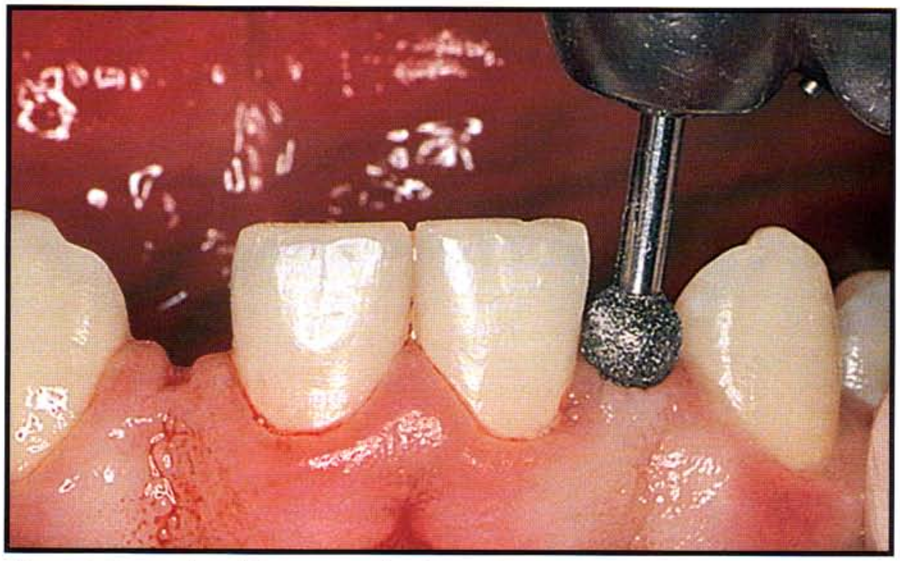

Figure 4. Preparation of the ovate pontic site to enhance gingival symmetry is achieved by using a #6 round bur. (Ovate Pontic Surgery performed by Tres Reeves, DDS, MS.)

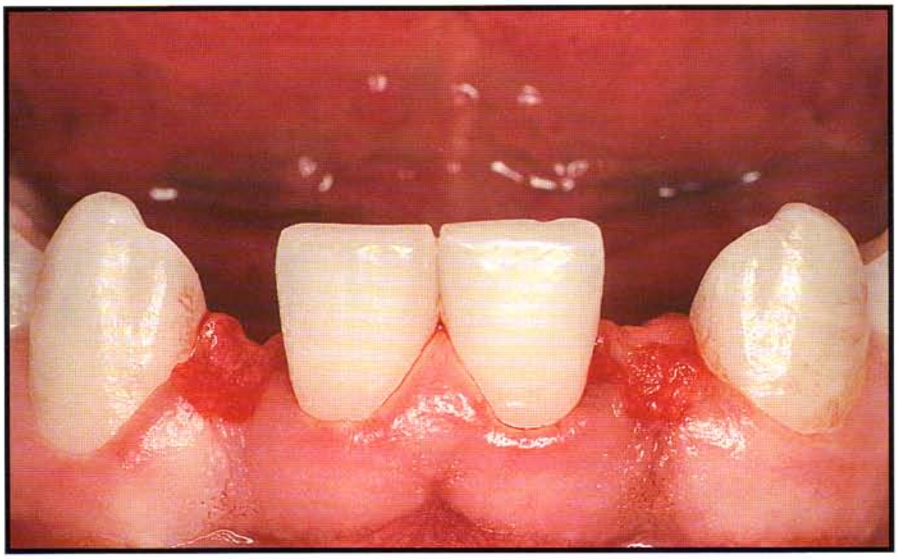

Figure 5. Immediate postpreparation facial view of the ovate pontic sites for mandibular lateral incisors.

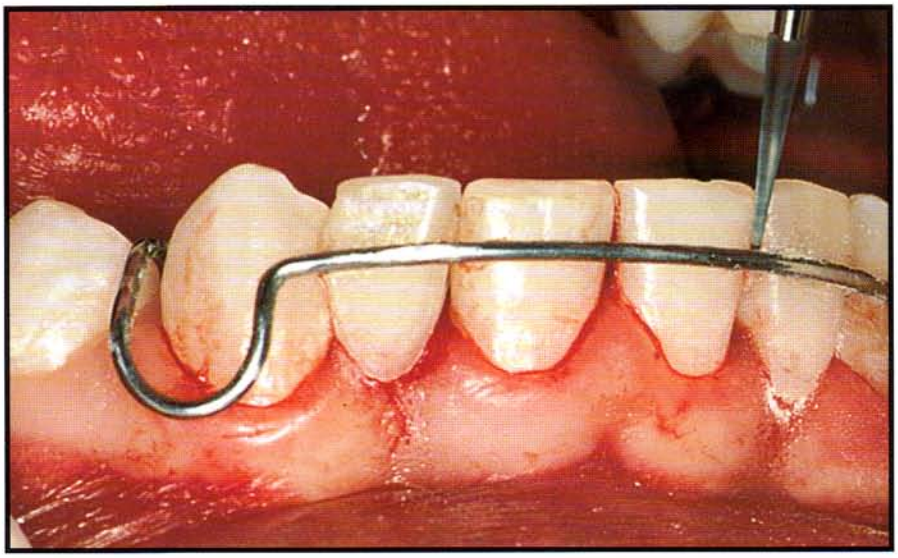

Figure 6. Microfill composite is bonded to the facial surface of the retainer and seated on the pontic area to maintain the pontic morphology.

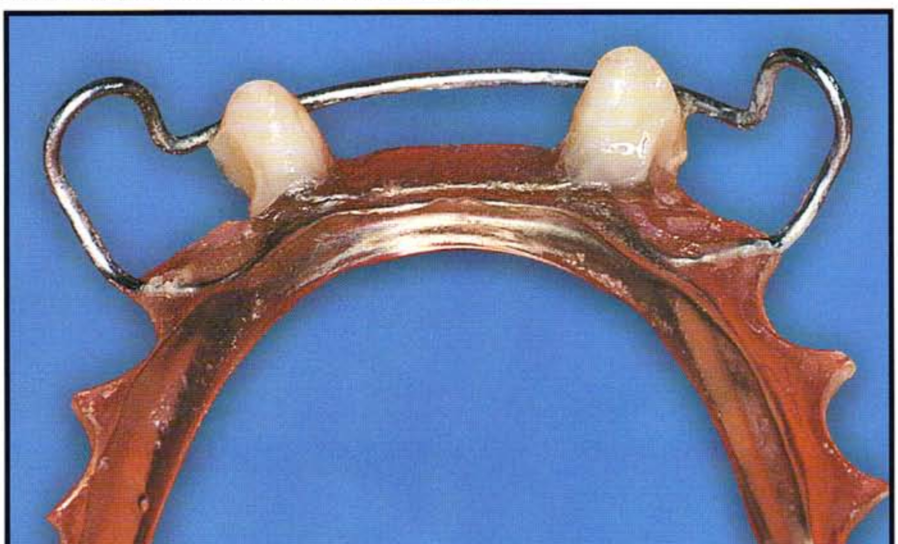

Figure 7. Tissue view of the appliance. Note the highly polished composite surface.

CASE PRESENTATION

A 19-year-old male patient presented with congenitally missing mandibular lateral incisors (Figures 1 and 2). The edentulous spaces were uneven, and the gingival tissue on the mesial aspect of tooth #27 was hyperplastic. The patient had a history of orthodontic treatment with early termination due to inadequate patient compliance. The patient's primary complaint was a dislike of wearing the retainer, and the patient requested an immediate fixed restoration.

Clinical examination revealed no soft tissue or osseous lesions. Gingivitis with hyperplastic attached gingiva was present in the anterior mandibular labial region and was treated by routine prophylaxis and scaling; a home care oral hygiene regimen was advised and implemented. The edentulous spaces were evaluated, and radiographs were examined. The mandibular central incisors were of approximately the same width. However, the distal incisal one-third of tooth #25 was 0.5 mm wider than tooth #24, ie, the contralateral edentulous spaces were uneven. The distal aspects of the canines were visible from the facial view, and their axial inclinations were not mesially tipped. The long axes of the mandibular central incisors were canted buccally. Diastemata were present between the canines and the premolars. The gingival symmetry of teeth #24 and #25 was exposed when smiling, the incisal height was even, and the midline was congruent with the face.

In this particular case, none of the three restorative methods described were suitable.

PATIENT DIAGNOSIS AND TREATMENT PLAN

The patient was advised that the optimal result could be achieved by resuming orthodontic treatment to rotate the canines and to even the edentulous spaces. The patient declined. The conventional prosthodontic treatment options were reviewed, and the utilization of a conventional prosthesis with a metal substrate was dismissed. The edentulous spaces were examined on radiographs, and insufficient space for implant placement was noted. Diagnostic models and photographs were sent to the laboratory to evaluate placement of a fiber-reinforced composite veneer bridge. Due to the mesiodistally narrow edentulous spaces and the short incisal/gingival height of the central incisors (the abutment teeth), a successful restoration using a fiber-reinforced composite bridge was determined to be contraindicated.[9]

In this particular case, neither of the three restorative methods described were suitable: The use of the conventional PFM bridge was rejected primarily due to the required excessive reduction of healthy adjoining tooth structure; the Maryland bridge was not acceptable due to the underlying metal substrate radiating through the dentition; and the fiber-reinforced bridge could not be utilized since the width of the reinforcement exceeded the height of the mandibular teeth. Placement of a single pontic all-ceramic resin-bonded bridge was recommended; diagnostic models were prepared, and the appointment was set for ovate pontic surgery.

An ovate pontic form is indicated when aesthetics are of paramount importance.

PREPARATION OF THE OVATE PONTIC

An ovate pontic form is indicated when soft tissue aesthetics are of paramount importance.[10,11] The rounded base of the pontic must be accurately formed to precisely fill the prepared concave recipient site. Due to their convex tissue surface, ovate pontics provide optimal access for oral hygiene.[2,10] Anesthesia (2 carpules of 2% lidocaine 1:100,000 epinephrine) was administered, and the flat edentulous gingival ridge was reshaped in such a manner that when viewed from the direct buccal aspect, it

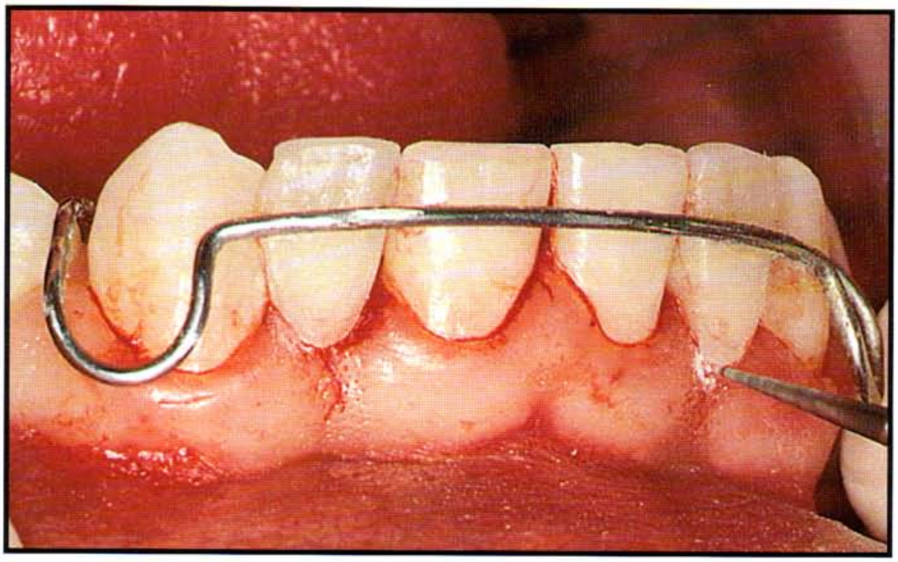

Figure 8. Facial view of the seated removable orthodontic mandibular appliance. Note the contouring of excessive gingival composite with a high-speed handpiece.

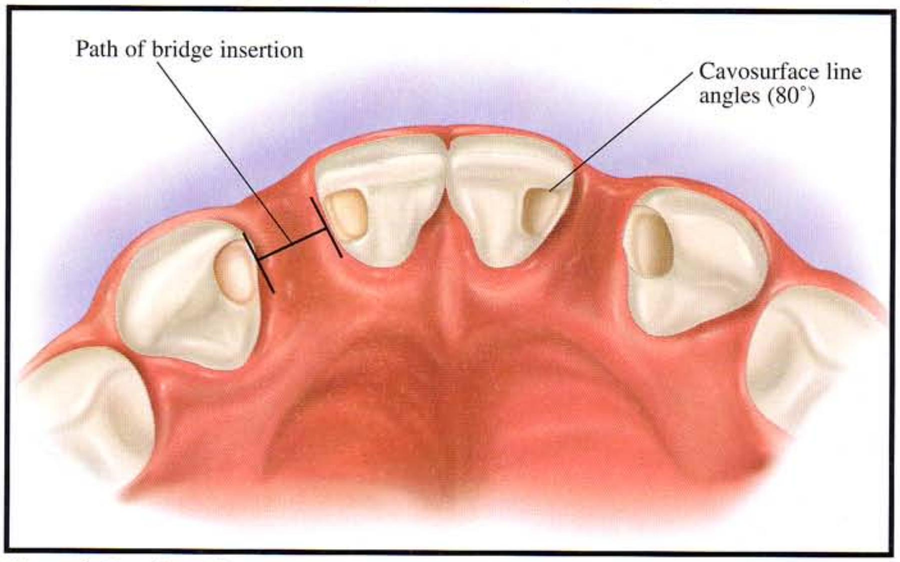

Figure 9. Drawing of the prepared ovate pontic sites. (All internal line angles of the tooth preparation should be rounded.)

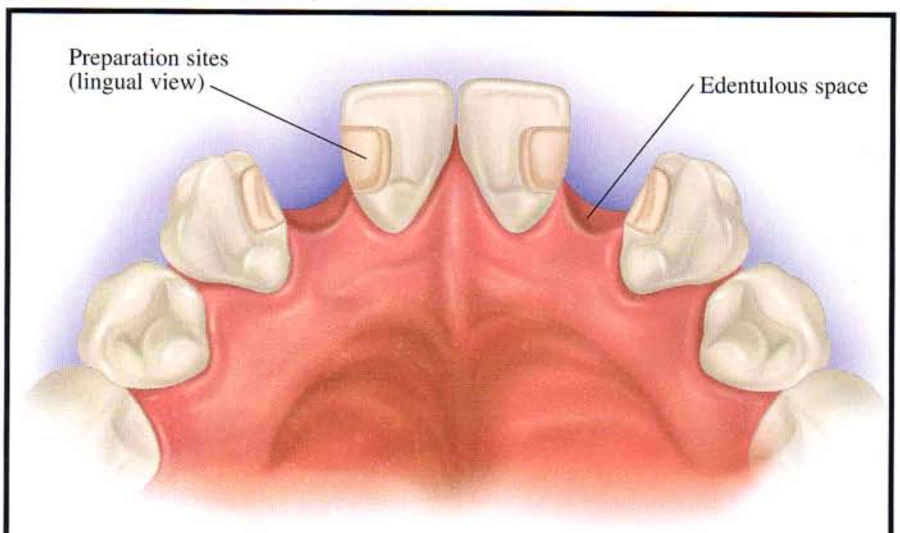

Figure 10. Drawing of a lingual view of the abutment preparation design for the single pontic all-ceramic prosthesis.

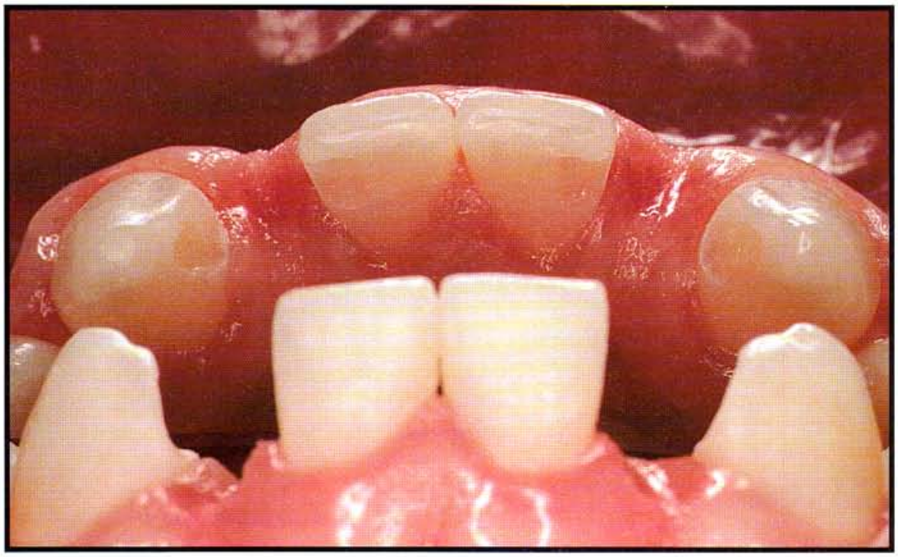

Figure 11. Buccal and lingual postpreparation views of the abutment teeth.

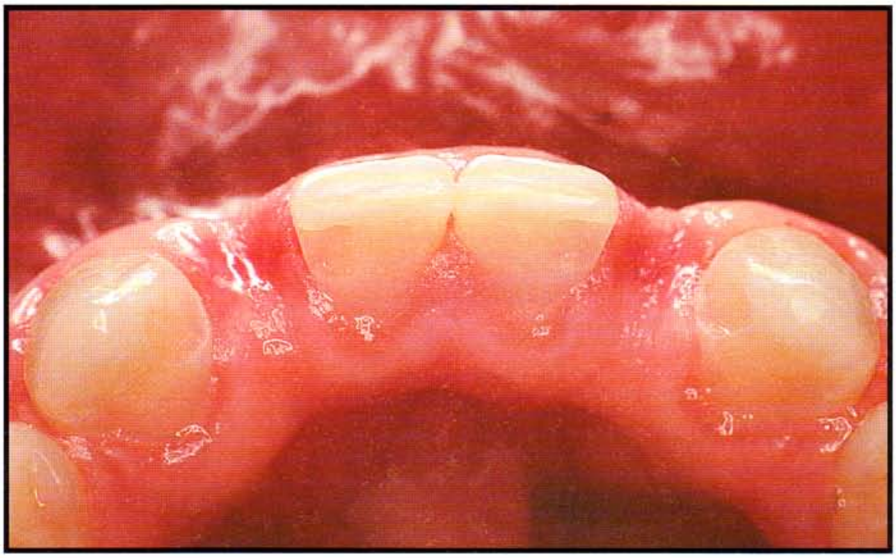

Figure 12. Occlusal view of the preparation of ovate pontic sites. Note the path of insertion for the bridge and the morphology and health of the pontic sites.

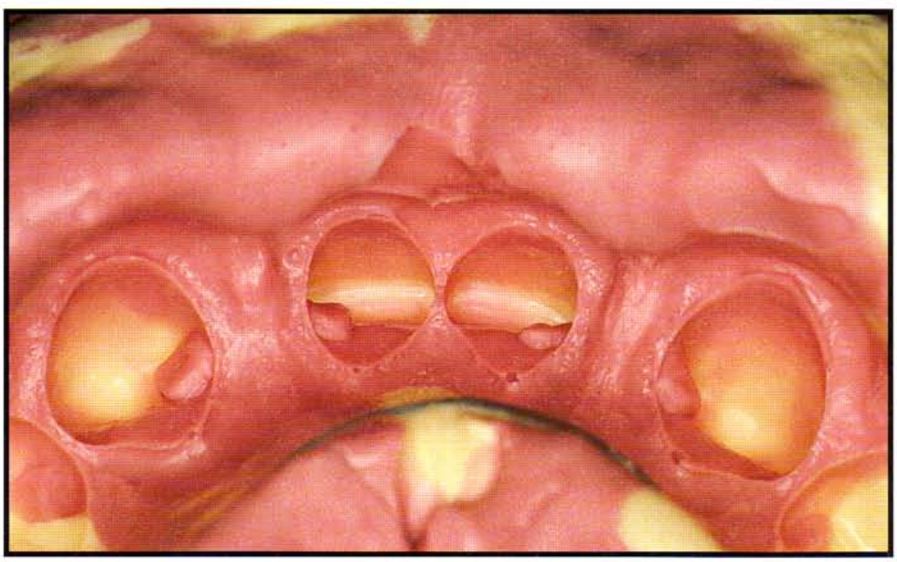

Figure 13. Occlusal view of the final impression. Note the depth of the boxes.

was congruent with the scalloped osseous form of the adjacent teeth (Figure 3). A depression, 2 mm deep and 4 mm wide, was prepared with a round bur in the edentulous lateral incisor area (Figures 4 and 5).

PROVISIONALIZATION OF THE OVATE PONTIC

The patient wore a removable orthodontic retainer for stabilization and tooth replacement. The existing retainer was modified and polished to maintain the soft tissue ovate pontic morphology (Figures 6 through 8).[12] To maximize tissue healing in the pontic region, it is imperative that the surface of the pontic is free of any irregularities or abnormalities. The patient was released with homecare instructions to apply chlorhexidine solution on a cotton tip 3 times a day to the recipient sites and advised to maintain the region plaque free.

Placement of a single pontic all-ceramic resin-bonded bridge was recommended.

Even though anesthesia is not a general requirement for this procedure, the patient in this particular case was anesthetized for preparation of the mandibular anterior teeth due to the thinness of the enamel in the lateral incisors and the depth of 1 mm in the box preparation, which impinges upon the dentin. Without anesthesia, preparation of the lateral incisors would cause discomfort.

The porcelain material utilized requires enamel reduction of at least 0.6 mm to ensure sufficient thickness for adequate pressing of the ceramic. Optimally, the preparation should remain in the enamel; however, if exposure of dentin occurs, a new generation adhesive bonding agent should be applied to address the challenge. In this case, to allow a path of insertion, modified 1-mm-deep box preparations with cavosurface line angles at 80 degrees were completed (Figures 9 through 12). The mesiodistal width of the box did not extend past one-half the width of the tooth. Impressions were taken using polyvinylsiloxane in a rimlock tray. Bite registration and a second triple tray impression were also completed (Figure 13) and sent to the laboratory with a detailed prescription and photographs for the fabrication of the definitive single pontic all-ceramic restorations. The patient was released with the retainer as a provisional restoration.

CEMENTATION

The etched and silanated single pontic all-ceramic restorations were received from the laboratory (Figures 14 through 16) with instructions to use dual cure cement as the luting agent. The restorations were tried in for color match, shade, and fit. The aesthetic prerequisites were met, and dental dam isolation was achieved for the mandibular segment from premolar to premolar (Figure 17). The preparations were cleaned with chlorhexidine and pumice, washed, and dried. The abutments were etched with 35% phosphoric acid for 15 seconds, washed, and rewet (Tubulicid Red, Global Dental, North Bellmore, NY). The wet technique creates less gap formation and deeper penetration of the resin into the dentin. A single-component bonding agent (One Step, Bisco, Itasca, IL) was applied according to the manufacturer's instructions. The application was repeated, dried, and light cured. The microfilled dual-cure luting cement (Dual Cement, Ivoclar Vivadent, Amherst, NY) was mixed with radiopaque fluoride and placed in the preparation.[4] Light finger pressure was used to seat the restorations, all excess cement was removed with a brush, and each bridge was spot-tacked with a 2 mm light source. Glycerine was placed over the margins to prevent the formation of the oxygen inhibition layer. The buccal and lingual surfaces were cured for 2 minutes; finishing cups, discs, and strips were utilized to complete the restoration (Figure 18). The dental dam was removed, and the occlusion and aesthetics of the definitive restorations were evaluated (Figure 19). It is of paramount importance to ascertain that the bridge is not in traumatic occlusion in protrusive or lateral excursions.

CONCLUSION

The traditional approach for replacing congenitally missing mandibular lateral

Figure 14. Lingual view of the preparations of the abutment teeth on stone model. Note the outline of the box preparation.

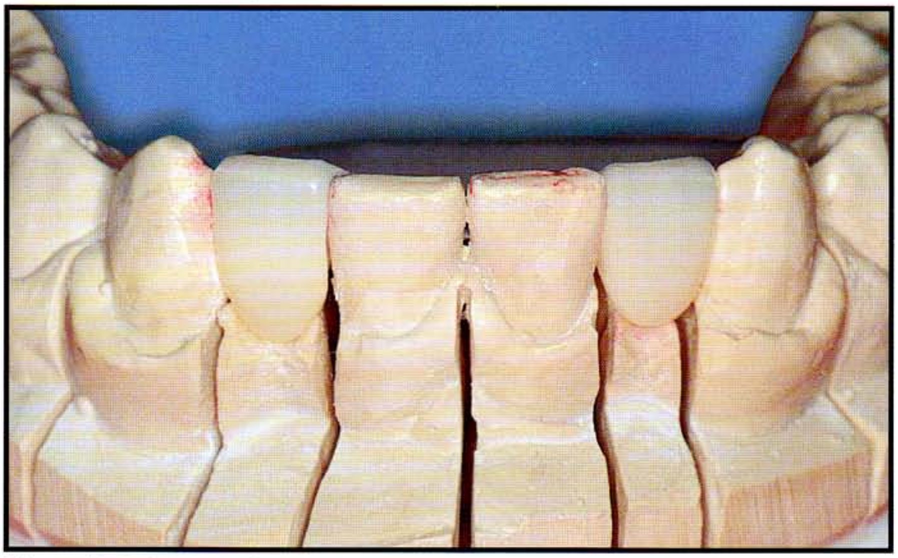

Figure 15. Facial view of the single pontic all-ceramic restorations on stone model. Note the enhanced symmetry and natural aesthetics.

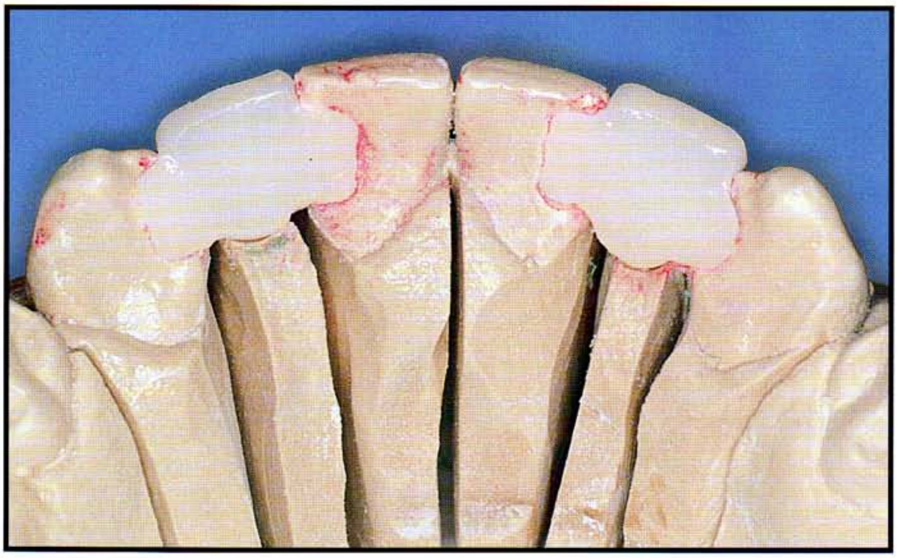

Figure 16. Lingual view of the restorations on stone model. Note marginal adaptation to the model.

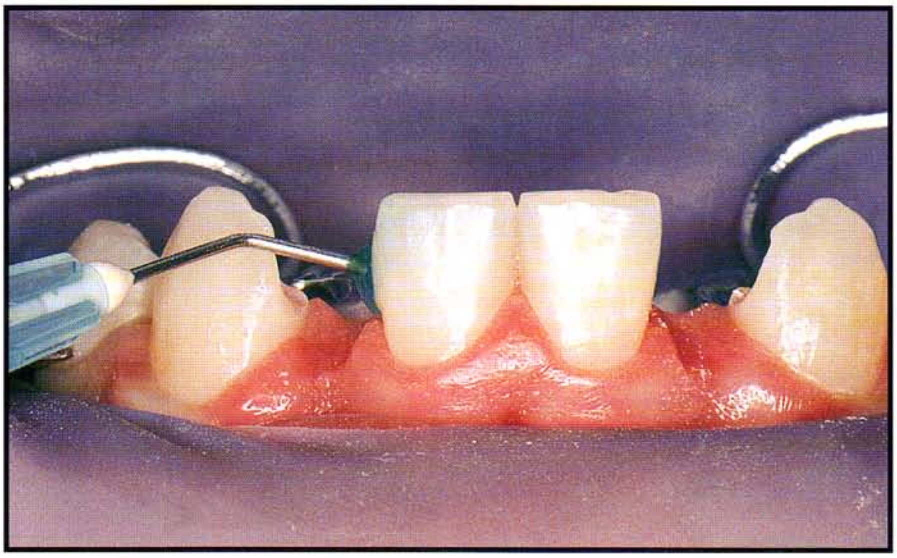

Figure 17. Total etching of the preparations was completed; mandatory dental dam isolation was achieved to ensure high bond strength.

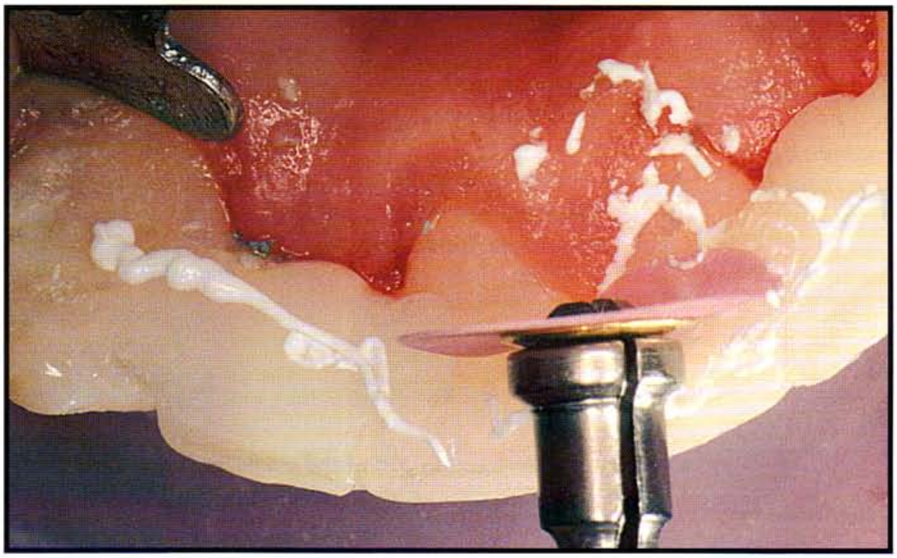

Figure 18. Polishing of the margins is accomplished with discs and cups.

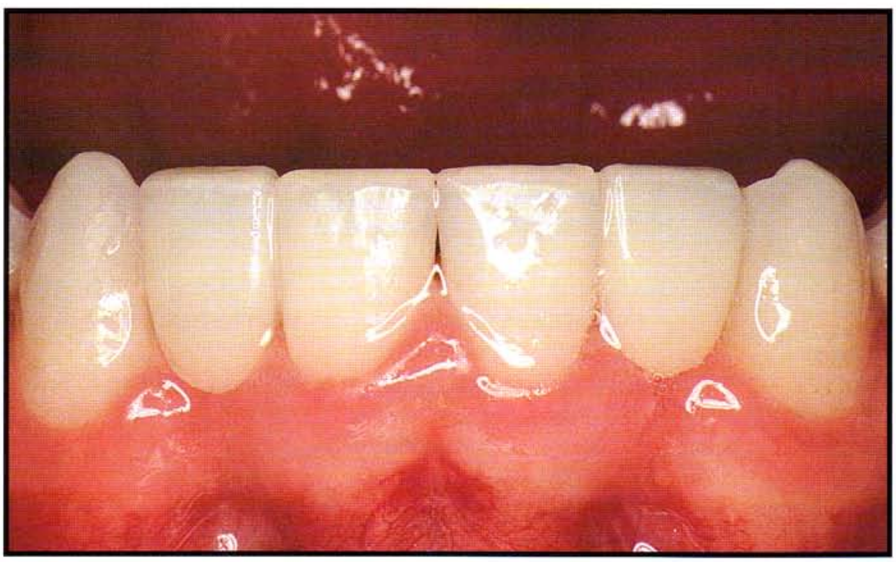

Figure 19. Posttreatment view of the restorations. Note the aesthetic natural quality of the bridges. (Technician: Violet Molnar, Microdental Laboratories.)

incisors dictates the placement of either a conventional 3-unit PFM bridge, Maryland bridge, fiber-reinforced composite veneer bridge, or single implant-supported restoration. None of these treatment modalities were appropriate for the restoration of the clinical case presented. Instead, the congenitally missing mandibular lateral incisors were restored with a single pontic all-ceramic prosthesis and ovate pontic surgery to integrate the edentulous spaces. The all-ceramic restorations have been successfully functioning for 18 months, and the patient is pleased with the aesthetics. Although this treatment exhibits promise, long-term clinical evaluation of this type of restoration is required to validate its use.

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