

Treatment of Congenitally Missing Lateral Incisors with Resin-Bonded Fixed Partial Dentures

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Missing lateral incisors is one of the most common congenital dental anomalies.¹⁻⁴ New technology and materials offer a wide variety of treatment options for the replacement of missing teeth in order to improve esthetics and restore function.⁵ Nevertheless, indications and limitations of each system have to be considered and weighed in each case for the selection of the most adequate treatment.

This article presents clinical steps and laboratory procedures for the treatment of congenitally missing lateral incisors with resin-bonded fixed partial dentures, a traditional approach that is conservative and can provide excellent esthetics if certain guidelines are followed. An innovative approach used to handle the gingival issues and to achieve a natural appearance at the perio-restorative interface is also presented.

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TREATMENT PLANNING

Patients who are missing a lateral incisor often have a removable appliance to replace the missing tooth, at least for a while following orthodontic treatment. Besides orthodontic space closure,⁶ there are several definitive fixed treatment options for missing lateral incisors:

1. Dental implant and fixed restoration
2. Full-coverage fixed partial denture (porcelain-fused-to-metal [PFM], all-ceramic, or resin-based)
3. Partial-coverage fixed partial denture (metal framework [Maryland bridge], ceramic framework, or fiber-reinforced resin with porcelain veneer[s])

Each of these options has advantages and disadvantages. Implants may eventually be the routine treatment of choice⁷⁻⁹; however, a number of contraindications must be considered:

- Medical contraindications
- Young age (growth incomplete)

- Unfavorable root proximity and/or root alignment, especially after orthodontic treatment
- Deficient alveolar ridge requiring significant augmentation
- Smoking habits
- High occlusal stress
- Severe occlusal discrepancies

Traditional PFM bridges are long lasting, but significant tooth reduction is necessary for highly esthetic results. In young patients, pulp size may preclude sufficient tooth reduction.

All-ceramic and resin-based fixed partial dentures lack long-term scientific clinical data. Practitioners are recommending these options increasingly often, yet both have disadvantages. Rigid all-ceramic systems require significant tooth reduction, at least as much as a PFM. In addition, the required connector dimension is limiting in many patients. An overbite that is equal to or greater than average or tooth size that is equal to or smaller than average (which is common in patients who are congenitally missing laterals) will often contraindicate a large connector. Fiber-reinforced resin-based fixed partial dentures¹⁰ may not require extensive tooth preparation, but long-term follow-up studies are not available. The use of such materials requires placement of a porcelain veneer on the facial of the pontic, which is a very sensitive technique that significantly increases operative time.

A resin-bonded fixed partial denture (Maryland bridge)¹¹⁻¹³ represents a very conservative treatment approach. However, many practitioners may have reservations about this option due to the high incidence of failure.¹⁴ It is also challenging to achieve an excellent shade match to the adjacent natural teeth serving as abutments, as it is with any single crown. The Maryland bridge complicates shade matching even more because of the shade change that generally occurs on the abutments at cementation due to the cast-metal lingual retainers that impart a gray appearance in the incisal third. Even if the pontic matches perfectly at try-in, once it has been luted the result may be disappointing. However, when certain

clinical guidelines are followed, the resin-bonded fixed partial denture can be conservative, predictable, practical, and highly esthetic.

CASE PRESENTATION

A 17-year-old healthy female had a congenitally missing maxillary left lateral incisor (Fig 1). The maxillary right lateral incisor was slightly undersized and malformed, although not enough for it to be classified as a peg lateral. Orthodontic treatment was complete, and the patient was using a Hawley-type retainer with a denture tooth attached for the prosthetic replacement of the left lateral. The patient was unhappy with the appliance and wanted a permanently fixed solution. Records were taken, and the diagnosis and treatment plan were completed.

Soft Tissue Considerations in the Pontic Area

Ideal gingival contours are the natural framework for any dental restoration and require special attention. The amount of remaining hard and soft tissue dictates subsequent treatment to create a natural appearance. In this case, the edentulous alveolar ridge had a deficiency in the gingival architecture (Fig 2), and though surgical ridge augmentation was the most appropriate procedure, the patient declined it. In cases of moderate ridge deficiencies or if the patient does not comply with a surgical intervention, an ideal pontic site might be developed with a fixed temporary restoration and a pontic specifically shaped for this site. However, during fabrication of a resin-bonded fixed partial denture, the most viable temporary restoration is often a removable appliance. In the present case, a thermoformed clear acrylic appliance (Essix, Raintree Essix Inc, Metairie, LA, USA) with a denture tooth in the left lateral incisor position was used as a provisional restoration with an additional goal of reshaping the underlying gingiva (Figs 3a and 3b). Since this patient had a gin-



Fig 1 Preoperative view. Maxillary left lateral incisor is congenitally missing and the maxillary right lateral incisor is malformed. Orthodontic treatment is complete.



Fig 2 The edentulous alveolar ridge reveals a deficiency in the gingival architecture.



Figs 3a and 3b A thermoformed clear acrylic splint (Essix appliance) with a denture tooth in the position of the left lateral incisor was used as a retainer with an additional goal of "orthodontically" shaping the underlying gingiva.

gingival deficiency, it was decided to avoid any gingivectomy procedure at the pontic receptor site and rather to guide the soft tissue into a more ideal shape without surgical intervention.

Indications for a nonsurgical gingivoplasty are:

1. Slight-to-moderate horizontal deficiencies
2. Slight or no vertical deficiencies
3. Gingival thickness over bone of at least 2 mm
4. Mesiodistal space available within normal ranges
5. Patient willing to comply with a removable appliance for a few weeks

The limitations of this technique are primarily related to the lack of new tissue "created," since there is no augmentation of the ridge. Therefore, this technique is not indicated if severe ridge defects exist. However, no surgery is needed to create an ovate pontic receptor site if the patient meets the aforementioned criteria. This method also creates an opportunity to increase the apparent size of the papillae, to give the appearance of additional facial bulk of tissue, and to form a gingival-tooth interface that resembles that of a natural tooth.



Figs 4a and 4b Situation after home bleaching and operative restoration of the misshapen right lateral incisor with a direct composite restoration. Keep in mind that the planned pontic must mimic the contours of the restored right lateral incisor.

Orthodontic Considerations

This particular patient had successfully completed orthodontic treatment. Orthodontic intervention often is required prior to the restorative treatment phase to address unfavorable spacing or occlusal issues and to optimize the position of the teeth.^{6,7} It is recommended that the restorative dentist evaluate the patient prior to orthodontic treatment and close to its completion. Information on the restorative treatment may influence the orthodontic result, and in some cases, minor modifications prior to the removal of the brackets will improve the restorative result.

Restorative Treatment

Since the patient was not satisfied with the original shade of her natural teeth, home bleaching was performed until she was satisfied with the shade. A direct composite restoration was then fabricated to improve the shape of the small, misshapen right lateral incisor. During the operative procedure it is important to keep in mind that the planned pontic must mimic the contours of the restored right lateral incisor. Reasonable symmetry was a goal for achieving an overall esthetic smile (Figs 4a and 4b).

Temporary Restoration and Soft Tissue Contouring

An Essix appliance adapted to the six anterior teeth was fabricated to replace the Hawley retainer. A denture tooth was used as a pontic to replace the left lateral incisor, which provided a comfortable and esthetic provisional without the use of a wire and the bulkiness of the previous retainer. This denture tooth was selected in the appropriate shade and mold, and was then customized to resemble the contralateral tooth. In similar cases, microetching the denture tooth, using an unfilled resin as an adhesive, and adding a hybrid composite may accomplish further modifications. The tissue side of the pontic was contoured in a ridge-lap shape to avoid initial impinging of the tissue. Proper alignment of the denture tooth to the approximating teeth was verified, and the denture tooth was attached to the model using light-cured block-out resin. This resin was preferred over sticky wax to avoid any material that would melt during adaptation of the thermoformed Essix material. Essix Type B and C+ are the materials of choice due to their optimal esthetic and physical properties and excellent durability. After removal of the thermoformed plastic from the model and subsequent trimming, the denture tooth was separated from the model and

Figs 5a and 5b After about 1 week of wearing the Essix appliance, a narrow extension made of composite—the “site former”—was added to the base of the pontic.

Figs 6a to 6c After adding increments of composite twice a week for a total of 6 weeks, the pontic receptor site had reached its desired shape.



5a



5b



6a



6b



6c

slipped into the Essix. To ensure adequate retention, Triad gel (clear) (Dentsply, York, PA, USA) was applied into the pontic space of the Essix appliance. The denture tooth was repositioned, excess gel was removed, and the restoration was light-cured. This type of appliance is approximately 0.5 mm thick, which the patient quickly adapted to. However, a minimally open bite has to be expected in the anterior region if the appliance is worn full time, but the open bite is reversed within a few weeks of discontinuing the use of this appliance.¹⁶

Shaping of the pontic receptor site was started 1 week after the patient received the Essix appliance to allow for adaptation. Initially, a narrow extension—the “site former”—was added to the base of the pontic (Figs 5a and 5b). The apical aspect of the denture tooth was microetched and rinsed. An unfilled resin was applied and additional composite sculpted to the desired shape. This initial shape was modified every few days to guide the tissue primarily toward the facial aspect. Local anesthesia was administered to assure patient comfort when the appliance was first placed in the mouth, which can be avoided with a more

gradual addition of composite. The patient was instructed to remove the appliance for cleaning only and to replace it within a few minutes in order to avoid tissue relapse. Additional composite was gradually added twice a week in small increments without the need for anesthesia. After 6 weeks, the natural tooth pontic receptor site had reached the desired shape (Figs 6a to 6c).

Final Preparation

The preparation design used was similar to a Maryland bridge using a PFM pontic fixed with cast-metal lingual retainers adhesively cemented to the adjacent abutment teeth. Contrary to the traditional Maryland bridge technique, the abutment teeth were prepared on the lingual aspect to avoid extension of the metal framework onto the thinner incisal third to half of the abutment teeth, which would compromise esthetics. To increase retention and to prevent a bulky framework, a definitive preparation (Fig 7) with nearly parallel walls, sharp internal line angles, and a pin hole (about the size of a 330 bur) centered in the

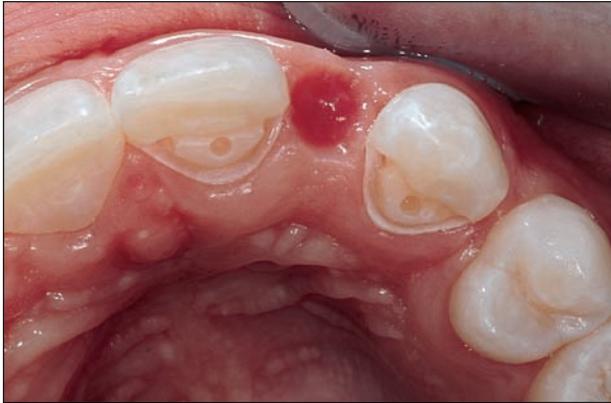


Fig 7 Intraoral view of the final preparations of the abutment teeth (the maxillary left canine and central incisor) for a resin-bonded fixed partial denture.



Fig 8 Little or no die spacer on the master cast allows for the most accurate adaptation of the cast metal to the preparation.

cingulum area was fabricated. Little or no die spacer is used on the master cast for accurate adaptation of the cast metal to the preparation (Fig 8). The combination of accurate fit, retentive preparation design, adequate pretreatment of the metal surfaces, and a composite resin luting material should increase the long-term retention of a resin-bonded fixed partial denture.

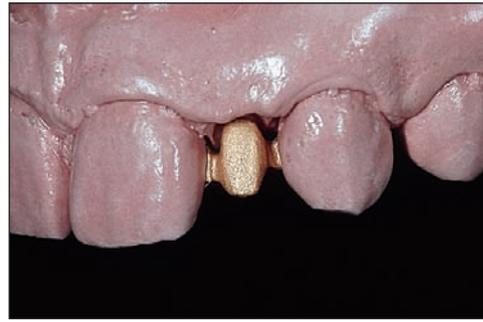
Fabrication of the Final Restoration

The Essix appliance continued to be used for a temporary restoration during fabrication of the final restoration in the dental laboratory. The metal framework was waxed up, cast with an alloy containing 74% Ni and 13% Cr (Williams Pisces, Ivoclar Vivadent, Amherst, NY, USA) (Fig 9) and coated with Deck-Gold (Degussa, Bloomfield, CT, USA) (Fig 10). The framework was tried in during a separate appointment and, after verification of optimal fit, sent to the laboratory where the veneering porcelain was built up and fired (Figs 11 to 16). Figure 17 shows the final restoration. The tissue side of the ovate pontic was contoured to place slight pressure on the gingiva at delivery in order to assure a tightly adapted tissue surface and ade-

quate support of the interproximal papillae and the "generated" facial tissue. The tissue should blanch with initial placement and return to normal color within a few minutes. Proper interocclusal contacts in static and dynamic occlusion were verified. The oral surfaces of the metal framework were covered with a thin layer of porcelain to achieve a toothlike shade. With resin-bonded bridges, the weak link in the metal-composite-tooth unity is usually the metal-composite interface. Therefore, selection of an adequate alloy and pretreatment of the metal surface are key factors for the long-term survival of resin-bonded fixed partial dentures. Nonprecious alloys should be used due to their rigidity and ability to build an oxide surface layer, which facilitates resin bonding. Various surface treatment methods are available to enhance the micromechanical and chemical bond of resin cements to the metal surface.¹⁵ The metal bonding surface was acid etched in the dental laboratory and air-abraded with a micro-sandblaster (Microetcher ERC, Danville Engineering, San Ramon, CA, USA) in the dental office. Final cementation was accomplished with an opaque, autocuring resin cement (Panavia 21 opaque, Kuraray, Osaka, Japan). Figure 18 shows the 2.5-year follow-up of the completed restoration.



Figs 9a and 9b Cast framework, lingual and buccal views.



Figs 10a and 10b Framework after coating with Deck-Gold (Degussa), lingual and buccal views.



Fig 11 Opaqued framework, lingual view.

Fig 12 Dentin buildup, lingual view.



Figs 13a and 13b Translucent layering, lingual and buccal views.



Fig 14 Prosthesis after first firing cycle, lingual view.



Fig 15 Cervical buildup with saturated dentin and internal characterization of the buccal surface.



Figs 16a and 16b Completed buildup of the translucent enamel, lingual and buccal views.



Figs 17a and 17b Completed prosthesis, lingual and buccal views.



Figs 18a to 18c Postoperative (2.5-year follow-up) views: contralateral side, radiograph, and resin-bonded fixed partial denture replacing the maxillary left lateral incisor.



CONCLUSION

Though a variety of options are available to solve the problem of congenitally missing lateral incisors, this article presented a modification of a traditional technique. Long-term success of resin-bonded fixed partial dentures depends on the preparation design, fit, metal and tooth-surface pretreatment, and luting agent. In addition, the

nonsurgical gingivoplasty created a pontic receptor site almost as ideal as with surgical augmentation. This modified technique may satisfy the functional and esthetic demands of today's patients. It is a minimally invasive and very conservative treatment approach. However, certain clinical guidelines and laboratory steps have to be followed closely, and controlled clinical trials are necessary to verify its long-term success.

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