

Integrating Space Closure and Esthetic Dentistry in Patients with Missing Maxillary Lateral Incisors

Further Improvements

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In a 2001 article in this journal,¹ we described how considerable improvement can be achieved in patients with missing lateral incisors by combining carefully detailed orthodontic space closure with techniques from esthetic dentistry. Such methods may include:

- Individualized extrusion and intrusion during mesial movement of the canine and first premolar, respectively, to obtain an optimum level for the marginal gingival contours of the anterior teeth.
- Careful correction of the crown torque of a mesially relocated canine to mirror the optimal crown torque of a lateral incisor, along with the provision of optimal torque for the mesially relocated maxillary first and second premolars.
- Esthetic recontouring of a mesially relocated canine to a more ideal lateral incisor shape and size with a combination of grinding and compos-

ite resin build-ups or porcelain veneers.

- Increasing the width and length of mesialized and intruded first premolars with composite resin build-ups and/or porcelain veneers to achieve optimal esthetics and functional occlusion.
- Intentional vital bleaching of a yellowish canine that has been moved mesially into the lateral incisor position.
- Simple minor surgical procedures for localized clinical crown lengthening.

Common Esthetic Problems with Orthodontic Space Closure

The most obvious difficulty in substituting canines for missing maxillary lateral incisors is the achievement of an excellent esthetic and functional outcome that resembles an intact natural dentition.¹⁻⁴ Particularly in unilateral agenesis cases, space closure can create problems in matching tooth size, shape, and color.⁴ The canine is normally a longer and larger tooth, mesiodistally and labiolingually, than the lateral incisor it is to replace, and more saturated with color. The first premolar is generally shorter and narrower than the contralateral canine. If these natural size differences are not compensated for, the esthetic outcome will be compromised,¹⁻³ and, as is commonly seen in orthodontic treatment, the premolars substituting for the canines will be too diminutive.⁵⁻⁹

This article describes the advantages not only of increasing first premolar length and width, but also of evaluating and restoring the maxillary central incisors to create optimal dental exposure during function. In addition, it presents important new information on indications and contraindications for the space-closure alternative.



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Although we have generally achieved satisfactory and stable results over many years of substituting canines for missing lateral incisors (Fig. 1), in some patients the outcome was a dentition that did not appear entirely natural; in other patients the composite resin build-ups needed more maintenance than expected. From our recently treated maxillary lateral incisor agenesis cases, we have selected the following two difficult and challenging patients to demonstrate further improvements in the technique and provide some clinical guidelines.

Case 1

A 12-year-old female presented in the late mixed dentition with a Class III malocclusion, a hypodivergent growth pattern, a narrow maxilla, and pronounced spacing in the maxillary arch, including spaces from bilaterally missing lateral incisors (Fig. 2). The mandibular arch was normally shaped with no crowding.

Traditionally, a Class III malocclusion in a patient with missing lateral incisors, a narrow max-

illa, and severe spacing has been corrected with space reopening and replacement of the absent lateral incisors with single implants or other restorations. Because of the excellent motivation and cooperation shown by this patient, however, it was decided to attempt closure of all spaces in the maxillary arch. The treatment plan involved rapid maxillary expansion (RME); improvement of the facial convexity by molar extrusion, which would increase facial height and induce clockwise rotation of the occlusal and mandibular planes; extrusion of the maxillary anterior teeth for better exposure during speech and smiling; and finishing of the occlusion with the first molars in a Class II relationship, canines substituting for the missing lateral incisors, and first premolars replacing the canines.

The RME was followed by bonding of fixed appliances in both dental arches, including the lower second molars (Fig. 3), and space closure with Class III elastics. As recommended in our previous article,¹ the marginal gingival contours were leveled by combining extrusion of the maxillary canines with lingual root torque and intrusion of the first premolars with labial root torque.

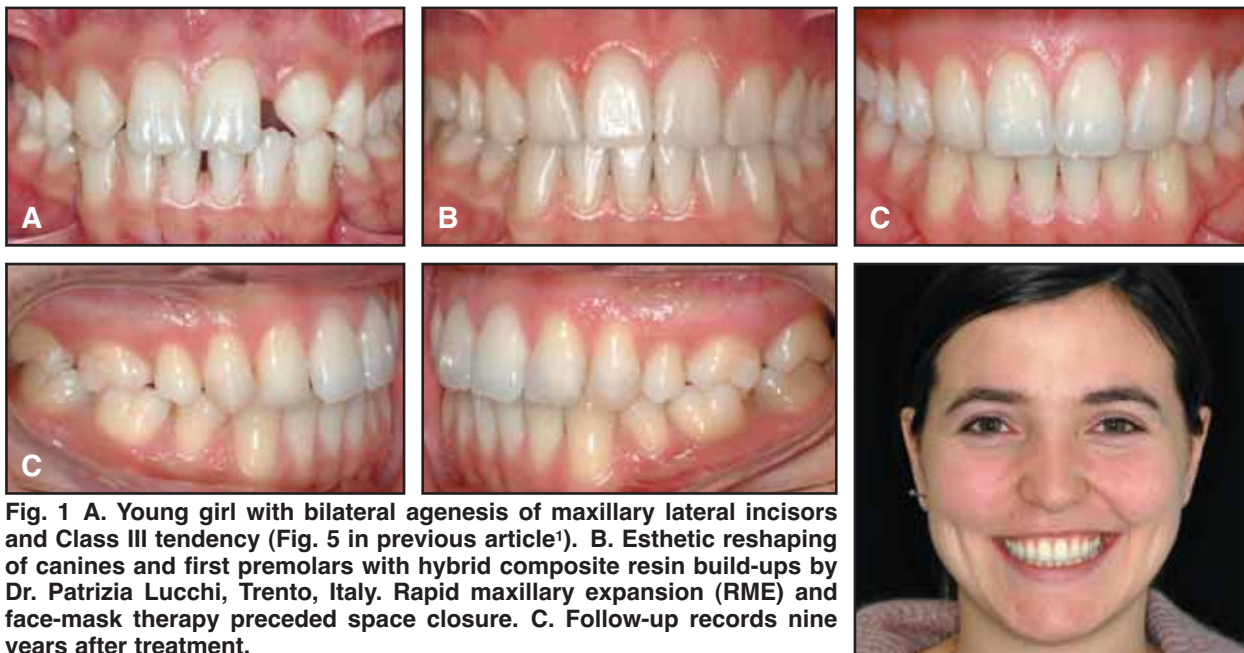


Fig. 1 A. Young girl with bilateral agenesis of maxillary lateral incisors and Class III tendency (Fig. 5 in previous article¹). B. Esthetic reshaping of canines and first premolars with hybrid composite resin build-ups by Dr. Patrizia Lucchi, Trento, Italy. Rapid maxillary expansion (RME) and face-mask therapy preceded space closure. C. Follow-up records nine years after treatment.

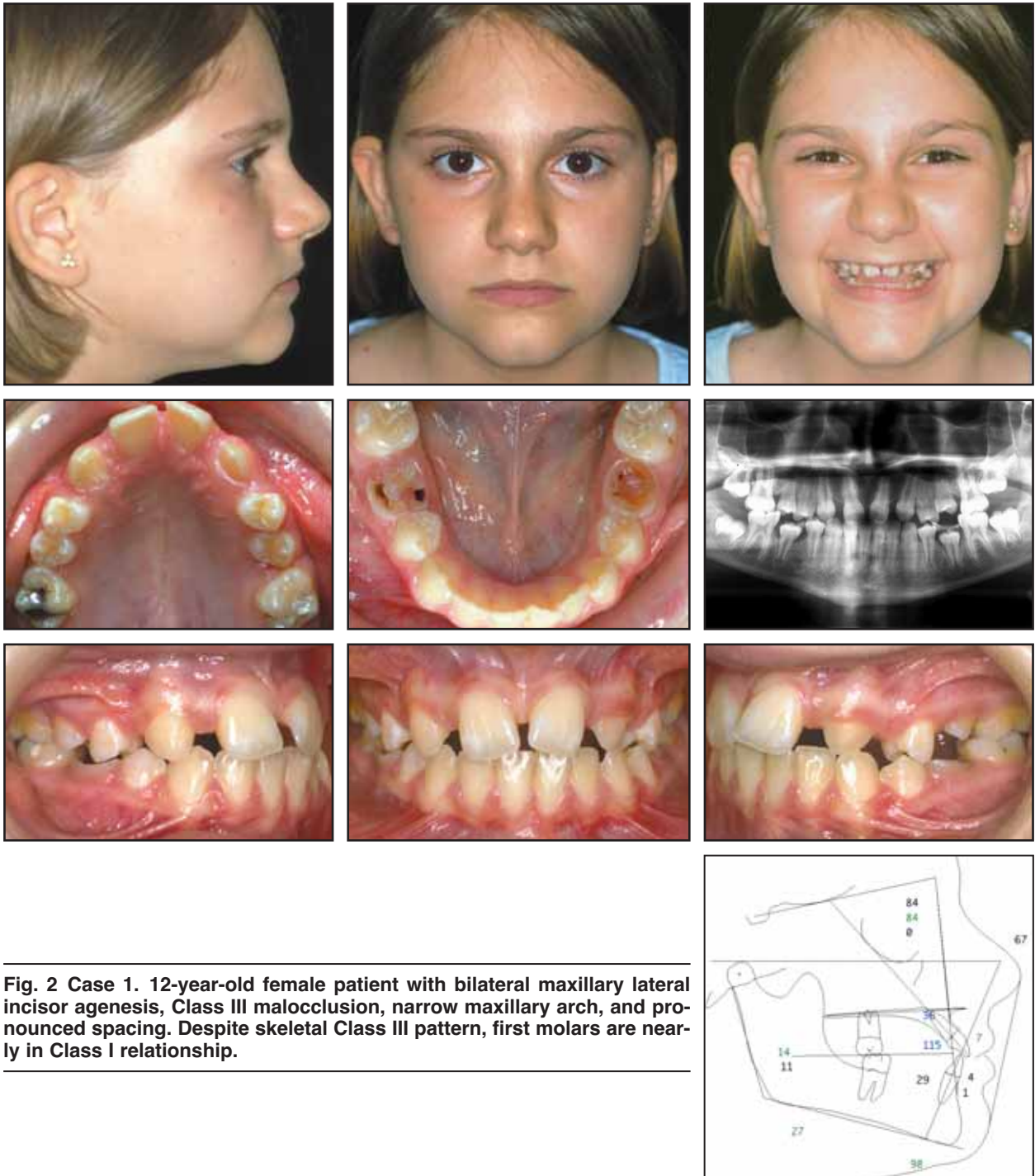


Fig. 2 Case 1. 12-year-old female patient with bilateral maxillary lateral incisor agenesis, Class III malocclusion, narrow maxillary arch, and pronounced spacing. Despite skeletal Class III pattern, first molars are nearly in Class I relationship.



Fig. 3 Case 1. After early RME, before placement of full fixed appliances. Space closure produced Class II molar occlusion with good intercuspation of second premolars. Canine extrusion, first premolar intrusion, and torque control of anterior and posterior teeth were achieved by archwire bending. Maxillary anterior teeth need further elongation to improve relationship to upper lip (upper right photo). Note detailed alignment using rectangular stainless steel archwires, with mesial and distal offset bends for canines in lateral incisor positions and distal offsets for first premolars in canine positions (upper left photo).



Fig. 4 Case 1. After orthodontic treatment, showing natural high-low-high relationship of gingival margins achieved by selective canine extrusion and first premolar intrusion. Note pronounced open bite of first premolars, minimal anterior overbite, and short, square appearance of central incisors.

At the end of the orthodontic phase, the spaces were fully closed, and a functional occlusion with a Class II molar relationship had been achieved (Fig. 4). After the canine and first premolar substitutions, the gingival contours showed a natural high-low-high pattern. Exposure of the six maxillary anterior teeth with relaxed lips and in smiling had improved due to the incisor extrusion and clockwise rotation of the occlusal plane and mandible, but their exposure with the lips at rest

was still inadequate.¹⁰⁻¹²

Cosmetic finishing was begun on the day of debonding by Dr. Patrizia Lucchi of Trento, Italy (Fig. 5). This involved grinding of the canines and hybrid composite resin build-ups of both the canines and the first premolars. The canine cusp tips were ground only slightly because of their insufficient exposure with the lips at rest. To establish harmony in the anterior segment, it was necessary to elongate these teeth, which were too square.

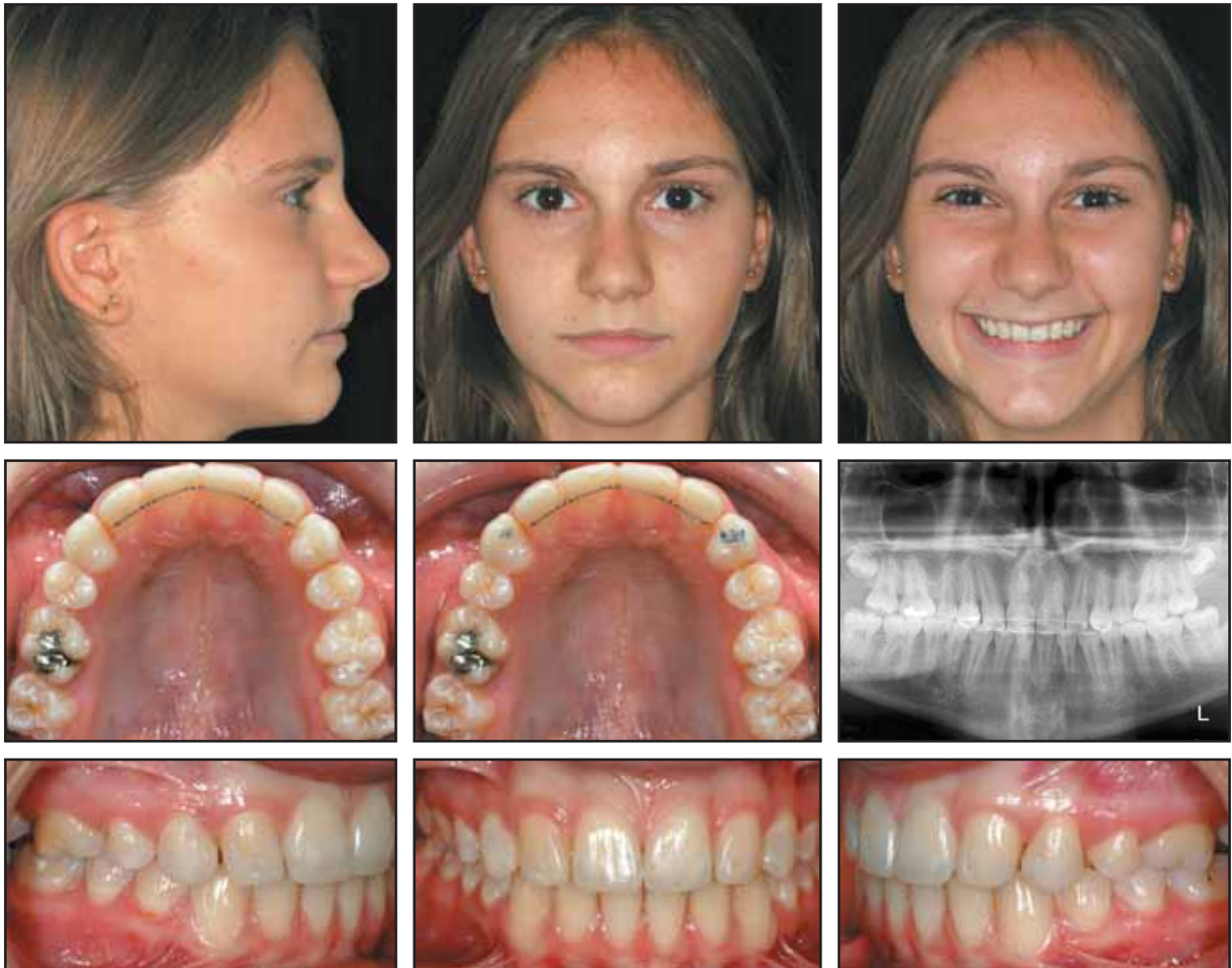


Fig. 5 Case 1. After composite resin build-ups of all six maxillary anterior teeth and whitening (vital bleaching) of canines (courtesy of Dr. Patrizia Lucchi), with fixed lingual retainer bonded to four maxillary anterior teeth. Smile is pleasant not because of new lateral incisors, but because of central incisors and restored first premolars in canine positions. Note balanced, natural facial appearance and profile, with canine-protected functional occlusion (blue articulation marks, center photo). Panoramic radiograph shows maxillary third molars ready to erupt into occlusion.



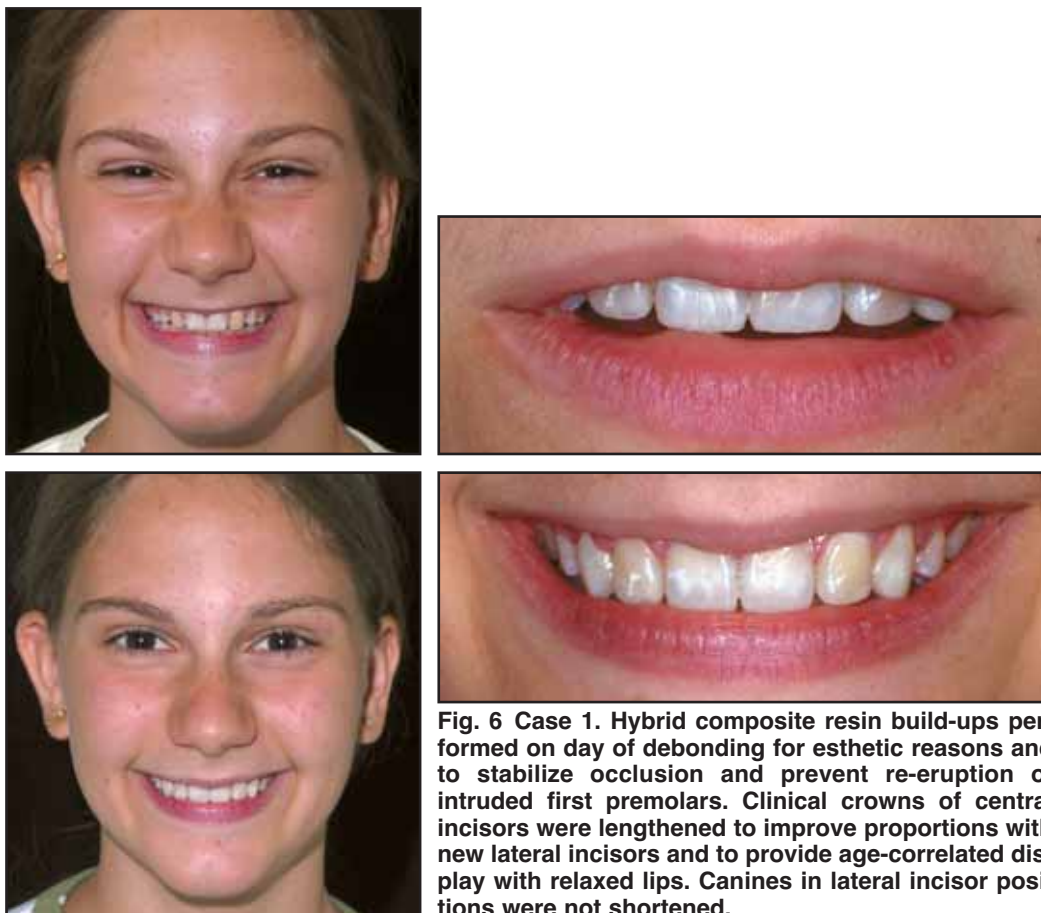


Fig. 6 Case 1. Hybrid composite resin build-ups performed on day of debonding for esthetic reasons and to stabilize occlusion and prevent re-eruption of intruded first premolars. Clinical crowns of central incisors were lengthened to improve proportions with new lateral incisors and to provide age-correlated display with relaxed lips. Canines in lateral incisor positions were not shortened.

What made the smile appear natural in the end was obviously not the new lateral incisors, but the large new “canines” and the well-proportioned central incisors in a balanced, wide archform, thanks to the RME (Fig. 6).

Immediately after the composite resin build-ups, a bonded lingual wire was placed on the four maxillary anterior teeth for indefinite retention.

Case 2

A 14-year-old female presented with a Class II, division 1 malocclusion, unilateral agenesis of the maxillary right lateral incisor, a midline deviation, and a deep anterior overbite (Fig. 7A). The mandibular arch was normally shaped, with minor crowding.

The treatment plan was to correct the severe maxillary midline deviation after extraction of the left first premolar, close all spaces, and correct the deep bite by intruding the mandibular incisors. The maxillary incisors needed to be extruded, because the anterior tooth display with the lips at rest was

only 1mm at the start of treatment. Extrusion of the right canine and intrusion of the right first premolar for marginal gingival leveling were to be achieved mainly by bracket placement, with the canine bracket placed in a gingival position and the first premolar bracket close to the incisal edge (Fig. 7B). Immediately after appliance removal, the maxillary right first premolar and canine were to be restored with porcelain laminate veneers to simulate a natural canine and lateral incisor, respectively.

Full fixed appliances were bonded in both arches, including the mandibular second molars. Double tubes were bonded to the mandibular first molars to accommodate an .0175" x .025" CNA* (beta III titanium) overlay base-arch for intrusion of the lower anterior teeth (Fig. 8A). A von der Heydt torquing auxiliary** was used to add lingual root torque to the upright maxillary central incisors (Fig. 8B).

*Ortho Organizers, 1822 Aston Ave., Carlsbad, CA 92008; www.orthoorganizers.com.

**RMO Inc., 650 W. Colfax Ave., Denver, CO 80204; www.rmortho.com.



Fig. 7 Case 2. A. 14-year-old female patient with unilateral agenesis of right lateral incisor, maxillary midline deviation to right side, deep anterior overbite, and Class II molar occlusion on left side. Note minimal anterior tooth display with lips at rest. **B.** First premolar bracket bonded more incisally and canine bracket more gingivally than usual (left), producing intrusion and extrusion, respectively, during leveling stage (right).

At the end of the orthodontic phase, the maxillary right first premolar had been intruded and the right canine had been extruded and ground incisally, producing a normal high-low-high marginal gingival contour (Fig. 8C). The maxillary midline was slightly overcorrected.

Cosmetic finishing was begun immediately after appliance removal by Dr. Sverker Toreskog of Göteborg, Sweden. His treatment involved fabrication of two ultrathin, enamel-bonded porcelain veneers after a minimally invasive preparation of the maxillary right first premolar and canine. The “artificial” right side of the maxilla was almost more natural looking than the patient’s intact left side (Fig. 8D).

The maxillary incisor display with relaxed lips was improved by at least 1mm due to the extrusion of the anterior teeth (Fig. 9). The post-

treatment smile was full and radiant, with a mild lingual crown tilt of the canines, straight premolars¹³ (Fig. 8D), and a smile arc consonant with the inner contour of the lower lip (Fig. 9).

Retention involved a six-unit maxillary lingual retainer bonded to the mesial occlusal surface of the first premolar, a maxillary removable plate, and a mandibular 3-3 lingual retainer. The maxillary retainer was cut between the first premolar and canine during fabrication to minimize the bulk of the entirely passive retainer, as described elsewhere.⁴

Discussion

These case reports demonstrate that a combination of carefully performed orthodontic space closure and a cosmetic finishing stage, including build-ups of anterior teeth with either composite

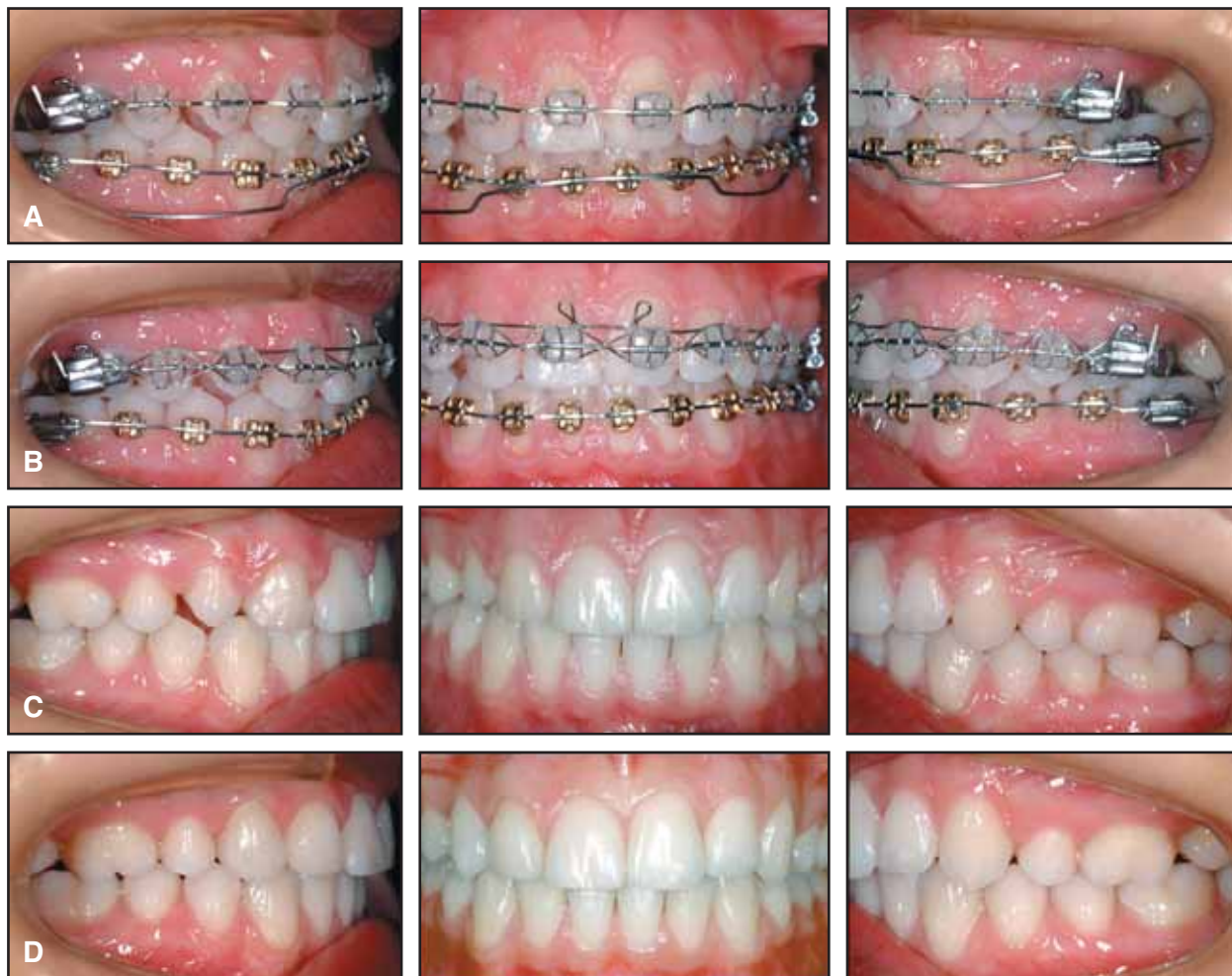


Fig. 8 Case 2. Premolar intrusion maintained throughout treatment with stainless steel rectangular archwires. A. Connector area between central incisors lengthened to about 50% of clinical crown length by recontouring mesial surfaces; maxillary incisors extruded with archwire bends. B. Deep bite corrected by intrusion of mandibular incisors with .0175" x .025" CNA (beta III titanium) overlay base arch inserted in double tubes on first molars; lingual root torque added to central incisors with von der Heydt torquing auxiliary. C. After orthodontic treatment. D. Porcelain laminate veneers (courtesy of Dr. Sverker Toreskog, Göteborg, Sweden) placed on intruded first premolar (substituting for canine) and on extruded canine (replacing missing right lateral incisor).

resin or porcelain laminate veneers, can achieve the look of a natural, healthy dentition in a patient with one or both missing maxillary lateral incisors and a coexisting malocclusion (Figs. 5,8D,9).

A major advantage of this approach is the permanence of the finished result.¹⁻⁴ Alveolar bone height is maintained by early mesial movement of

the canine, avoiding the need to use removable or resin-bonded retainers until implants can be placed. The two most common reasons for postponing permanent prosthetic treatment of young and adolescent patients—the risk of pulp perforation and the exposure of gingival crown margins during tooth eruption—are not contraindications for the



Fig. 9 Case 2. After cosmetic finishing, maxillary midline is parallel to facial midline, and extrusion of maxillary incisors has improved anterior tooth display with lips at rest (compare with Figure 7A). Note natural tooth sizes, shapes, colors, and gingival margins on agensis side.

minimally invasive ultrathin, enamel-bonded porcelain veneers, which can be placed directly on any of the anterior teeth¹⁴⁻¹⁶ (Fig. 9). The only possible disadvantage of the space-closure approach—that spaces may reopen after treatment—can be overcome with long-term fixed retention, using a lingually bonded flexible spiral wire retainer from first premolar to first premolar¹ (Fig. 5). The bonded retainer should be supplemented with a removable plate to be worn continuously for six months and then only at night. A 10-year follow-up study found no apparent side effects with this regimen.¹⁷

Another important advantage of the space-closure alternative is that the healthy gingival tissues and intact interdental gingival papillae will change in synchrony with the patient's own teeth over a lifetime. This is in contrast to current long-term experiences with single-implant porcelain crowns in the esthetic zone.¹⁸⁻²⁴ After only a five-year observation period,²⁵ artificial crowns on osseointegrated implants have shown side effects such as progressive resorption of the labial bone plate and bluing of the overlying gingivae; progressive infraocclusion, even in mature adults^{21,23}; and gingival retraction and abutment exposure. In an award-winning article describing 10-year follow-ups of oral implants, Thilander and colleagues

found increasing degrees of infraocclusion even after completion of growth, and significant marginal bone loss at tooth surfaces adjacent to the implants.²¹ It is our opinion, therefore, that maxillary lateral incisor agensis patients with gummy smiles should be treated with space closure. If the treatment plan includes space reopening, it is preferable to open the spaces for prosthetic replacements in the premolar areas.²⁴

We have emphasized that in lateral incisor agensis cases, where the teeth tend to be relatively small, it is frequently desirable to build up the maxillary central incisors to improve the balance of the six maxillary anterior teeth. If the patient has a broad face, the increased mesiodistal width of the central incisors will then be more harmonious with the width of the facial structures,⁴ and the overall smile will be more esthetic than can be achieved with space reopening and placement of small artificial lateral incisors. This approach will also minimize the amount of grinding required on the canines and improve the central incisor display (with relaxed lips and in speaking) in cases of insufficient incisor exposure.¹⁰⁻¹²

Although the materials currently used for composite resin build-ups can easily be adapted to create optimally esthetic tooth morphology, they

need frequent repair. We therefore prefer to use the more durable porcelain veneers,¹⁴⁻¹⁶ except for composite “corners” on canines in lateral incisor positions. Porcelain veneers can even be added after a retention period or after occlusal adjustments of the functional occlusion by selective grinding. Porcelain veneers on the canines and first premolars (Fig. 9), or on the central incisors if these teeth need to be widened or elongated, are more expensive for the patient than grinding or composite build-ups, but they compare favorably with the cost of restorations on single-tooth implants.²² Furthermore, lifetime maintenance of composite resin build-ups may be more expensive than one would expect. The porcelain veneers have shown long-term durability and excellent esthetics, even if the gingival margin retracts with time.^{15,16} Light reflected on porcelain veneers appears normal, in contrast to ceramic crowns and porcelain crowns fused to gold, where the shadows of incoming light tend to produce dark backgrounds.^{15,16}

Given our recent successful experience, the customary contraindications for space closure should be reconsidered.¹ Agenesis of lateral incisors in Class III malocclusions, especially in cases with narrow maxillae and pronounced spacing (such as Case 1), has traditionally been regarded as an inarguable indication for space reopening and prosthetic rehabilitation. The reopening of spaces supposedly facilitates maxillary arch expansion and provides dentoalveolar compensation with significant profile improvement. Nevertheless, both Class III malocclusion cases shown here (Figs. 1-6), like other cases to be reported in a further article in this series, demonstrate that space closure can be a valuable alternative for careful and detailed orthodontic treatment, providing long-term stability after appliance removal (Fig. 1). Recent advances in miniscrew techniques may improve anchorage control in these cases.

Lateral incisor agenesis patients with excessive gingival display in smiling, especially young ones, should not be treated with space reopening and lateral incisor implant placement. It is inconceivable that such a technique can achieve the long-term occlusal, gingival, and periodontal results in the esthetic zone that are seen with space clo-

sure^{1,24} (Fig. 1). Even unilateral space closure, which has long been ruled out in a patient with only one missing lateral incisor, can provide a satisfactory outcome from both the esthetic and functional^{25,26} points of view when coupled with cosmetic finishing (Figs. 7-9).

Conclusion

This article has described how to further improve clinical results using space closure and cosmetic finishing in patients with missing maxillary lateral incisors. The following factors have been considered:

1. Natural marginal gingival contours (high-low-high) can be achieved by selective extrusion and intrusion of the canines and first premolars, respectively.
2. Restoration of intruded first premolars with composite resin build-ups or porcelain veneers is necessary to reshape such teeth to resemble natural canines and to produce a balanced smile.
3. Composite build-ups may also be required on the central incisors for two reasons: the canines cannot be ground beyond the diameter of the roots and may be too wide for the existing central incisors, and the patient's incisor display with relaxed lips is often inadequate.
4. Attention to achieving correct maxillary arch-form and torque of the posterior teeth will ensure a full and radiant smile.
5. Enamel-bonded porcelain veneers provide improved esthetics with less need for maintenance than composite resin build-ups.
6. The major advantages of space closure are that treatment is finished at an early age, that the result is permanent, and that optimum gingival and periodontal health can be preserved, with later modifications occurring in synchrony with the patient's own teeth.
7. For these reasons, space closure is particularly indicated in agenesis patients with gummy smiles.
8. A Class III malocclusion (even with a narrow maxilla) is not a contraindication for space closure. Treatment may be more difficult, but a natural-looking result is possible with good cooperation.

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