

Fiber-Reinforced Composite Space Maintenance for Anterior Implant Therapy

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Dental implants, like ankylosed teeth, do not follow the growth of the facial bones. Considering the risk of apical displacement, therefore, implants are contraindicated until the completion of maxillary and mandibular bone growth.¹⁻⁵ Long-

term space maintenance from the end of the orthodontic treatment until implant placement can be difficult to manage.

Removable Hawley-type appliances rely on strict patient cooperation and do not always provide rigid retention, sometimes requiring a second orthodontic finishing phase before implant placement. Bonded Maryland bridges have been used to replace missing lateral incisors, but are relatively unesthetic and have questionable survival rates, due to the low bond strength between the metalwork and the etched enamel.⁶⁻¹⁰ Bonded lingual retainers with acrylic pontics are more esthetic and com-

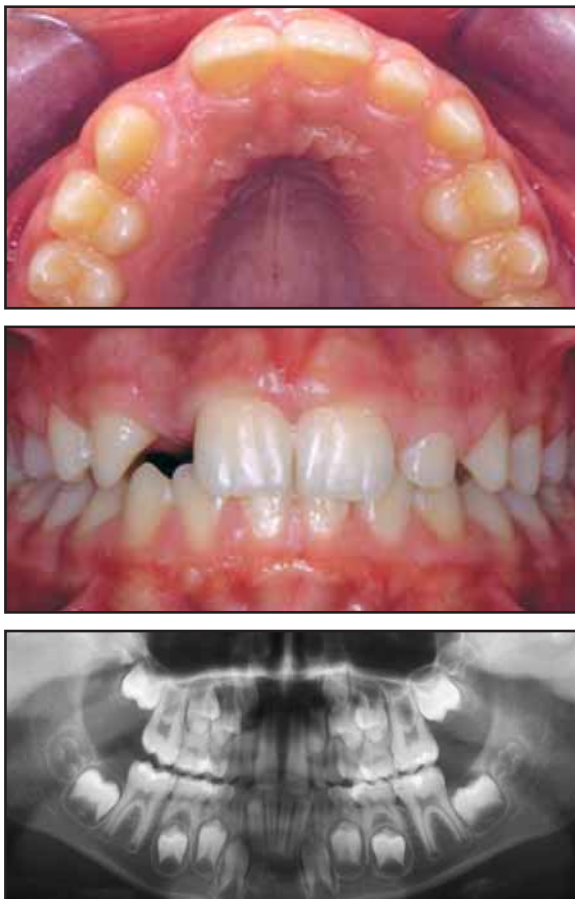


Fig. 1 Patient with congenitally missing upper right lateral incisor after initial orthodontic treatment leaving 6.5mm of interradicular and intercoronal space.

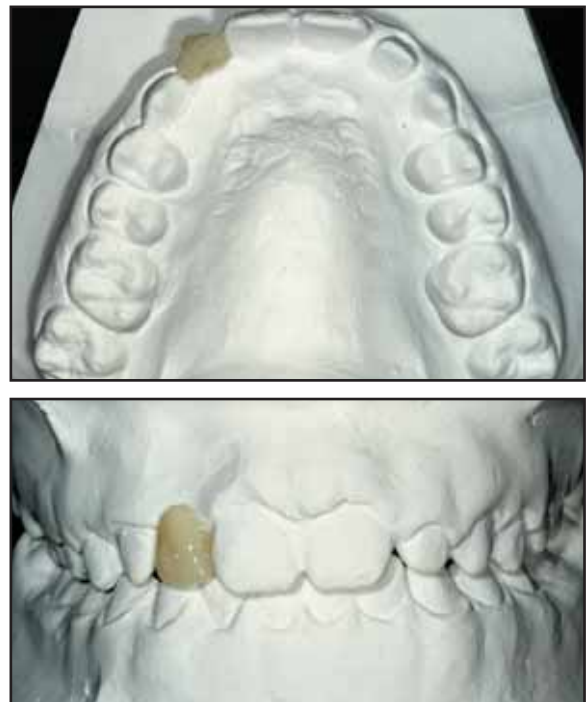


Fig. 2 Artificial tooth fabricated on working cast from composite material fully compatible with FRC.

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fortable than Hawley retainers and more practical and inexpensive than fixed prosthetic restorations, but are only suitable as short-term replacements for missing teeth.^{11,12}

Fiber-reinforced composites (FRCs) can be combined with bonded prefabricated 3-3 retainers or esthetic acrylic bridges for long-term space maintenance when implant therapy is planned at the end of the growth period.^{10,13-16} This article illustrates such a technique.

Procedure

In a patient with a congenitally missing upper right lateral incisor, a 6.5mm interradicular and intercoronal space was left at the completion of



Fig. 3 Occlusal contact points checked and marked with articulating paper. Note adequate space for FRC between upper and lower anterior segments.

orthodontic treatment, with good parallelism of the adjacent teeth (Fig. 1). Space for bonding a long-term FRC with an artificial pontic was provided between the upper and lower anterior segments, to prevent wear and consequent breakage of the fiber. The procedure is as follows:

1. Take alginate impressions of both arches, and pour plaster casts.
2. Fabricate an artificial tooth on the appropriate cast using a composite material that is fully compatible with the FRC (Fig. 2). Follow the shape and color of the patient's contralateral incisor. If the contralateral tooth is missing, model the pontic on the proportions of the central incisors.
3. Use articulating paper to check and mark contacts with the opposing arch on the working casts and in the mouth (Fig. 3).
4. Cut a suitable length of fiber ribbon with a scissor (Fig. 4).
5. After placing a rubber dam, transfer the pontic to the mouth, and affix it to the adjacent teeth with a light-cured flowable composite.
6. Make a palatal horizontal groove in the artificial tooth to accommodate the fiber and composite.
7. Etch the lingual surfaces of the teeth to be bonded with 37% phosphoric acid for 30 seconds. Copiously rinse these areas and dry them, taking care to preserve the articulating marks on the occlusal contact points.



Fig. 4 Fiber ribbon cut with scissor.

8. Apply the primer to the lingual surfaces. Bond the fiber ribbon to the teeth with the flowable composite, nudging the fibers up or down if necessary to avoid the marked contact points.

9. Check the length of the fiber ribbon, and trim the ends if needed. Apply the fully compatible composite to the fiber, and cure it with a halogen lamp, one tooth at a time.

10. After removing the rubber dam, check the occlusion.

Instruct the patient to avoid chewing hard foods and to meticulously clean the teeth adjacent to the pontic. Recheck the patient every six months (Fig. 5). If any fiber has been exposed, repair the FRC; if the color of the pontic has changed, modify the superficial layer of composite.

Case Report

A 12½-year-old male in the mixed dentition presented with congenitally missing upper lateral

incisors (Fig. 6). Orthodontic space opening for later implant therapy was planned because of the patient's concave profile, maxillary spacing, and relatively small teeth.¹⁷

The upper permanent canines were allowed to erupt. Once the deciduous canines had exfoliated, maxillary brackets were bonded to produce 7mm of interradicular and intercoronal space, with good parallelism of the adjacent teeth and adequate space for FRC between the upper and lower anterior segments.



Fig. 5 Satisfactory space maintenance two years after FRC bonding.



Fig. 6 12½-year-old male patient with congenitally missing upper lateral incisors before treatment.

After the orthodontic space opening, two composite pontics were bonded with FRC as described above. Two years after bonding, the esthetic result had remained stable (Fig. 7). Although no periodontal problems could be detected, the patient was repeatedly cautioned about his oral hygiene, and an in-office hygiene program is planned.

Discussion

FRC adhesives have high retention rates because they are identical to composites that are commonly used in orthodontics. The fiber reinforcement adds rigidity and strength¹⁶; layers of fiber can be added later to change shape or color, or to improve stability. It is important to fabricate the artificial tooth from compatible composite material rather than acrylic resin, which tends to debond easily⁹ and to change color unpredictably.



Fig. 7 Stable space maintenance two years after FRC bonding.

FRCs have been shown to maintain the space created by orthodontic treatment without relapse.¹⁸ Distal movement of the canine will offset an average 1% loss of crest thickness in a missing lateral incisor site during a long space maintenance phase, so that subsequent implant placement will not be jeopardized.¹⁸

The survival rate of 29 glass FRC fixed partial dentures, in patients who required replacement of one to three missing maxillary or mandibular teeth, was 75% at a mean 3.5 years after bonding, with a mean survival period of 4.7 years.¹⁹ Freilich and colleagues showed that a unidirectional, preimpregnated FRC could be used to make various bridges that would last four years or longer, as long as a high-volume substructure was used.²⁰ More long-term studies of FRCs are needed, however, because some patients do not complete their growth until years after their initial orthodontic treatment—in male patients, as late as age 25.

Conclusion

We have achieved good results and patient satisfaction by treating cases of congenitally missing lateral incisors or incisor trauma as described in this article. FRCs provide a well-accepted method of space maintenance, avoiding the need for a second phase of orthodontic treatment before implant placement. They can be reliably expected to last until the end of the growth period, although they must be checked periodically for wear and discoloration. FRCs can also be used as temporary prostheses during the osseointegration of permanent implants.

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