

# Consequences of Poor Oral Hygiene During Clear Aligner Therapy

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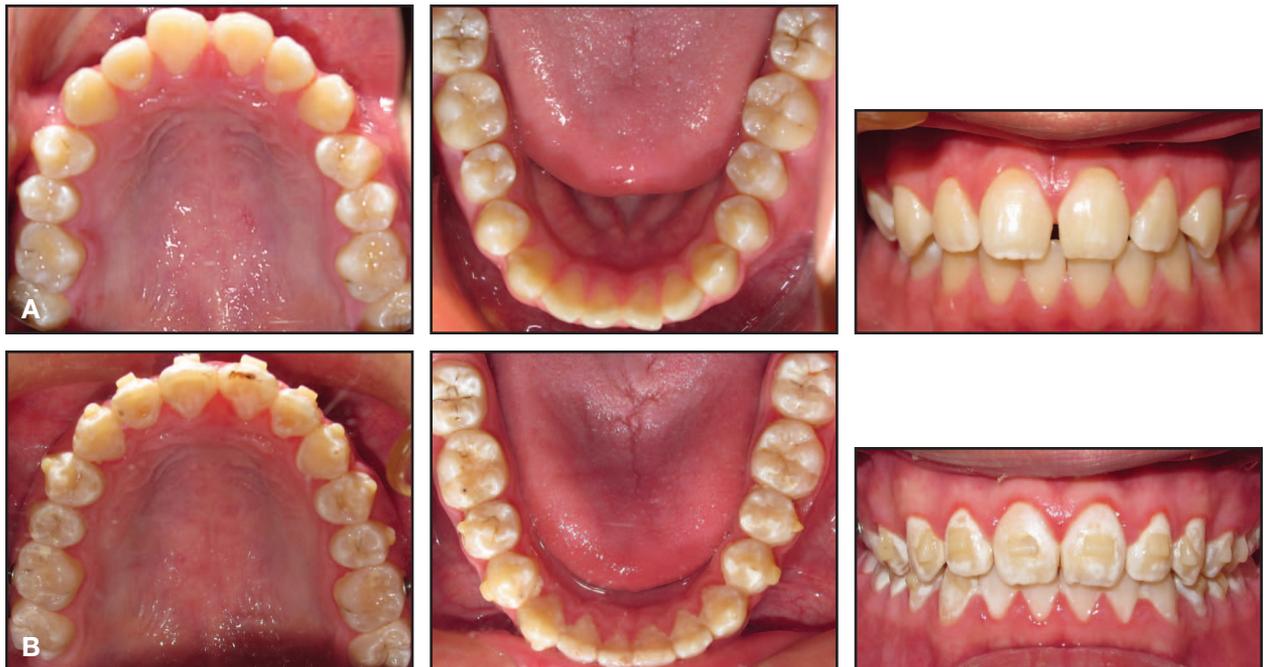
**W**hile the use of clear aligners has become increasingly common in orthodontic therapy, information regarding decalcification or caries in patients undergoing aligner therapy has not been widely disseminated. Although the general assumption is that these appliances are hygienic by design, perhaps it is an assumption that needs to be questioned.

Invisalign\* and other clear aligner trays are usually prescribed to be worn about 22 hours per day for optimal results. A plastic aligner or vacuum-formed retainer is a protective environment that

limits the flow of saliva, negating saliva's natural cleansing, buffering, and remineralizing properties. Additionally, the usual cleansing activities of the lips, cheeks, and tongue are interrupted, allowing further entrapment and development of plaque under the appliances.

Most patients will drink liquids without removing their aligners, providing the opportunity for pooling of these liquids beneath the trays. This

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**Fig. 1 Case 1. A.** 14-year-old male patient during aligner therapy. **B.** Significant decalcification observed around bonded attachments, upper incisal edges, and lower first-molar cusp tips after 10 weeks without oral hygiene.



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is especially problematic if the liquid is a highly acidic, cariogenic soft drink, sports drink, flavored water, or fruit juice. Birdsall and Robinson described a former orthodontic patient with a lower vacuum-formed retainer who consumed five or six soft drinks per day and demonstrated significant decalcification and caries in normally self-cleansing areas, such as cusp tips and incisal edges.<sup>1</sup> Sheridan and colleagues recommended warning of the potential side effects of acid-containing beverages, illustrating their point with a patient whose incisal edges had demineralized due to frequent consumption of soft drinks while wearing a plastic surgical splint.<sup>2</sup>

Some patients do not bother to remove their aligners during meals because they feel too busy, lazy, or embarrassed, or because there is no clean place to leave the trays. Patients wearing aligners fitted with composite pontics may be especially reluctant to remove their aligners in the presence of others. Any food allowed to accumulate within the plastic trays can be quickly converted into acid-producing plaque.

If these factors are compounded by poor oral hygiene, a rapid demineralization—often in areas

not normally considered prone to caries—can result in greater dental damage than might be found in a non-compliant brusher with fixed appliances. Here are several examples of the atypical demineralization patterns we have seen in aligner patients, both teenagers and adults.

### **Case 1**

A 14-year-old male patient proved compliant enough with aligner wear that he was given five sets of trays in the middle of his treatment (Fig. 1A). Upon his return to the office 10 weeks later, we noted obvious decalcification around the bonded attachments, the upper incisal edges, and the lower first-molar cusp tips (Fig. 1B). He admitted that he had not brushed his teeth since his previous appointment.

### **Case 2**

A teenage male patient developed severe gingival inflammation and several brown areas of decay of the incisal edges and cusp tips over a four-month period of aligner wear (Fig. 2). He re-



**Fig. 2 Case 2.** Teenage male patient with severe gingival inflammation and incisal-edge and cusp-tip decay after four-month period of eating and drinking without cleaning aligners.

ported that he did not remove the trays to eat lunch at school and consumed several sodas after school without cleaning his aligners.

### Case 3

A 47-year-old female patient (Fig. 3A) did not want to remove her upper aligner, which incorporated a pontic for the missing left central incisor, in front of others while eating. As a result, she developed the habit of leaving her aligner trays in place nearly 24 hours a day. There was no evidence of decalcification eight months into treatment, when refinement records were taken (Fig. 3B), but significant decalcification developed during her second year of treatment (Fig. 3C).

### Case 4

A 33-year-old female patient wore her aligners while eating, removing them only to brush once a day (Fig. 4A). Although some incisal edges of the upper anterior teeth had become thin and irregular after nine months of treatment, decalcification did not become apparent until two months later (Fig. 4B).

### Discussion

The ability to remove aligners clearly aids in oral hygiene by providing normal access to all tooth surfaces, virtually eliminating the need for special flossing and brushing aids. On the other hand, aligners limit the ability of saliva to cleanse,



**Fig. 3** Case 3. A. 47-year-old female patient before treatment with aligner incorporating pontic in place of upper left central incisor. B. No decalcification noted after eight months of treatment. C. Significant decalcification seen during second year of treatment due to patient's habit of leaving aligners in place during meals.

buffer, and remineralize the tooth surfaces, in addition to preventing the mechanical actions of the tongue and cheeks in removing plaque. Moreover, the tight, form-fitting plastic aligners or retainers introduce new surfaces for the potential adhesion of plaque biofilm. Plaque forms not only on the enamel surfaces, but also on the inner surfaces of the plastic, where it can accumulate particularly in the cusp-tip and incisal-edge areas unless aggressive efforts are made to remove it. This explains the unusual appearance of cusp-tip and incisal-edge demineralization in several of the cases shown here.

A recent study found that a significant amount of bacteria and biofilm remained on the surfaces of thermoplastic orthodontic appliances even when proper oral hygiene was performed.<sup>3</sup> The authors attributed this effect to the availability of niches and reservoirs for bacteria on the irregular inside surfaces of the aligners. Another study noted that indentations for attachments offer further areas of opportunity for bacterial colonization and conse-

quent biofilm formation, and that the cusp tips can also be trouble spots due to the difficulty of access for cleaning.<sup>4</sup>

### Recommendations

Orientations for aligner therapy should emphasize that patients *must* remove their aligners when eating. If an Invisalign candidate is considered a high risk because of such factors as a high pretreatment plaque score, existing decalcification, or a history of caries, the practitioner may want to recommend that the patient use the aligners as fluoride trays. Any practice that routinely gives a patient four or five sets of aligners and schedules a return visit in eight to 10 weeks may need to defer this option until the patient has proven trustworthy in oral hygiene, since decalcification from a cariogenic environment beneath the aligners can occur quite quickly. The orthodontist may also consider doubling the number of aligners indicated in the treatment plan, so that the patient



**Fig. 4** Case 4. A. 33-year-old female patient before aligner treatment. B. Sudden appearance of decalcification after 11 months of treatment; patient had removed aligners only once a day for brushing.

changes to a new, clean aligner weekly instead of every other week.

The complete avoidance of foods and drinks containing certain types of acid, high-fructose corn syrup, sucrose, and other sugars—especially sports/energy drinks, sodas, and juices—during aligner wear needs to be stressed. We hope the photographs in this article can serve as visual aids to impress on patients the potential for negative sequelae from poor dietary habits or oral hygiene during aligner therapy.

Our recommended oral-hygiene protocol for aligner patients is as follows:

- Absolutely never eat with the aligners in place.
- Brush the inside of the aligners with water and toothpaste every time the teeth are brushed, paying special attention to the cusp-tip areas and the attachment wells.
- Brush the teeth for two minutes with a soft toothbrush and 2cm of toothpaste three times per day, followed each time by a “toothpaste slurry” rinse: take a small sip of water and swish the mixture around the mouth, filtering between the teeth, then expectorate the mixture, but do not rinse further.<sup>5</sup> (This method leaves some fluoride on the teeth.) Place the clean aligners back in the mouth immediately.
- At night, supplement the normal brushing routine with flossing and a one-minute fluoride mouthwash rinse, then place the aligners back in immediately.
- Any white matter that accumulates in the aligners is plaque and should be removed. Use of an ultrasonic retainer bath or the Invisalign Cleaning

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System\* with cleaning crystals several times per week will cleanse areas where a toothbrush may not reach adequately, such as the cusp tips. (Note: Invisalign specifically advises that denture cleaners should not be used to clean aligners due to FDA warnings about the risk of allergic reaction to persulfate, an ingredient in most denture cleaners.)

- Follow up with the general dentist for professional cleanings and examinations as recommended.

### Conclusion

While Invisalign treatment is inherently more hygienic than traditional fixed-appliance therapy, special attention still needs to be paid to educating patients in proper oral-hygiene techniques and dietary restrictions. Aligner patients—especially teenagers with high pretreatment plaque scores—should be carefully monitored for the development of decalcification or caries.

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