

# Avoiding Demineralization and Bite Alteration from Full-Coverage Plastic Appliances

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**T**here has recently been a flurry of interest among both orthodontists and prospective patients in the use of clear plastic appliances to align teeth without the esthetic drawbacks of fixed appliances. When using any clear plastic appliances, however, the clinician must be aware of their potential to cause demineralization of enamel and serious disruption of the occlusion.

## The Potential for Demineralization

Because of the acidity of certain beverages in our contemporary diet, a potential for enamel decalcification is constantly present. The erosive effects of acid beverages on enamel have been extensively documented, but most of these studies have been limited to the citric acid in fruit juices.<sup>1-3</sup> Nevertheless, the extensive use of soft drinks has proven to be an equally potent erosive agent.<sup>4-6</sup> Although the distributors of sugar-free “diet” soft drinks have promoted the idea that

their products are sugarless and therefore harmless to the dentition, that statement is true only in terms of the carious properties of sugar. Carbonated cola beverages contain as much as 10% phosphoric acid and have a pH of less than 3.0.<sup>4,7</sup> The significance of these figures can be appreciated when one realizes that acid etching for bonding requires the application of a 50% phosphoric acid solution for 30 seconds. Many people sip acid-containing soft drinks throughout the day.

Normally, the flushing and buffering action of saliva and adequate oral hygiene are sufficient to neutralize the decalcification process.<sup>8</sup> If that natural protective process is interfered with, however, the pathological decalcification of enamel can occur—as has been shown when clear plastic appliances are worn full-time<sup>9</sup> (Fig. 1).

Any plastic appliance that covers some or all of the teeth is, in effect, a tray. When fluoride is placed in it, the enamel becomes more resis-



**Fig. 1** A. Appearance of enamel prior to wearing plastic surgical splint that covered incisal edges of maxillary anterior teeth. B. Incisal edges demineralized due to frequent drinking of cola beverage while wearing splint full-time (reprinted by permission<sup>9</sup>).

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tant to decay, and when bleach is placed in it, the teeth become whiter. On the other hand, when acidic beverages are retained in it, it becomes an acid reservoir, causing the enamel to become susceptible to demineralization and subsequent decay. That's one of the reasons that clear plastic Essix\* retainers are intended to be worn only at night, after brushing and flossing.

The risk of demineralization is more severe in the maxillary arch, where gravity does not let the acid-containing fluid drain out.<sup>9</sup> Therefore, we recommend that the maxillary terminal molars not be completely encapsulated with plastic. Because the distal half of the terminal molar does not occlude with the lower arch, the plastic covering it can be cut away, affording at least a distal drain path for any acidic beverage.

Even when this precaution is taken, we believe it is incumbent on the clinician to inform the patient of the potential side effects of acid-containing beverages when wearing any full-arch clear plastic appliance full-time, and to instruct the patient to flush the mouth with water immediately after drinking any such beverage. We also recommend prescribing commercially available daily fluoride rinses. These steps may prevent the incisal edges from being marred by unsightly decalcification.

### Anterior and Posterior Disruption of the Occlusion

Any full-coverage plastic removable appliance that is used to move teeth, or is used as a full-time retainer for extended periods, should be equilibrated. Otherwise, it will cause significant premature occlusal contacts in the posterior teeth

\*Registered trademark of Essix Raintree, Inc., 1071 S. Jeff Davis Parkway, New Orleans, LA 70125.

\*\*Registered trademark of Align Technology, 851 Martin Ave., Santa Clara, CA 95050.

and, in turn, an anterior open bite. According to the "1-to-3" prosthetic concept, every 1mm of bite opening on the terminal molars will induce 3mm of bite opening on the incisors. This is because prior to translation, the initial opening movement from centric relation is purely rotational, with a hinge axis (center of rotation) around the condyles. When a full-coverage plastic appliance is seated, the thickness of the appliance between the terminal molars inevitably causes a hinge-axis interference, and thus a disproportionately larger anterior open bite.

The situation is aggravated when two plastic appliances, upper and lower, are worn simultaneously, because that creates a double thickness of plastic between the terminal molars. Therefore, without equilibration of the plastic appliances, the patient will not have any semblance of an efficient centric occlusion. Additionally, if multiple full-coverage appliances are used in sequence (as in the Invisalign\*\* technique), each one must be equilibrated, thereby compromising the claim of reduced chairtime.

The thermoformed plastic is so thin (about .6mm with either Essix or Invisalign appliances) that any plastic causing prematurities can be easily ground away. Although this will perforate the appliance, it will not affect the structural integrity of an appliance that is thermoformed from a polypropylene-based plastic. Additionally, the perforations will act as drain holes for fruit juices or acid-containing cola beverages.

### A Demonstration

A case with efficient buccal intercuspation and incisal coupling was selected for demonstration purposes. The casts were mounted on a fully adjustable articulator in centric occlusion, and the bite was recorded with the pin on the baseplate (Fig. 2A). Polyvinylsiloxane impressions

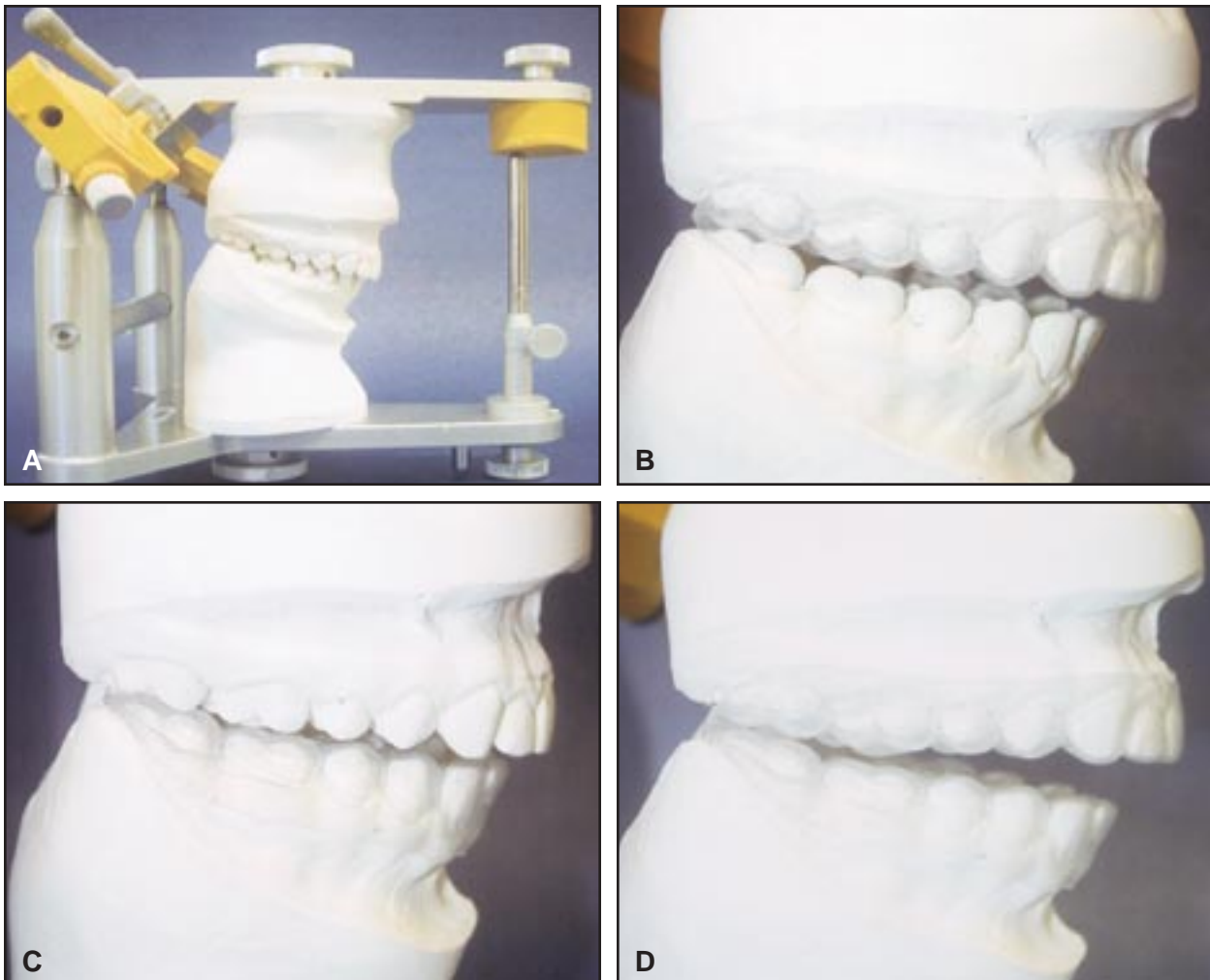
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were taken of each arch with a custom tray and poured with die stone. Full-arch clear plastic appliances were constructed from a 1mm Essix C+ plastic sheet, trimmed 2mm from the gingival margins, with the plastic encapsulating the terminal molars.

The maxillary appliance was placed on the upper arch of the cast mounted on the articulator, and the bite was recorded (Fig. 2B). This appliance was removed, the mandibular appliance

was seated, and the bite was recorded again (Fig. 2C). Then both appliances were seated, and the bite was recorded a third time (Fig. 2D).

Prematurities were established with articulating ribbon (Fig. 3), and each plastic appliance was equilibrated to resolve the observed occlusal and incisal disruptions. The extensive amount of grinding (Fig. 4) required to establish centric occlusion and close the bite to a less alarming level was glaringly obvious (Fig. 5).



**Fig. 2** A. Casts mounted in centric relation on fully adjustable articulator. B. Open bite created with only maxillary full-coverage plastic appliance in place. C. Open bite created with only mandibular full-coverage plastic appliance in place. D. Open bite created with both appliances in place.

It may be comforting to believe that an induced anterior open bite will disappear once the appliances are removed, but there are no data to support this belief. If the bite doesn't "settle in", then a fixed appliance would probably be required to resolve the discrepancy, since vertical positioning of teeth is difficult to achieve with removable plastic devices. The clinician would then be in the embarrassing position of having to solve a problem generated by an esthetic plastic appliance with a fixed appliance, which is exactly what the patient didn't want in the first place.

This dilemma is avoidable—simply equilibrate full-arch clear plastic appliances when they are initially seated. If only one device is needed, equilibrate it. If upper and lower appliances are worn concurrently, place one and equilibrate it. Then place the other and equilibrate it until reasonable occlusal and incisal bites are established.

### Conclusion

Clear plastic appliances should be reserved for responsible adults who have mild-to-moderate arch discrepancies and are reluctant to wear fixed appliances. Because these appliances can resolve the adult patient's chief complaint, they do serve a purpose. Nevertheless, the clinician



Fig. 3 Prematurities marked with articulating tape.



Fig. 4 Equilibration required to establish more efficient buccal occlusion.



Fig. 5 Occlusion with both plastic appliances in place after equilibration.

should be aware of the potential for demineralization and the occlusal and incisal disruptions that these full-time appliances will generate, no matter what their purpose. Patients can then be fully informed, and the steps required to nullify, or at least diminish, these effects can be taken.

Orthodontists work with a biomechanical web—you can't pull one thread without twitching another. The conditions induced by constant wear of clear plastic appliances, stated in this article, are based on valid observation, but are not the results of a controlled study. Research is currently under way at the Department of Orthodontics, Louisiana State University School of Dentistry, to quantify and qualify these valid observations and to generate a report on the long-term sequelae.

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