# Enamel Microabrasion Followed by Dental Bleaching for Patients after Orthodontic Treatment—Case Reports

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# ABSTRACT

This article reports clinical procedures used to remove residual bonded resin and enamel stains following bracket "debonding" at the conclusion of orthodontic treatment. A water-cooled fine-tapered diamond bur was used for resin removal, followed by enamel surface finishing using a commercially available microabrasion paste. It was noted that residual tooth coloration remained yellowish because of enamel translucency; the yellow dentin shade showed through. Additional tooth shade lightening was achieved using carbamide peroxide dental bleaching solution in custom-formed trays. This report describes a safe and effective technique that optimizes tooth appearance at the conclusion of orthodontic therapy. Mechanical resin removal, enamel microabrasion, and tooth bleaching are employed.

# CLINICAL SIGNIFICANCE

A combination of treatment methods are sometimes required for the best esthetic result. After orthodontic treatment, mechanical resin removal followed successively by enamel microabrasion and tooth bleaching can yield ideal long-lasting improvement.

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#### INTRODUCTION

A dhesive bonding materials and methods used to attach orthodontic hardware have come a long way since routine banding of anterior teeth and premolars, rather than bracketing, became obsolete. The bond created between resin attachment materials and superficial enamel, resulting from the acidetch technique, is so sure that debonding such materials at the conclusion of treatment can be problematic.<sup>1–7</sup> Zarrinnia and colleagues observed that the adhesive used and the methods employed for the removal of a bracket and residual resin influence enamel surface status and appearance after debonding.<sup>2</sup>

Various techniques have been proposed for removing bonded "luting" resin from teeth after

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orthodontic therapy.<sup>1-7</sup> Most practitioners agree that some type of mechanical cutting or abrading the thin residual resin layer is usually appropriate, with great care used so as not to nick, abrade, or gouge the enamel. Mechanical resin removal, regardless of how careful the resin is cut, usually results in some superficial enamel damage. Enamel microabrasion, analogous to dermabrasion on skin surfaces, was developed to improve surface texture, remove superficial intrinsic tooth stains, and to repair enamel decalcification and texture defects.<sup>8-10</sup> Using enamel microabrasion compounds, enamel surfaces become smooth and lustrous and maintain a glasslike sheen as years pass after treatment. When there is a proper case selection and when the enamel microabrasion is completed conservatively, enamel loss is clinically insignificant and unrecognizable.

The use of chemical agents to remove superficial enamel stains is quite effective, and the treatment results are permanent.<sup>11</sup> Regardless of the acid/abrasive materials used, much care should be exercised to preserve as much enamel thickness as possible. Even with such care, the slightest reduction in enamel thickness<sup>12–17</sup> in some cases causes treated teeth to appear darker or more yellow. That type of discoloration occurs because the enamel not only can vary in color, but is translucent and reveals the underlying dentinal coloration showing through.

In 1989, Haywood and Heymann first described tooth bleaching using hydrogen peroxide solutions placed in vacuum-formed custom trays, applied personally by the patient.<sup>18</sup> Since then, an entire industry within the profession of dentistry has arisen: tooth lightening, also called dental bleaching.

This report describes tooth color improvement achieved in patients using enamel microabrasion followed by dental bleaching and resin-based composite repair of a fracture site, after the initial removal of residual bonded orthodontic attachment resin. Long-term results are presented.

## CASE REPORT 1

After the removal of her orthodontic appliances, a teenager had residual bonded resin on her central incisors (Figure 1A). In addition, the patient also had generalized idiopathic white enamel dysmineralization defects. An oblique coronal fracture involving dentin and enamel, without penetration into the pulp chamber, was noted on the maxillary left central incisor (Figure 1A).

After cleaning the teeth with dental prophylaxis paste, a fine-tapered diamond bur (3195 FF, KG

Sorensen Indústria e Comércio Ltda., Barueri, São Paulo, Brazil) was used to remove the resin remnants (Figure 1B). The bur was also used to slightly abrade the white enamel defects on facial surfaces of the anterior teeth and first premolars.

The teeth were then isolated with a rubber dam and ligated with dental tape. A layer of petrolatum was placed between the rubber dam and the gingival tissue to augment the protection afforded by the rubber dam. The patient wore eyeglasses for protection and much care was exercised by the dentist and the assistant to avoid acid contact. Whiteness RM (FGM, Joinville, Santa Catarina, Brazil) microabrasion compound was compressed upon the enamel surfaces using a rubber cup with enclosed brush bristles, specifically developed for this purpose (Ultradent Products, Inc., South Jordan, UT, USA). The cup was mounted on a slow-speed, 10:1 gear reduction handpiece. Therefore, the compound was applied with high torque, but very slow speed, to prevent splattering.

The compound was applied three times on each of the three teeth for 60-second intervals. The teeth were rinsed with water/air spray after each application. The teeth were then dried with the air syringe and polished with fluoridated prophylaxis paste. A 2% neutral-pH



Figure 1. A, Teen-age girl, after orthodontic treatment, with white enamel stain and resin residue on the maxillary and mandibular teeth. B, Application of fine-tapered diamond bur on facial surfaces of the maxillary and mandibular incisors and premolars. C, Microabrasion compound is applied. D, After application of the enamel microabrasion compound. E, Placement of soft vinyl, custom-fitted trays containing carbamide peroxide gel. F, After enamel microabrasion and tooth bleaching, resin-based composite restoration.

sodium fluoride gel was applied on the treated enamel surfaces and left in place for 4 minutes.

One month after the completion of microabrasion, the patient showed unspotted, lustrous enamel, but the teeth had a yellow intrinsic appearance (Figure 1D). It was decided to initiate a course of "home bleaching," using a 10% carbamide peroxide-based product (10% Whiteness Perfect [FGM]) in custom-vacuum formed thin flexible trays. Maxillary and mandibular alginate impressions were taken and the custom trays vacuumformed in the usual manner. At the next appointment, the patient was instructed to place a small drop of the bleaching solution into each tooth section of the tray, from first premolar to first premolar. The trays were inserted and the excess bleaching solution exuding at the

margins was wiped away using a dental brush. The patient was advised to use the tray for 4 hours daily (Figure 1E). Four weeks later, topical applications of 2% neutralpH sodium fluoride gel were accomplished, for 4 minutes daily.<sup>14,18,19</sup> Seven days after cessation of bleaching, the left central incisor was restored with a resinbased composite (Opallis, FGM) (Figure 1F).

#### CASE REPORT 2

One year after the completion of orthodontic therapy, a 15-year-old girl had resin remnants and surface texture irregularities on her anterior teeth (Figure 2A). After the removal of the residual bonding resin as previously reported, enamel microabrasion of the maxillary and mandibular anterior teeth was completed using Prema Compound (Premier Dental Products Company, Plymouth meeting, PA, USA). In this case, the microabrasion paste was used for 3- to 30-second applications on each tooth. Afterward, home tray tooth bleaching with carbamide peroxide (Opalescence 10%, Ultradent Products, Inc.) was completed in 3 weeks. The permanent maxillary left central incisor was then restored using a bonded resin-based composite (TPH, Dentsply Indústria e Comércio Ltda., Petrópolis, Rio de Janeiro, Brazil)<sup>9</sup> (Figure 2B).

## DISCUSSION

Finishing of enamel surfaces and removal of bonding resin is important to avoid staining of the resin or the resin/enamel interface. One also aims to eliminate niches for bacterial colonization. The goal is to reestablish the best enamel surface without introducing iatrogenic damage. The use of a water-cooled fine-tapered



Figure 2. A, Teenager with residual resin and surface irregularities in the anterior teeth. B, Ten years after resin removal, enamel microabrasion, and tooth bleaching.

diamond bur has been proposed, followed by enamel microabrasion,<sup>2,9,10,19,20</sup> yielding a rapid removal of resin material, an unnoticeable damage to the enamel, and a smooth and lustrous enamel surface.

Questions often arise about the amount of enamel loss during the above procedures. In 2001, Sundfeld and colleagues conducted a study using common optical microscopy under polarized light and found enamel loss varying from 25 to  $200 \,\mu$ m, corresponding to 1 and 10 1-minute product applications, respectively.<sup>21</sup>

During resin removal with the finetapered diamond bur, all care was taken to avoid excessive enamel loss. Using a dental probe with digital pressure, the facial surface was rubbed to see if gray marks occurred. With most resins, the filler particles scratch the metallic hand instrument and markings are seen on the adhering resin. Some authors report that they consider resin removal achieved when the tooth surface seems smooth and free of composite to the naked eye, under the light of an operative lamp.<sup>22,23</sup> Enamel microabrasion is an ideal technique to complete surface finishing because the diamond bur produces grooves on the enamel surface that correspond to the size of the abrasive diamond particles. Such findings have also been reported by other investigators.<sup>2,4,24</sup> Practical experience, over many years, shows that overall enamel loss after bonding and debonding of orthodontic brackets and other attachments is clinically insignificant in relation to enamel thickness of 1,500 to 2,000  $\mu$ m.<sup>25</sup> Such enamel loss is also not recognizable clinically.

In case 1, diamond bur "microreduction" during residual resin removal also initiated the removal of white enamel dysmineralization spots, which were completely removed during microabrasion. Some have recommended that initial mechanical enamel microreduction should be considered for removing intrinsic, but superficial, enamel discoloration.9,10,19,21,26-29 Because commercially available enamel microabrasion compounds have a relatively low acid concentration, for safety considerations, mechanical initiation of enamel reduction hastens the procedure considerably without affecting the final outcome.

Final enamel appearance after debonding should be assessed in relationship to natural dried enamel surfaces of adjacent teeth. Examination of tooth appearance both in a wet and dry state is important because reflection and refraction phenomena are altered in the presence of saliva.<sup>30</sup>

Teeth subjected to enamel microabrasion develop a smooth

glasslike luster. The surface sheen is maintained over the years by the constant intraoral demineralizaton/remineralization phenomena. A dense, compacted mineral layer remains because of the combined erosive and abrasive action of the compound on enamel surfaces.<sup>31,32</sup> It has also been shown that such surfaces show a higher resistance to demineralization and *Streptococcus mutans* colonization.<sup>33–35</sup>

Since 1990, Sundfeld and colleagues have verified the clinical and laboratory efficacy of the microabrasion technique using hydrochloric acid mixed with pumice<sup>8</sup>—and also, using the Prema Compound<sup>36</sup>—and its use in conjunction with diamond bur initiation.<sup>9,10,21,26–29</sup> The newer microabrasion compounds (Opalustre and Whiteness RM, FGM) have been shown to give equivalent clinical results.

Because enamel microabrasion results in microreduction of the adamantine surface,<sup>9,26,31</sup> treated teeth may acquire a darker or yellowish color. Enamel is translucent and, therefore, underlying dentinal coloration shows through. In such cases, tooth bleaching in custom trays can be considered.<sup>18,28</sup> Bleaching can be completed prior to bonded resin-based composite repair of teeth with coronal fractures. In that way, color matching can be assessed much more accurately. In cases in which dentin is exposed, temporary dentin coverage can be achieved with a coating of resin-modified glass ionomer restorative cement or liner, or with an interim bonded resin-based composite layer.

## CONCLUSION

After removal of bonded orthodontic appliances, certain procedures can be considered with the goal of achieving an ideal enamel surface layer in structure and appearance. Judicious use of fine grit diamond burs for mechanical resin removal and initiation of enamel microreduction is the first consideration. Enamel microabrasion using acid/abrasive compounds completes surface finishing and permanently removes texture and superficial coloration defects. In many cases, the final tooth appearance can be further augmented, with long-lasting results, by dental bleaching using routine methods.

#### DISCLOSURE

Dr. Croll has financial interest in Prema Compound by virtue of a licensing agreement with Premier Dental Products Company. The authors have no other financial interest in the companies whose materials are included in this article.

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