Megabrasion: A Conservative Strategy for the Anterior Dentition

Pascal Magne, DMD

Continuous developments in adhesive restorative techniques, tooth whitening procedures, and restorative materials have significantly broadened the initially defined spectrum of indications for composite restorations. These developments have thereby contributed to the achievement of one of the major objectives of conservative restorative dentistry — the maximum preservation of sound tooth structure. In order to optimize the application of modern composite resin technology, mastering the basic principles of natural aesthetics is an essential prerequisite. The learning objective of this article is to discuss the etiology of enamel discoloration and conservative treatment strategies, including microabrasion and masking procedures. Emphasis is placed on a simple procedure — the megabrasion technique — which does not depend extensively on the artistic skills of the operator. It represents a useful and predictable approach for the elimination of white opaque stains on the enamel and yellow-brown enamel discolorations.

A wide range of techniques for restoration of discolored dentition is currently evaluated and the results documented in the dental literature. Chemical treatment of discolored dentition represents successful therapeutic modalities. When combined with the freehand application of composite resins, dramatic clinical conditions may be efficiently and economically treated. These conservative treatments eliminate the requirement of more invasive procedures, particularly in the case of single

Pascal Magne, DMD, is Visiting Associate Professor, Minnesota Dental Research Center for Biomaterials and Biomechanics, School of Dentistry, Department of Oral Science, University of Minnesota, Minneapolis, Minnesota. He is also Lecturer, Division of Fixed Prosthodontics and Division of Restorative Dentistry and Endodontics, University of Geneva, Switzerland.

Address correspondence to:

Pascal Magne, DMD
School of Dentistry, Biomaterials and Biomechanics
University of Minnesota
16-212 Moos Tower
515 Delaware Street SE
Minneapolis, MN 55455-0329

E-mail: pascal@web.dent.umn.edu
Fax: 612-626-1484

Table
Conservative Strategies: Clinical Circumstances and Recommended Treatment Options

Clinical Circumstances / **Treatment:**	Mild fluorosis. White & brown.	Mild fluorosis. White.	* Injury during developing. White & brown spots and surface defects.	* Injury during developing. White & brown spots.	Injury during developing. White spots.
Microabrasion[10]	?	?			
Bleaching[12]					
Megabrasion					

* Preliminary bleaching to eliminate yellow-brown discolorations prior to megabrasion.

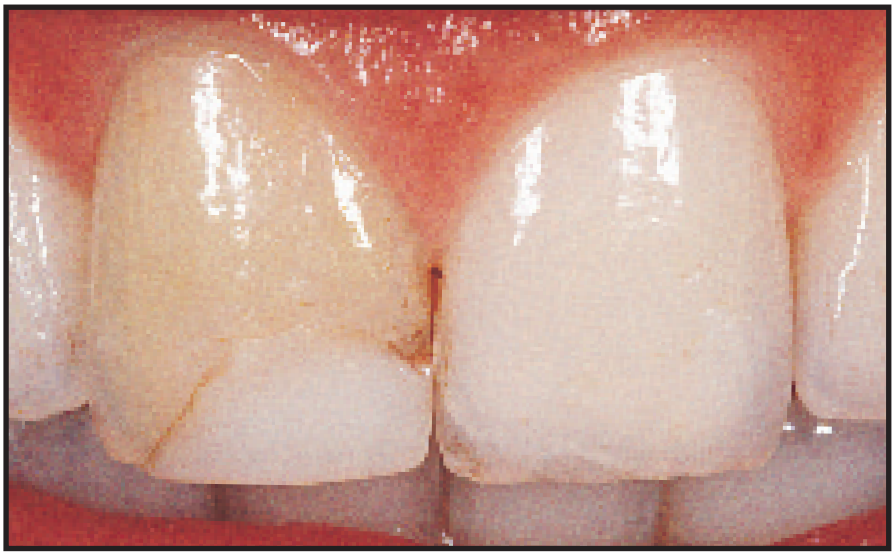

Figure 1. Case 1. Treatment of a single tooth. Preoperative view of the maxillary anterior dentition exhibits an existing Class IV restoration on discolored nonvital tooth #8.

Figure 2. Palatal view at the completion of the internal bleaching procedure. The coronal cavity was filled with glass-ionomer cement.

Figure 3. Postoperative clinical view following the replacement of the Class IV restoration.

Figure 4. A very simple but efficient stratification[3] was used to simulate the sophisticated effects of the reference tooth, #9.

Figure 5. Glass-ionomer cement was maintained inside the pulp chamber and removed only superficially to allow composite placement.

tooth restorations in young patients in the aesthetically important anterior region (Figures 1 through 5). Utilization of the most recent generation restorative materials which successfully simulate enamel and dentin is a prerequisite in these restorations.[1,2] Uncomplicated and innovative composite layering techniques have also been developed to replicate the fine details of natural dentition; the so-called "sandwich technique"[3] is one of these innovative methods (Figures 6 and 7). In this case, white intensive colorants (Kolor Plus, Kerr, Orange, CA) were placed between enamel-like and translucent composite layers. Finally, for patients with high levels of expectations, particularly when extensive procedures are involved, utilization of laminate veneer restorations is indicated (Figures 8 and 9).[4] This last treatment modality provides the highest potential for a successful global integration of harmonious aesthetic characteristics. Conservative treatment strategies will continue to evolve, inevitably, and they contribute to the current "crescendo" of hard and soft tissue preservation. The purpose of this article is to describe specific applications which may be added to the classification of conservative treatment modalities. These innovative treatments have been developed in response to the need for a more effective treatment of the specific but commonly encountered clinical findings — the presence of either white or yellow-brown enamel discolorations.

The complete mechanical eradication of the lesion ... is the most efficient way to master the white enamel spots.

CLINICAL ASPECTS AND ETIOLOGY OF WHITE AND YELLOW-BROWN ENAMEL DISCOLORATIONS

White and yellow-brown enamel discolorations are clinically encountered in the form of bilateral, extensive, and superficial

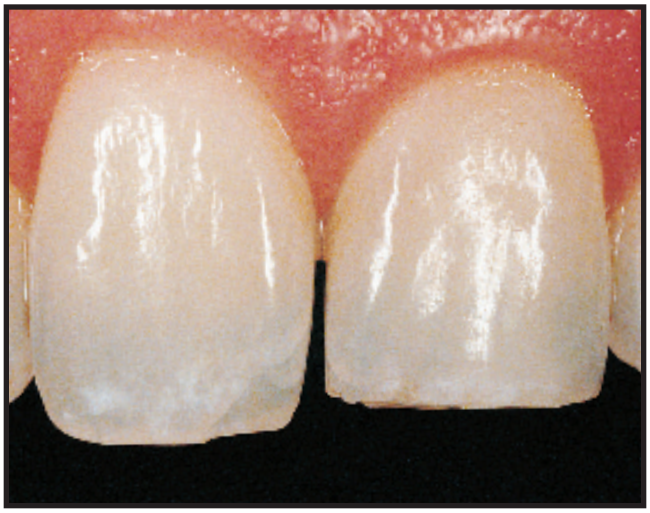

Figure 6. Case 2. Modified stratification using the "sandwich technique." The patient demands reproduction of the enamel white spots.

Figure 7. White intensive colorants were placed between enamel-like and translucent composite layers.

Figure 8. Case 3. Preoperative clinical facial view demonstrates a severe loss of tooth substance following trauma.

Figure 9. Postoperative view. Two laminate veneers have been placed on central incisors to recreate anatomy, function, and aesthetics.

lesions, related primarily to moderate fluorosis (ingestion of fluoride ≥ 4 mg/l/day).[5] Another frequent representation of these discolorations are the unilateral lesions, which have also been described as "idiopathic white spots." However, several etiologic circumstances may result in such color changes, and the patient's history generally reveals either an injury to the primary dentition,[6] a periapical inflammation of primary teeth[7] (initiating "Turner teeth"), or a fracture of the mandible.[8]

White Lesions

The extent of the white lesions may vary from isolated minuscule spots to extended wider areas of the tooth, generally without major anatomic defects of the enamel surface (Figure 10). A previous study by Andreasen et al[9] reported that the origin of such discolorations seemed to be related to a disturbance in the maturation stage of the mineralization of the tooth. This disturbance apparently occurs without the involvement of the enamel matrix formation. Regardless of the etiology, a significant fact remains that the clinically identifiable white area is less mineralized than the surrounding noninvolved enamel.

The lesions created by moderate fluorosis involve only the very superficial layers of enamel.

Yellow-Brown Discolorations Associated with Caries

Some patients, however, present with an indentation, a cavity, in the superficial layers of enamel (Figure 11), which can be explained as having been created by a direct injury to the enamel matrix prior to its complete mineralization. It is thought that the associated yellow-brown aspect may be initiated by the breakdown products of hemoglobin when bleeding occurs during the injury. These hemoglobin breakdown products are subsequently entrapped in the tooth structure during the mineralization process.[6]

Figure 10. Case 4. Lesions caused by injury to developing teeth. Moderate lesions on tooth #8, more extensive on tooth #9.

Figure 11. Superimposed white and yellow-brown lesions that will be further revealed after bleaching (see Figures 14 and 15).

Figure 12. Case 5. Moderate fluorosis. Preoperative view demonstrates "leopard-like" teeth. Microabrasion would be theoretically indicated.

Figure 13. Vital bleaching alone, using a nightguard, was sufficient to eliminate the contrast between the dark and white areas.

TREATMENT MODALITIES FOR MASKING ENAMEL DISCOLORATIONS

Moderate Fluorosis: Microabrasion Versus Bleaching

Since the lesions created by moderate fluorosis involve only the very superficial layers of enamel, the original microabrasion technique is usually indicated.[10] However, clinicians should be aware that microabrasion slightly modifies the surface texture of enamel, and that the resulting smooth microabraded enamel is increasingly light absorbent. As a consequence, the brightness of the tooth is decreased, and chroma is increased. These adverse effects may be readily alleviated by combining microabrasion with vital bleaching. In the context of the adverse effects, the use of microabrasion may be questioned (see Table, page 389) in cases of mild fluorosis, since the bleaching procedure alone is able to provide acceptable results by decreasing the contrast between the white spots and the bleached surrounding tissues (Figures 12 and 13).

The clinician should be aware that microabrasion slightly modifies the surface texture of enamel.

Discoloration Caused by Injury to Developing Teeth

In presence of deep discolorations caused by injuries to developing teeth, microabrasion is firmly contraindicated, since these discolorations may become even more prominent following microabrasion treatment, exhibiting the internal aspect of the stain. As previously explained, the brownish aspect associated with the lesion is an organic pigment; as such, it may be effectively eliminated with a preliminary bleaching procedure. In such circumstances, further application of adhesive restorative materials is best delayed for 2 weeks, due to the relapse in color in the first few days as well as the inhibiting effect of oxygen (which is a byproduct in the

Figure 14. Case 6. Combined bleaching and masking procedures. Preoperative view exhibits a large yellow-brown discoloration.

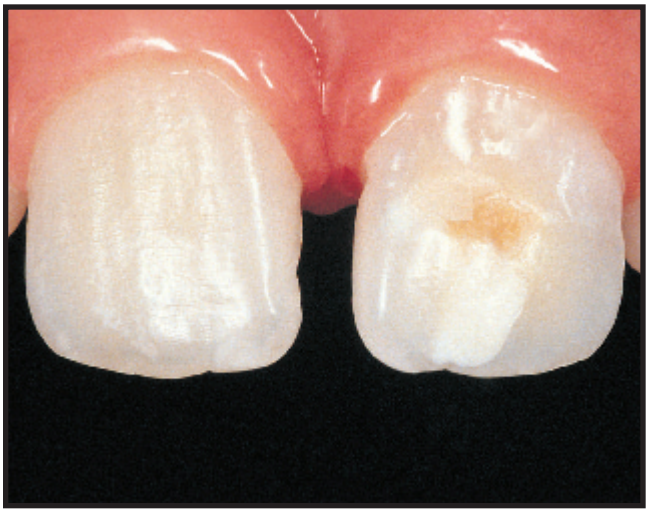

Figure 15. A preliminary bleaching revealed an underlying opaque white area.

Figure 16. Postoperative view of adequate but disguised translucence at the incisal edge.

Figure 17. Case 7. Preoperative view of tooth #8, discolored without surface defect. Tooth #9 has only a superficial defect.

breakdown of hydrogen peroxide) on the bond strength of composites.[11,12]

1. Masking Procedures — The Simulation

In treating residual white spots, one potential modality is the masking procedure, which uses intense resin stains to simulate the original chroma of the tooth or the translucence of enamel (intense blue stain). This initial foundation is subsequently covered by a layer of translucent composite (Figures 14 through 16). This procedure preserves the underlying whitish lesion; however, it is difficult to control, and the final result remains only an emulation of the sophisticated natural effects of the incisal area. Actually, the bluish effect is maintained even in the presence of the tongue on the palatal incisal surface, whereas the pink color of the tongue is discernible in the translucent incisal border of intact adjacent teeth. Moreover, since the tooth surface is not reduced specifically, an overcontour of the restoration is frequently encountered.

Since the lesion is generally restricted to enamel, its elimination does not result in exposure of dentin.

2. Megabrasion — A Radical Advanced Approach

A selection of dental professionals may be reluctant to undertake such radical stain removal. However, the most effective way to treat such white enamel spots is, without exception, the complete mechanical eradication of the lesion and subsequent restoration with a neutral and translucent composite (Figures 17 through 25). This procedure is indicated for several reasons:

- Since the discolored enamel contains an increased amount of organic

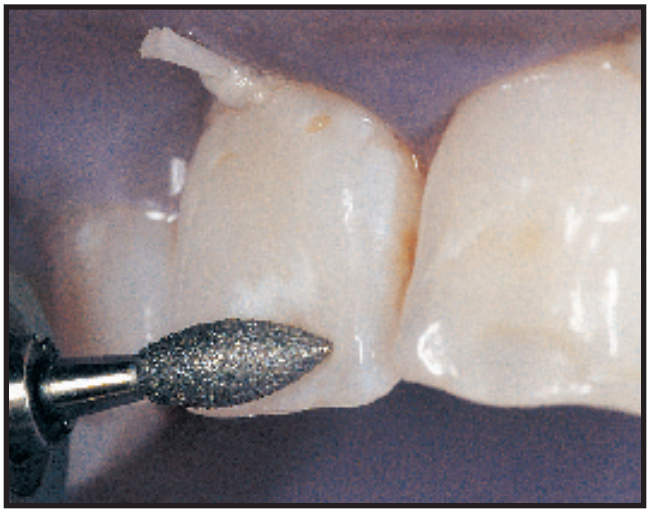

Figure 18. A pear-shaped bur will be used at low speed (400 rpm to 2,000 rpm) to progressively remove the discoloration.

Figure 19. Comparative view of the intermediate stage. The white area is beginning to disappear at the incisal edge.

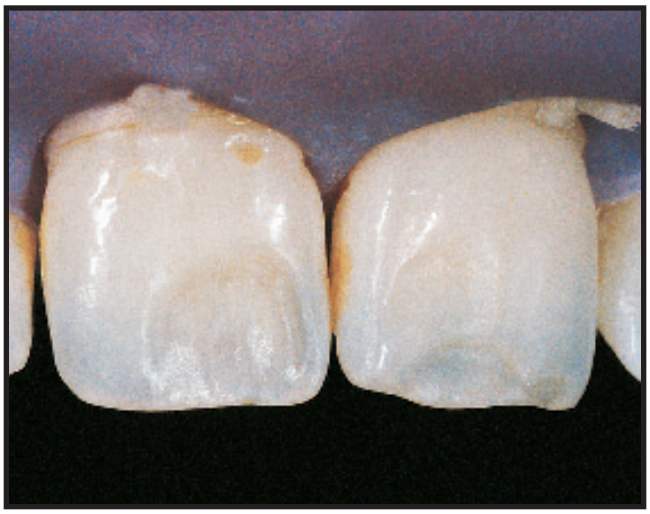

Figure 20. View following complete stain removal. The surface of both central incisors was textured with coarse flexible discs.

Figure 21. The buccal surface is etched at least 1 mm beyond the touched-up areas.

matrix, it does not represent an adequate substrate for adhesion.

- Since the lesion is generally restricted to enamel, its elimination does not result in exposure of dentin and will create an optimal substrate for adhesion.
- Since the intact underlying dentin provides the natural optical effects of the tooth (color, intense dentin lobes, fluorescence, etc.), the simple freehand application of neutral, translucent, and a slightly fluorescent composite resin material allows restoration of the surface morphology of enamel without overcontouring and creates the most natural appearance of a tooth.

Clinical Procedure

Coarse diamond instruments, used at low speed (400 rpm to 2,000 rpm), allow a safe and well-controlled elimination of enamel. High speed operation is contraindicated, since the vibration of the instrument may cause enamel microcracks. Some clinicians find high speed operation preferable; however, no scientific evidence has been reported in support of this practice. Finishing of the prepared surfaces is performed with coarse flexible discs (Sof-Lex, 3M, St. Paul, MN) to remove sharp angles. A fine finishing of the tooth surface is not desirable, since a rough enamel surface represents an improved substrate for adhesion.

Conservative treatment strategies ... contribute ... to the current "crescendo" of ... tissue preservation.

The selection of the covering composite is made according to the reference teeth. A neutral incisal-like composite resin material (Herculite, Incisal Medium, Kerr, Orange, CA) is generally selected, while special composites are indicated in cases of strong opalescence (Enamel Plus HFO, Ivory, Micerium, Avegno, Italy) or particularly high translucence (Enamel Plus Clear I, Micerium, Avegno, Italy). However, the use of these special covering composites

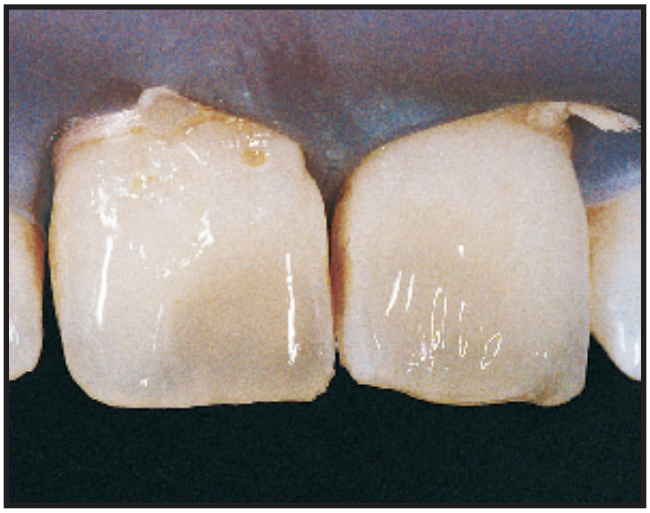

Figure 22. A bulk of composite is placed to reproduce the morphology of lost enamel and cured through a layer of glycerin jelly.

Figure 23. Reproduction of the surface texture may be assisted by rubbing articulating paper on the buccal surfaces.

Figure 24. Postoperative view. The restoration takes on the color and detailed characteristics of the underlying intact dentin.

Figure 25. The chameleon effect on restored tooth #8 is the same as natural tooth #7, despite the presence of tongue on palatal surface.

should be restricted to the incisal aspect of the teeth, since the material would create excessive light absorption when placed in the central or cervical area.

The final result is remarkable, and it does not depend on the artistic skills of the operator to any significant extent. The advantage of this method is precisely the chameleon effect — no color control is necessary, and utilization of dental dam isolation is not problematic.

The most difficult aspect of the technique is the restoration of the surface morphology and the texture of composite resin. This procedure is facilitated with the use of articulating paper, rubbed on the surface of the restoration and adjacent natural control tooth. A range of clinical circumstances and the corresponding treatments available are summarized and presented in the Table (page 389).

CONCLUSION

This article has presented alternative strategies as methods for effecting discoloration removal in conservative dental treatment. The reasons for the need to develop improved treatment modalities have been discussed, and two modalities — masking and megabrasion — have been presented. Emphasis is placed on the latter approach, which is radically innovative. It does not depend entirely on the artistic skills of the operator while still achieving excellent results. The etiology of the specific but commonly occurring white or yellow-brown enamel discolorations has been presented, and the clinical procedures of these alternate treatments have been utilized to illustrate the effectiveness of the alternate treatment modalities presented.

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Continuing Education (CE) Exercise No. 13

UTHSCSA ADA C·E·R·P Continuing Education Recognition Program

To submit your CE Exercise answers, please use the enclosed postage-paid Answer Card (one for all 4 CE articles) found opposite page 386, and complete it as follows: 1) Complete the address; 2) Identify the Article/Exercise Number; 3) Place an X in the appropriate answer box for each question for each exercise. Return the completed card.

The 10 multiple-choice questions for this Continuing Education (CE) exercise are based on the article "Megabrasion: A conservative strategy for the anterior dentition" by Pascal Magne, DMD. This article is on Pages 389-395. Answers for this exercise will be published in the August 1997 issue of *PP&A*.

Learning Objectives:

This article discusses the conservative treatment strategies with focus on the "megabrasion" technique, which does not depend primarily on the artistic skills of the operator. Upon reading and completion of the CE exercise, the reader will have:

- An updated knowledge of conservative treatment strategies.
- Increased familiarity with the megabrasion technique.

1. **Therapeutic modalities of discolored dentition discussed in this article include the following, except:**
   a. Chemical treatments.
   b. Crown restorations.
   c. Composite resin restorations.
   d. Veneer laminate restorations.

2. **Material for anterior restorations should have the following characteristics, except:**
   a. Ability to emulate enamel.
   b. Adaptability for use in layering techniques.
   c. Unique opacity.
   d. Usability in replication of fine details.

3. **Which of the following treatment strategies does the author select as the one with the highest potential for a global aesthetic integration?**
   a. Laminate veneer restorations.
   b. Full-coverage crown restorations.
   c. Composite restorations.
   d. Ceramometal restorations.

4. **The possible frequent cause of white and yellow-brown enamel discolorations is:**
   a. Lack of appropriate toothbrushing.
   b. Moderate fluorosis.
   c. Excessive use of tobacco.
   d. Excessive use of alcohol.

5. **The etiology of white lesions, specifically, includes the following, except:**
   a. Disturbance in the maturation stage of mineralization.
   b. Disturbance with enamel matrix involvement.
   c. Disturbance without enamel matrix involvement.
   d. General lesser mineralization of the enamel.

6. **The etiology of yellow-brown discolorations associated with cavities includes the following, except:**
   a. Direct injury to the enamel matrix.
   b. Injury to the matrix prior to its complete mineralization.
   c. Injury to the facial aspects of veneer laminates.
   d. Breakdown products of hemoglobin in bleeding.

7. **Microabrasion produces the following effects, except:**
   a. A surface that is more textured than natural enamel.
   b. A surface that is smoother than natural enamel.
   c. Brightness of the tooth is decreased.
   d. Chroma is increased.

8. **The masking procedure includes the following, except:**
   a. Application of a layer of translucent composite.
   b. Preservation of the underlying whitish lesion.
   c. Easy controllability.
   d. Overcontouring of the restoration.

9. **Megabrasion is characterized by the following statements:**
   a. The discolored enamel contains an increased amount of organic stroma.
   b. The elimination of the lesion does not result in exposure of dentin.
   c. Simple freehand application of composite can be used without overcontouring.
   d. All of the above.

10. **Which one of the following statements is not applicable to the megabrasion procedure:**
    a. Diamonds are used for elimination of enamel.
    b. Low speed operation does not produce microcracks.
    c. Coarse discs are used to remove sharp angles.
    d. Fine finishing is not desirable for best adhesion.