

Limitations of enamel microabrasion technique applied in a pediatric patient: case report

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Resumo

A microabrasão do esmalte é um método não-invasivo que remove defeitos intrínsecos e superficiais dos dentes objetivando melhorar a estética dentária com mínimo de perda estrutural. Este relato de caso descreve uma tentativa para a correção da cor dentária utilizando esta técnica conservativa numa paciente jovem cujo incisivo central superior apresentou uma mancha branco-opaca. Microscopia eletrônica de varredura (MEV) foi realizada de modo a ilustrar o aspecto de vidro lustrado e uma textura lisa da superfície do esmalte microabrasionado. O correto diagnóstico do defeito é uma tarefa difícil ao se considerar esta abordagem conservativa.

Palavras-chave: Microabrasão; defeitos do esmalte dentário; manchas.

Abstract

Enamel microabrasion is a non-invasive method that removes intrinsic and superficial defects from teeth aimed to improve dental esthetic with minimal loss of dental tissue. This case presentation describes the attempt for teeth color correction utilizing that conservative technique in a young girl whose upper central incisor presented an opaque white stain. Scanning electron microscopy (SEM) was conducted in order to illustrate the glasslike luster and a smooth texture of microabraded enamel surface. The correct diagnosis of defect is a difficult task, when consider this conservative approach.

Keywords: Microabrasion; dental enamel defects; stains.

INTRODUCTION

Cosmetic dentistry is a field whose concern is to provide various alternatives to correct or enhance the appearance of unaesthetic tooth¹.

Available options to treat unsightly discoloration of anterior teeth compromising smile aesthetic involve tooth preparation being considered invasive procedures as porcelain veneers or bonded composite resin. Hence, conservative approach (e.g. microabrasion) have been developed to eliminate stains and superficial dental defects preserving tooth structure and, at same time, improve dental aesthetics^{2,3}.

The microabrasion is a simple, safe, atraumatic, conservative and nonrestorative technique that removes the superficial part of stained enamel and eliminates defects such as brown or white opacities. The goal of this method is based in immediate re-establishing esthetic without the need for cavity preparation and restoration^{4,6}. It consists of making an abrasive acid material into a

paste that is applied manually or with a rubber cup at low rotation to the discolored buccal surfaces of the teeth. Furthermore, the microabraded enamel acquires a highly polished surface which reduces colonization by *Streptococcus mutans* and renders the surface more resistant to demineralization^{3,7,8}.

In spite of this technique demonstrates success in several cases, the esthetic outcome depends directly on the severity, location and depth of the stain because the thickness of the enamel layer varies with tooth's region and surface^{9,10}.

The purpose of this clinical report was to describe the use of microabrasion technique in a young patient.

CASE REPORT

The patient, a 9 year-old girl, was referred to the Pediatric Dentistry Clinic, Araraquara Dental School, São Paulo State

University for treatment of traumatic injuries occurred twelve days before the first appointment. The right maxillary permanent central incisor (11) was avulsioned and the left maxillary permanent central incisor (21) was partially intruded. Tooth 21 was repositioned and stabilized with a composite resin splint followed by root canal treatment. The root canal was filled with calcium hydroxide (Callen paste, SS White, Rio de Janeiro, RJ, Brazil) and this material was monthly changed until the complete root formation. During clinical examination it was noted an enamel stain that was characterized by opaque white area on the left maxillary permanent central incisor (Figure 1). This enamel alteration could be related to several trauma in the anterior primary dentition suffered by the girl due to the practice of professional sport since early childhood.

Following authorization and consent from the patient's guardian microabrasion technique was purposed to enhance appearance of her stained teeth.

1. *Microabrasion protocol*

As for all microabrasion procedures, the eyes of the patient, clinician and dental assistant were shielded with protective glasses. Prior to treatment, the teeth was submitted to rubber cup prophylaxis with pumice/water slurry, rinsed thoroughly and dried. The gingival tissues were protected with vaseline while the affected tooth was isolated with a rubber dam to avoid contact between the acidic material and other teeth as well as soft tissues of the mouth.

The paste was prepared with 37% phosphoric acid in gel form (Dentaltec, Cathec Industrial Ltda., Rio do Sul, SC, Brazil) mixed together with pumice to make a stable consistent paste. The paste was applied manually with a plastic mixing spatula (Master-Dent, Dentonics Inc, Monroe, NC) for 10 seconds in circular movements on entire surface enamel attempting to stained region (Figure 2). This procedure was repeated more 5 times, (6 times in total) in a single session. After using the paste, the tooth was liberally rinsed with copious amount of water between applications to remove the paste. Post-operative characteristics teeth following procedure is illustrates in Figure 3. The treatment was followed by removing the rubber dam and applying neutral sodium fluoride at 2% (DFL, Indústria e Comércio S/A, Jacarepaguá, RJ, Brazil) for 1 minute to enhance remineralization. The patient was instructed not to rinse for thirty minutes. Figure 4 shows the result immediately after treatment.

2. *Scanning electric microscopic analysis*

To assess the enamel surface morphology before and after the microabrasion procedure impression was obtained using a condensation-type polyvinyl siloxane (Vigodent S/A Indústria e Comércio, Bonsucesso, RJ, Brazil) and filled with epoxic resin in order to obtain specimens that were evaluated by scanning electric microscopic (SEM) at magnification of 100×. Figure 5a presented the roughness aspect of the untreated enamel and Figure 5b showed regular and a smooth texture surface of the microabraded enamel.



Figure 1. Initial clinical aspect of the left maxillary permanent central incisor presented an opaque white stain.

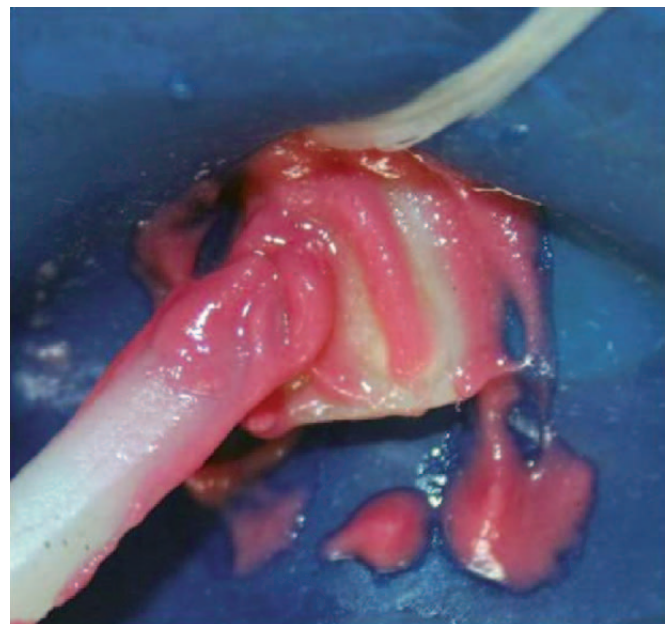


Figure 2. Application of the 37% phosphoric acid pumice applied manually with a plastic mixing spatula (Master-Dent, Dentonics, Inc, Monroe, NC).

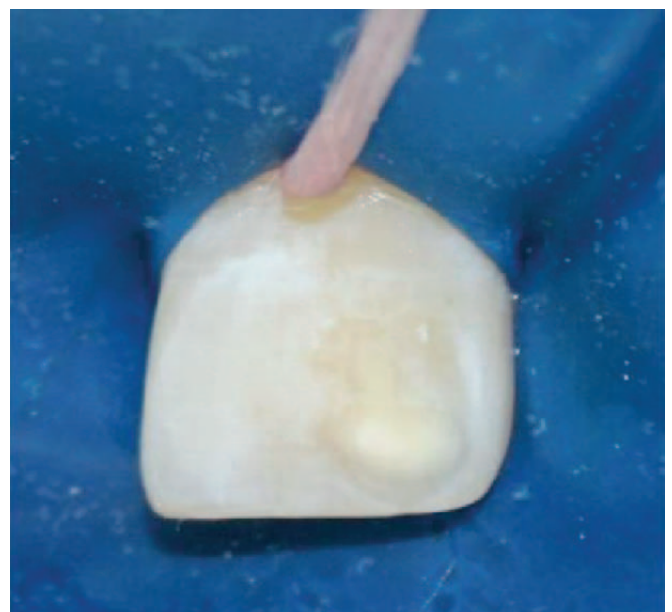


Figure 3. Post-operative aspect after the microabrasion procedure.

DISCUSSION

It is often difficult to determine actual depth of enamel intrinsic stains¹¹. Face to this fact, enamel microabrasion should be the first treatment option because it is a less invasive and more conservative procedure. Advantages of this technique include small structure removal, lack of sensitivity, and post-operative pain, no need for dental cavity preparation or restorative materials and shorter time required for the procedure which is easy to execute¹²⁻¹⁵.

Microabrasion masks, removes stained tooth structure and improves tooth coloration. The surface layer formed during treatment is highly polished, densely compacted mineralized structure¹⁶. This technique mixes hydrochloric acid or phosphoric acid and an abrasive powder to remove surface layer of the enamel. Donly et al.² showed that a dense prismless layer is formed on the abraded enamel surface giving the tooth a glass-like luster appearance. When light is reflected off this surface and refracted through it, does so in a different manner than it would on an untreated surface and these optical properties of the newly



Figure 4. View of the immediate result after microabrasion procedure. Notice the unsuccess of the employed technique.

micro-abraded surface camouflage the remaining subsurface stains^{2,17}. This vitreous characteristic is known as the “abrasion effect”² or “enamel glaze”¹⁸. This aspect was verified by the clinical appearance also confirmed by the microscopical one, which showed smooth and regular microabraded enamel (Figure 5b).

The amount of enamel removed by the procedure is related to the duration of applications, the number of applications and the pressure applied to the tooth during procedure in addition to the concentration of acid⁹. In the present study, it was used 37% phosphoric acid plus pumice technique because this procedure has similar effect and it is safer method in relation to amount of enamel removed when compared to 18% hydrochloric acid plus pumice or 18% hydrochloric acid alone²⁰. The materials used are readily available in dental office, thus no specific product is required for the technique.

There is not a concordance in the literature in relation to time of application^{4,5,19,21,22,24} also the numbers of applications^{4,5,19,21,22,24}. It is known the fact of the buccal enamel thickness in permanent incisors is approximately 1 mm. Microabrasion may produce dramatic improvement of discoloration in 10 applications of 18% hydrochloric acid, aspect sufficient to remove nearly 25% of the enamel in this area^{2,15,25}. Waggoner et al.²⁵ reported the first application of hydrochloric acid pumice mixture removed 12 μm and subsequent applications removed 26 μm . Meanwhile, enamel loss after mechanical application employing 37% phosphoric acid pumice was 27.41 μm ¹⁹. The present case report utilized 6 “ten seconds” application 37% phosphoric acid pumice manually which was a safe protocol based in previous validate study⁹. In this same research, it was advisable to use 4 applications with the mechanical technique and up to 7 applications with the manual technique. In this study no more than 6 applications were done due to immature aspect of the dental enamel and to avoid increase the stained area.

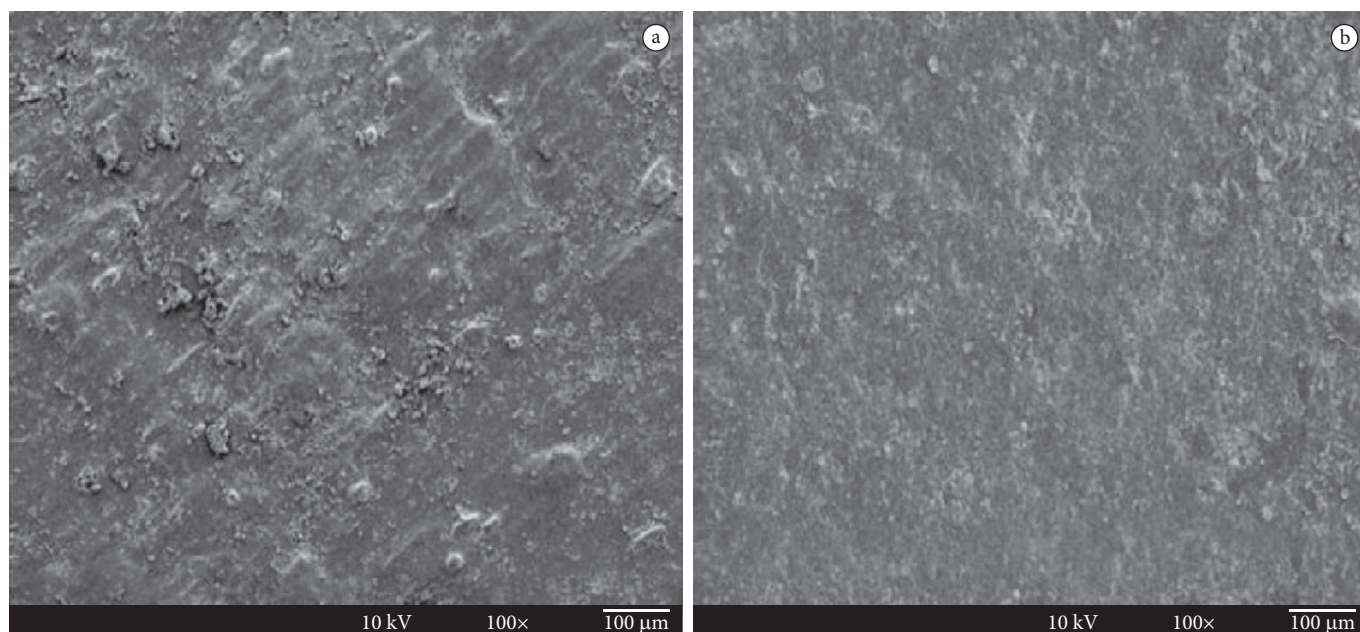


Figure 5. a) Scanning electric microscopic photo of untreated enamel at $\times 100$ magnification. b) Scanning electric microscopic photo of treated enamel with 37% phosphoric acid pumice at $\times 100$ magnification. Notice the smooth surface of treated enamel.

A study reported relevant results when employing manual technique in relation to enamel loss after microabrasion comparing to mechanical one and have some advantages as quicker and requires the use of materials usually available in general dental practice¹⁹. Contradictorily, variations in the technique revealed no difference in the quantity of enamel removed; whether applied manually with a wooden sticky or mechanically utilizing a slow-speed handpiece²¹. Attention must be the force applied during microabrasion since more pressure is employed more sound enamel structure is lost²⁵.

To define the etiology and to determine the depth of enamel defects before treatment is a hard task. The association between practice of sports in childhood and the incidence of trauma resulting in teeth defects is well established in the literature²⁶. It was supposed that this enamel defect have its etiology due to the frequent event of traumas in that region since the girl

practices sports and had began this physical activity in early childhood. The present case was characterized by enamel opacity hypomineralization which extends to a considerable depth into the enamel affecting left central incisor. This aspect was confirmed after unsuccess of microabrasion protocol (Figure 4). In this specific case the use of microabrasion technique was doubtful, so patient and parents were advice in relation to expectations to procedure. In succesfull microabrasion cases, there is generally less than 150 µm necessary to improve appearance significantly and distinct color improvement occurs by the sixth application, whether this aspect do not occurs the technique must be abandoned in order to avoid exposing more subsurface hypomineralized enamel^{5,23}.

Although evident modifications of the enamel surface characteristics were seen, employed technique could not result in a satisfactory clinical outcome.

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