

Microabrasion in Pediatric Dentistry and Orthodontics

Greta Bacionyte

Pediatric Dentist, Lithuania

***Corresponding author**

Greta Bacionyte, Pediatric Dentist, Lithuania, E-mail: greta.bacionyte@gmail.com

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Abstract

Enamel defects can differ in etiology (trauma, fluorosis, genetics, inflammation, systemic diseases or initial caries) and may present various appearance (varying from small white spots and pits to dark brown enamel morphology deficiencies). Depending on degree of expression of the defect or discoloration, it is proven to have a negative effect on the child's psychosocial life, but options for treatment are limited and often not even considered because of the young age of the patient. Enamel defects caused by fluorosis are common among up to 45 percent of children in Lithuania and up to 19 percent of children have other type of enamel defects so the treatment need is significant. Microabrasion – a technique based on using acid etching combined with abrasive materials on enamel. It is a minimally invasive enamel defect treatment technique that can improve the aesthetics in young age or allow to get better results during the following treatment. Microabrasion can also be combined with fluoride therapy, bleaching, composite fillings or even veneers and crowns after the occlusion is formed. The aim of this article is to review the literature, compare minimally invasive treatment versus restorative techniques for enamel defect elimination and evaluate advantages and disadvantages of various treatment options considering the age of the patient.

Introduction

Enamel defects which affect aesthetic appearance of incisors may have a negative impact on psychosocial life of a child [1]. These defects may be caused by various factors: genetic or systemic diseases, chemical agents, radiation, infection, stabilised caries or trauma [2]. In Lithuania up to 45% of children have enamel defects caused by overconsumption of fluoride and up to 19% - enamel defects caused by other factors [3]. According to study performed in UK, prevalence of incisor hypomineralisation in children is 11.0% [4]. Treatment of these defects in adults can vary from minimally invasive (fluoride applications) to restorative treatment with prosthesis depending on the extent of the lesion, but in pediatric dentistry treatment options are limited because of young age of the patient, insufficient cooperation, incomplete mineralisation of teeth after eruption and jaw growth, so elimination of enamel defects is often not even considered until the maturity of the child. While minimally invasive techniques are getting more and more popular, the aim of this article is to review the literature, compare minimally invasive treatment versus restorative techniques for enamel defect elimination and evaluate advantages and disadvantages of various treatment options considering the age of the patient.

Microabrasion is a minimally invasive treatment for enamel defects which can improve aesthetics of affected incisors and enhance the results of further treatment. The technique is described as chemical erosion (H3PO4 or HCl) combined with mechanical abrasion (pumice or silica particles) when the outermost part of enamel surface can be removed.

Indications

Microabrasion is recommended to be used for treatment of:

- Stains or defects restricted only to enamel
- Dental fluorosis
- Mineralized white stains
- Correction of surface irregularities
- Localized enamel hypoplasia
- Polishing of enamel and auxiliary removal of composite resin residues after orthodontic therapy [5]

Treatment planning in children for enamel defects is influenced by the dental age.

In the Table 1 protocol for treatment for children in case of molar – incisor hypomineralization developed in 2010 m. by European Academy of Pediatric Dentistry is stated. The proposed treatment options depend on the severity of dental lesion and dental age.

Table 1

		Dental age		
		Early mixed	Late mixed	Permanent
Level of severity	Mild	Prevention		
		Adhesive + sealant for restoration		
		Composite restoration		
		Microabrasion, bleaching and sealant for anterior		

Severe	Prevention and symptom control	
	Adhesion and sealant for posterior	
	Microabrasion, bleaching and sealant (for anterior)	
	Glass ionomere restorations	
		Composite restorations
		Preformed metal crowns
	Orthodontic extraction	
		Cast restoration

Unfortunately, microabrasion can not remove defects located in deeper layers of enamel, so in those cases microabrasion should be combined with bleaching or restorative treatment.

Technique

As a technique microabrasion first was introduced in 1926 by Kane and it was based on using 36% hydrochloric acid with metal spatula. Croll was the first to introduce the technique which is similar to the current one – it was based on using a less concentrated acid HCl (18%) in combination with water based mixture of abrasive particles applied with slow rotor motor. Those change in the technique made it more easy and safe.

Current commercial products used for microabrasion are also based on hydrochloric acid combined with abrasive particles. Prema Compound (Premier Dental Company, Philadelphia, PA, United States) was introduced as the first product for microabrasion, containing 10% hydrochloric acid. Currently the concentration of acid used is reduced even more for safety reasons (6.6%, Opaluste (Ultradent Products Inc., South Jordan, UT, United States). Both products as an abrasion particle contained carbide particles of various sizes dissolved in water based gel (Table 2). Use of 35% phosphoric acid instead of hydrochloric acid was introduced by Kamp in 1989, but considered more useful in restorative dentistry.

Comparison of different products available in the market in research has shown that regardless the technique, microabrasion as a treatment option statistically significantly improves aesthetic appearance of patients' teeth, but the satisfying result was achieved the fastest was when Opaluste™ was used [6].

Table 2

Product	Manufacturer	Acid	Abrasive	Particles
Prema Compound™	Premier Dental	10% HCl	Silica carbide/peroxide	30-60
Opaluste™	Ultradent Products	6,6% HCl	Silica carbide	20-160
Pumice (pemza)	Pumex	-	Pumice powder	30-50

Currently used technique for the microabrasion by Croll is application of acid abrasive paste on the affected areas and rubbing off the affected enamel. Only the outer layer of enamel is removed when chemical abrasion is combined with mechanical abrasion. Data proves that such removal of the enamel is safe, effective and minimally invasive way to treat enamel defects such as hypoplasia or demineralisation [7].

Microabrasion Effect on Incisors

Thickness of enamel in incisors varies from 1 mm on the incisor edge up to 0.5 mm in cervical third. Scientifically proven that application of HCl with pumice 5 x 5min 18% HCl removed about ~ 40 µm of enamel, and after 10 applications for 5 sec, removal of enamel was up to ~ 70 µm [6]. Removal of up to 33% of enamel does not increase sensitivity and symptoms and such amount of enamel can be remineralized by minerals in saliva, so can be considered safe.

Regardless the material which is used during the treatments, the loss of tooth tissues is abundant. The amount of the tissue lost depends on the pressure applied, time of the application and number of cycles of reapplication. Ulukapi, et al. stated reduction of microstrength of microabrasion and increased risk for erosion after the procedure [8]. To avoid side effects and remineralise the tooth after the procedure, remineralising agents are necessary. Comparison of different remineralizing materials by Zenouz, (2015) et al. a, (fluoride (MASTER-DENT™ 9000ppm), casein phosphopeptide amorphous phosphate (Tooth Moose™) and casein phosphopeptide amorphous calcium phosphate fluoride (MI paste plus™)) has shown that the best result can be only achieved with fluoride agents although some remineralisation was achieved with other materials [9]. Recommendations after microabrasion include polishing the surface on the tooth with fluoride containing tooth paste and application of fluoride varnish.

The most important step to get the best result with microabrasion is multidisciplinary treatment plan. Microabrasion can only remove lesions located not deeper than in the 40 µm depth of enamel, so this kind of treatment for deeper lesions is not effective enough so have to be combined with other treatment methodologies. Precise lesion dept evaluation can only be done *in vitro* by sectioning and scanning electron microscope examination but *in vivo* lesion dept can be only evaluated using traditional methodologies, e.g. ultrasound, transillumination or visual evaluation which is not always precise enough. One of the most innovative tools for such diagnostics is light induced fluorescence, which can evaluate the depth of loss of enamel minerals [10].

Alternatives to Treat Enamel Developmental Defects Conservative Treatment with Fluorides

This method is good to achieve satisfying result (less visible and stable defect) in cases of active white stain caries lesions if combined with good oral hygiene, but the result does not guarantee the stability of the colour of the lesion any more than it could be expected after remineralisation with saliva minerals [11].

Bleaching

Sometimes to eliminate enamel hypoplasia or white stain lesion microabrasion itself is not enough and in order to get a satisfying result, it is recommended to combine this technique with bleaching. JP. Simmer, et al. article states that part of the organic materials can be removed from enamel during bleaching, but since the enamel of an erupted tooth 90% consist of inorganic material, there is no significant difference in enamel strength during vital bleaching if used properly [12]. Overdosage of bleaching material can cause significant decrease in enamel strength, so it is important to evaluate the patient before prescribing home bleaching. Also total recovery of the tooth colour can not be expected, bleaching should be combined with microabrasion or other treatment methods [13].

Resin Infiltration (ICON)

It is considered to be a suitable treatment to treat white spot caries lesions. Resin infiltration is proven to assure the best colours stability after treatment of the lesion [11]. This treatment is special because there is no loss of enamel during the procedure which is very useful in treatment of active caries white spot lesions, but in hypoplastic enamel less hypoplastic areas infiltrates faster than more hypoplastic areas. Kumar H, et al. research states, that the effect of infiltration with resins is not sufficient enough to treat hypoplastic enamel [14].

Restoration with Composites, Veneers or Crowns

Taking into consideration formation of the jaws and bite, gingival line changes during growth, treatment with prosthesis should be postponed until the full maturation.

Conclusion

Every clinical situation requires analytical thinking and complex treatment plan. It was already proven that any kind of treatment for patients with enamel defects can be useful to increase the quality of the social life so it is always good to consider microabrasion as a minimally invasive treatment to benefit for the following treatment of enamel defects [15].

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