



## Opinion article

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# The Management of Developmental Defects of Enamel using Silicon/Calcium-Based Technology: A Light at the end of the Tunnel

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## Abstract

Enamel Development Defects (EDD) are some of the dilemmas that can be found in a daily clinical routine. EDD are disorders of dental enamel (lack of mineral formation) that impacts the tooth's shape, structure, and appearance. Also, most of the time it presents dentin hypersensitivity. These issues have encouraged scientists all over the globe to develop new materials for oral health care. In this sense, a novel bioactive silicon dental gel associated with calcium (Si/Ca protocol) reveals promising results against dental erosion, tooth demineralization, and sensitivity. Also, the rapid mineral formation in the internal structures of dental tissues when the Si/Ca protocol was applied is a valuable support in EDD structures with poor or no mineral formation. In this regard, fast pain relief occurs with an improvement of the patient's quality of life since first use. The application of Si technologies in EDD is as new as the evidence. As a result, it appears that using the Si/Ca protocol deserves more clinical investigations, making it a viable option for the future of EDD care.

**Keywords:** Enamel Development Defects; Molar Incisor Hypomineralization; Dentifrice; Silicon; Dentin hypersensitivity

## Introduction

Enamel Development Defects (EDD) have become increasingly common in clinical practice, becoming a challenge for dental professionals. EDD have been linked to decreased activity of enamel-forming ameloblasts, resulting in the formation of deformed enamel structures [1] (Figure 1). The Molar Incisor Hypomineralization (MIH) is the most evident disorder of tooth enamel development (lack of mineral formation) that impacts the tooth's shape, structure, and appearance. Treatment of EDD is often

complex due to the variability of clinical manifestations, particularly in MIH-affected teeth with potential dentin hypersensitivity, which could impact in a negative way the patient's quality of life [2].

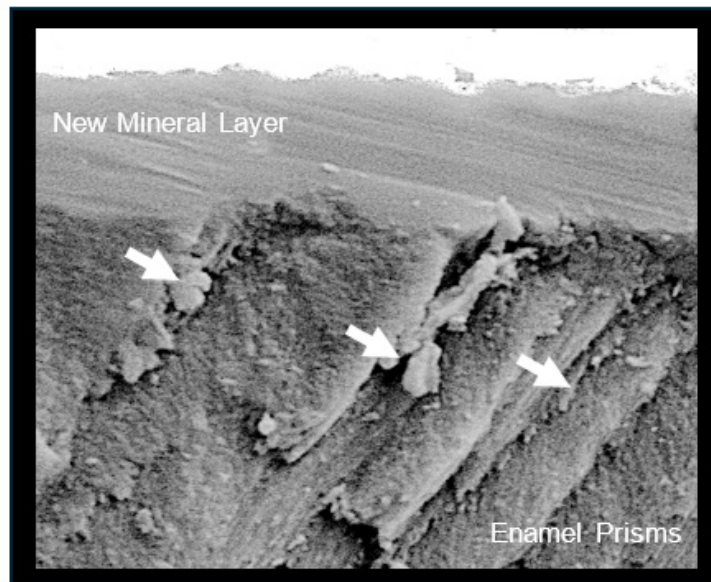
New approaches to managing EDD have emerged, particularly those using silicon (Si) compounds [3,4]. Si in formulations enhances the ability to "build" new minerals by acting as an apatite phase nucleator [4-6]. Furthermore, since dentifrices are the most used oral hygiene products in the population, they appear to be

the most straightforward and comprehensive method of treating EDD. In this regard, Sampaio et al. (2024) stated that Si-based dentifrices have demonstrated strong evidence of reducing dentin

hypersensitivity and promoting enamel-dentin repair by forming a Si-containing mineral layer [5] (Figure 2).



**Figure 1:** Enamel Development Defects examples: Molar Incisor Hypomineralization (left), Dental Fluorosis (middle), Enamel Hypoplasia (right).



**Figure 2:** Scanning electron micrograph of the dental enamel cross-section showing the new mineral layer formation in the surface and subsurface area (white arrows) after 7 days of Si-based dentifrice treatment.

Recently, a bioactive silicon dental gel associated with calcium (Si/Ca protocol) (REFIX® Booster System – Dentalclean US LLC, FL, USA) has been studied. Figure 3 illustrates the Si/Ca protocol that consists of two dentifrices: crystallizer gel containing silicon and phosphate (gray) and accelerator gel containing calcium (white). The Si/Ca protocol begins in a clinical office and continues at home. In Office: equal amounts of both gels are dispensed into a mixing block or dappen dish; after 10 seconds of mixing the gels, apply the mixture using a soft prophylaxis brush in slow rotation to the tooth surface for one minute. At home: The patient receives instruction to

brush their teeth at least two times per day, using small amounts of both gels directly on the toothbrush.

The combination of these elements can accelerate the mineral deposition in dental tissues [6]. This novel clinical protocol can treat and prevent dental erosion, tooth demineralization, and sensitivity [6-11]. Furthermore, according to [2], the use of the Si/Ca protocol for patients with MIH conditions reveals promising results; since fast pain relief occurs, an improvement of the patient's oral health and emotional condition was reported.



**Figure 3:** The Si/Ca protocol is a combination of silicon-rich dental gel associated with calcium (left). The protocol starts in the clinical office, applying the product mixture with a soft prophylaxis brush in slow rotation to the teeth surface for one minute (middle). At home, the patient follows the protocol by brushing the teeth with small amounts of both gels (right).

The rapid mineral formation in the internal structures of dental tissues when the Si/Ca protocol was applied [6-8] is a valuable support in EDD structures with poor or no mineral formation. Other studies that are taking place in Brazilian EDD Research Centers using the Si/Ca protocol have also shown aesthetic results without pain and mineral gain since first treatment session.

The scientific literature has shown that Si dentifrices have laboratory and clinical efficacy in dental tissue regeneration and tooth sensitivity relief [3-11]. The application of Si technologies in EDD is as new as the evidence. As a result, it appears that using Si/Ca protocol deserve more clinical investigations, making it a viable option for the future of EDD care.

### Acknowledgment

None

### Conflict of interest

The authors declare no conflict of interest, with the exception of Fabiano Vilhena, who has served as a consultant for Dentalclean.

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