Dental Bleaching, Microabrasion, and Resin Infiltration: Case Report of Minimally Invasive Treatment of Enamel Hypoplasia

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Enamel hypoplasia occurs because of a defect in formation of the organic matrix during the development of tooth enamel. Minimally invasive procedures of the slightly altered enamel contribute to a greater longevity of teeth and prevent them from relapsing into the repetitive restorative cycle. This case history report aimed to show a sequential technique of minimally invasive procedures for esthetic resolution in anterior teeth. Prior to microabrasion, anterior teeth were bleached in office with 37% hydrogen peroxide. Afterwards, hypoplastic spots on the buccal incisal thirds of the maxillary central incisors were treated with two sessions of microabrasion using phosphoric acid and pumice stone and one session using resin infiltrant. Besides a slight remaining white spot on tooth 21, the masking of spots was done with this sequence of treatments, re-establishing color harmony. Spot depth, diagnosis, and the most relevant treatment choice determined the clinical success. Int J Prosthodont 2020;33:105–110. doi: 10.11607/ipj.6232

Many people seeking dental treatment are concerned with tooth appearance, and color is one of the most esthetically important aspects.1 Besides tooth color, failures in the tooth surface also affect smile harmony and interfere with the natural development of dentition.2

Imperfections in tooth structure may come from different sources, either environmental or systemic; thus, changes during its formation directly affect the quality and amount of tooth enamel produced by ameloblasts. A reduced amount of enamel matrix formation causes enamel hypoplasia. Such enamel malformation may produce spots, depressions, grooves, and fissures because of the degree of disturbance to which the tooth was subjected.3,4

Veneers and crowns as treatment in these cases can remove greater amounts of healthy dental tissues, are more expensive, and can be lengthy.5 Hence, non/minimally invasive procedures of the enamel, such as bleaching, microabrasion, and the use of infiltrants, contribute to a greater longevity of teeth and prevent them from relapsing into the repetitive restorative cycle.

In many cases, a treatment performed in isolation presents good, but not excellent, results, requiring two or more adjunctive techniques. As tooth bleaching is the most conservative method, it is frequently the first alternative for brighter teeth and hypoplastic spot masking.6,7 If the spot is not masked, enamel microabrasion can act, promoting the selective removal of the surface layer of enamel with color or structure change and exposing an enamel sublayer with normal characteristics.8,9
teeth. The clinical examination showed white spots on teeth 11 and 21 (FDI), which were diagnosed as enamel hypoplasia (Fig 1). Vita color shade was determined to be A3.5. The light of the photopolymerization device was positioned on the palatal aspects of the affected teeth to verify the depth of the lesions (Figs 2a and 2b). During treatment planning, three minimally invasive treatments were selected: high-concentration dental bleaching, microabrasion, and the use of resin infiltrant.

Dental Bleaching
One of the objectives of bleaching is to reduce the contrast between the white spots and the other unaffected areas of the tooth, minimizing the chromatic difference and improving the esthetic perception of color (Figs 3 and 4). Therefore, the first treatment performed was in-office tooth bleaching with 35% hydrogen peroxide (Whiteness HP AutoMixx, FGM Produtos Odontológicos). Three sessions of tooth bleaching were performed following the manufacturer’s instructions, with a 1-week interval between each.

A third alternative is the Icon, a new material released in the dental market. This is a low-viscosity resin applied on the tooth surface that consequently infiltrates the enamel micropores. This material aims to seal the microporosities within the lesion because these pores provide diffusion paths for dissolved acids and minerals. This filling of pores changes the optical properties of the tooth, masking the enamel stains with no tooth removal.

Therefore, the present study shows the clinical steps of tooth bleaching techniques, microabrasion, and resin infiltrant application as a sequence of procedures for removing/masking hypoplastic spots in maxillary central incisors.

CLINICAL CASE REPORT

Clinical Diagnosis
A 26-year-old male patient presented at the Dental Clinic of the Federal University of Sergipe (Brazil), dissatisfied with the presence of white spots on the maxillary anterior teeth. The clinical examination showed white spots on teeth 11 and 21 (FDI), which were diagnosed as enamel hypoplasia (Fig 1). Vita color shade was determined to be A3.5. The light of the photopolymerization device was positioned on the palatal aspects of the affected teeth to verify the depth of the lesions (Figs 2a and 2b). During treatment planning, three minimally invasive treatments were selected: high-concentration dental bleaching, microabrasion, and the use of resin infiltrant.

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First, the soft tissues of the patient were protected with an oral retractor (Arcflex, FGM Produtos Odontológicos). A desensitizer (Dessensibilize 2% KF, FGM) was applied for 10 minutes, the excess gel was removed with an aspiration tip, and the teeth were washed with water and dried. A gingival barrier (Top Dam, FGM Produtos Odontológicos) was applied to the gingival outline between premolars in order to prevent any mucosal irritation or injury (Fig 3).

Next, the bleaching gel was applied, without involving the white spots, for 40 minutes. The gel was aspirated, the teeth were washed with abundant water, the gingival barrier was removed, and the desensitizer was applied again for 4 minutes.

Enamel Microabrasion
The microabrasion technique was performed as described by Mondelli et al. The abrasive agent, formed by the 1:1 mixture of 37% phosphoric acid (Condac, FGM Produtos Odontológicos) and pumice stone, was manipulated.

Using rubber dam isolation, two sessions comprised of 10 applications of the abrasive agent were performed in each spot, initially aided by a wooden spatula and later by a rubber cup and low-speed handpiece (Figs 5a and 5b) with rotating movements over the spot for 10 seconds. After each application, washing was performed with water blasting for 20 seconds. Two sessions were required for a better result due to the depth of the enamel defect and the tooth color change to A2.

At the end of each session, the teeth were polished with superfine soflex disc (3M) and Diamond R polishing paste (FGM Produtos Odontológicos), and the transparent and neutral 2% fluoride gel (Maquira Indústria de Produtos Odontológicos) was applied for 4 minutes.
Resin Infiltration

In the last session, resin infiltrant (Icon, DMG) was applied according to the manufacturer’s instructions. The procedure was performed on the same day as the last microabrasion session. After preparing rubber dam isolation, the 15% hydrochloric acid (Icon-etch) was applied for 2 minutes specifically over the surface of the teeth affected (Fig 6), thus wearing the superficial layer of the tooth enamel. After acid etching, the area was washed for 30 seconds with abundant water and immediately dried. Three Icon-etch applications were required, controlling the humidity of the region at each change.

After the third etching procedure, an agent composed of 99% ethanol (Icon-dry) was applied to remove the water retained in the microporosities of the enamel, letting it rest for 30 seconds (Fig 7).

After applying this compound, no white spots were observed in such proportions as before, which ensured that acid cauterization would no longer be required.

Next, the infiltrant (Icon) was applied carefully and specifically over the lesion with the proper applicator (Fig 8), letting it rest for 3 minutes so it would penetrate more efficiently and reach the remaining microporosities. The excesses were removed with a dental explorer. After two applications, the infiltrant was polymerized for 40 seconds to be retained in the microporosities.

Final Examination

After treatment completion, the coloration of white opacities had improved in both the maxillary anterior teeth, promoting benefits and consequently returning esthetics to the dental elements affected (Fig 9). Tooth color was improved with dental bleaching and resin infiltration, except for a remaining white spot on tooth 21 due to the microabrasion technique.
DISCUSSION

Hypoplastic/hypocalcified changes consequently present malformed and more porous enamel. Clinically, however, it is difficult to distinguish whether the enamel is hypoplastic or hypomineralized. Deficient formation of the organic matrix during the development of tooth enamel may be called enamel hypoplasia, while hypocalcification occurs at a second phase, during the mineralization of the formed matrix.

The carious, hypoplastic, or fluorotic clinical appearance of a white spot can be explained by a physical phenomenon. The Refractive Index (RI) in this porous area is different from the other areas of the tooth, and such an RI difference justifies the whitish aspect of the lesion. With the more porous enamel and increased crystalline spaces, the adamantine fluid (RI of water of 1.33) fills the spaces that should have been filled by enamel hydroxyapatite (RI of 1.62).

Infiltrants are photopolymerizable resins of low viscosity and a high-penetration coefficient. Via the forces of capillarity, this material penetrates and fills the porous spaces of the hypoplastic enamel. The use of resin infiltration (RI of 1.46) in teeth with enamel hypoplasia changes their optical properties, masking white spots.

Although the product was created initially to be used in caries lesions at their initial stage, the clinical trials by Tirlet et al. reported the use of resin infiltration for white spot lesions from other etiologies, such as the hypoplastic spots reported in the present study. The authors reported success in their cases, with the optical properties of the resin infiltration used to mask the lesion.

Nevertheless, in some cases the success is not achieved only with resin infiltration application and requires a small wear in the altered enamel to eliminate or decrease the white spot. Thereby, with microabrasion, the amount of enamel removed is related directly to the technique, type of acid applied, and number of applications. The manual technique with wooden wedges and spatulas wears less enamel when compared to the use of rotating instruments with rubber cups. Also, during the microabrasion procedure, the visualization of white spots becomes evident when the tooth is dry (RI of air = 1.0), requiring humidification (RI of water = 1.33).11,17

This clinical case presented two microabrasion sessions with phosphoric acid and pumice stone, which showed significant improvements. However, due to the depth of the enamel defect, the white spot was not completely removed. Therefore, seeking to prevent the excessive abrasion of tooth enamel, there were no more microabrasion sessions. In order to mask such enamel defects, they performed a direct restoration with composite resin. Despite the additional wear, once diamond bur abrasion and microabrasion are required, these procedures still remove a lower amount of enamel when compared to conventional preparations for resin or ceramic veneers or laminates. In general, the objective is to remove a minimum/no amount of enamel so that restorations are not performed and the tooth does not enter the repetitive restorative cycle.

Tooth bleaching was performed initially to reduce the discrepancy between white spots and the other areas of the tooth affected and then to verify the need for other treatments. The color of the tooth of the mentioned case report went from A3.5 to A2, but even so was not enough to mask the enamel white spot. As observed in this clinical case and reported by Auschill et al., in cases that the white spot is deeper, bleaching alone is not sufficient to mask it, requiring the adjunctive support of other minimally invasive techniques. Spot depth may be prognosed by transillumination using the light of the photopolymerization device. The more defined the spot margins, the deeper they are. Conversely, the more diffuse, the more superficial they are.

Also, the bleaching gel was not applied over the enamel white spot, since there is no evidence of how dental bleaching acts on tooth color. It perhaps could whiten the spot, so the authors opted to avoid contact with the...
hydrogen peroxide. Besides the interaction between hydrogen peroxide and organic structure of color, there is also an interaction based on the affinity of enamel and dentin.21

Finally, to avoid dental sensitivity caused by the high-concentration in-office dental bleaching, the desensitizer gel was applied for 10 minutes before the dental bleaching procedure. Since there is no universal protocol to avoid it, every treatment should be considered.

Performing the three minimally invasive procedures together achieved the minimization of the coloration of white opacities and preserving most of the tooth structure, which was revealed as a promising alternative to enamel hypoplasia treatment, especially when compared to more invasive conventional restorative procedures.19,22

CONCLUSIONS

The sequence of the minimally invasive techniques of bleaching, microabrasion, and resin infiltration was effective to solve hypoplastic changes and color of dental hard tissues. Clinical success is related directly to spot depth, diagnosis, and the most relevant treatment choice.

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REFERENCES