Effect of bleaching material containing remineralizing agent on the microhardness of enamel surface

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BY

Nada Kamal ElDin AbdelAziz Elsheikh

B.D.S.,
Faculty of Dentistry
Ain Shams University (2012)

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Dr. Omaima Hassan Ghallab

Professor and Head of operative dentistry department

Faculty of dentistry

Ain Shams University

Dr. Mohammed Nasser Mohammed Anwar

Lecturer of operative dentistry

Faculty of dentistry

Ain shams university

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A bright Whitesmile has been a symbol of charming beauty, health and vitality for decades. Recently public demand for aesthetic dentistry especially tooth bleaching has increased significantly. Dental bleaching provides a conservative, effective, safe and low-cost solution to treating the teeth discoloration and restoring the natural tooth color **(Maiti and Kumar, 2014)** [(93)]. Teeth discoloration is caused by several intrinsic and extrinsic stains formed on tooth surface. Intrinsic and extrinsic are categorized based on several factors; intrinsic discoloration is formed behind the inclusion of chromatogenic materials into dentin & enamel during development or after tooth eruption. Post tooth eruption; aging & pulpal disease are the main causes for intrinsic stain. Causes of extrinsic stains are mainly related to the ingestion of products like coffee, tea & smoking tobacco **(Bizhang et al., 2009)** [(25)].

There are several bleaching approaches including dentist supervised night guard (home bleaching), in office or power bleaching and Mass market bleaching products. Home bleaching uses low level of whitening agent applied to the teeth while using custom night guard worn at night for extended periods of time up to 2 weeks. In office bleaching uses higher levels of whitening agents compared to home bleaching. Mass market products contain low levels of bleaching agents and are like: gum, shield or strips. The significant result of any of the applied treatments mainly depends on the cause, diagnosis, and proper selection of bleaching materials and the correct clinical technique **(Sulieman, 2004)** [(124)].

The mechanism of bleaching is mainly an oxidation reaction involving the main component of bleaching agent hydrogen peroxide (HP) that converts the organic pigment to carbon dioxide and water resulting in significant whitening of the teeth. Although bleaching is coming with promising results,

some reports have still showed side effects. Bleaching agents may change the surface morphology and degree of mineralization of the dental enamel surface and subsurface. Oxidation reaction of bleaching results in production of free radicals from peroxide that causes a degree of deterioration of teeth structure as it penetrates teeth surface reacting with the organic content of enamel. Loss of some inorganic crystals that are bound to the organic matrix can take place (demineralization) causing decreased hardness of enamel surface, enamel roughness and teeth hypersensitivity. Acidity of bleaching agents can cause demineralization upon bleaching, some of them had pH values of less than 5.5, which is the critical value for the demineralization of enamel **(Azrak et al., 2010)** [(16)] and **(Goldberg, Grootveld and Lynch, 2010)** [(58)].

In order to decrease the side effects of demineralization that happen upon bleaching, various remineralizing regimens are recommended during or after the bleaching procedure to promote remineralization and decrease tooth sensitivity **(Poggio, et al., 2016)** [(134)]. Casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) or fluoride therapy application is recommended during or after bleaching treatment. Fluoride may form a calcium fluoride layer on the enamel surface acting as a remineralizing agent. This deposit is subsequently dissolved, allowing fluoride to diffuse into enamel and support remineralization and increases microhardness values. CPP-ACP, a milk-protein derivative, is another remineralizing agent that serves as a reservoir source for calcium and phosphate ions on the tooth surface, thereby helping to depress demineralization, enhance remineralization, and increase the microhardness of softened enamel **(Tyagi et al., 2013)** [(132)].

Accordingly; studying the effect of remineralizing agents use during or after bleaching is of a significant value that needs to be deeply assessed to understand whether the use of remineralizing agents during bleaching procedure is sufficient to restore initial microhardness of enamel or there is an additional need to use post bleaching remineralization!

I. Importance of bleaching:

Bleaching has become a popular treatment in dentistry & one of the most frequently requested dental procedures by the public. With the increased patient demand for esthetic improvements & whiter, more perfect smile. In response many choices for tooth whitening have been made available **(Shethri et al., 2003)**[(4)] and **(Carey, 2014)** [(33)]. Bleaching has been accepted as a method to treat tooth staining & discoloaration given the fact that it's the most conservative, non-invasive and a simple treatment compared to other modalities like crowns, veneers or composite bonding **(Majeed et al., 2015)**[(94)].

Teeth can be affected by several types of color problems impacting appearance of teeth, the reason for tooth staining must be assessed to allow better prediction of the rate and degree of bleaching will improve tooth color, as some stains are more responsive to the process than others. Accordingly, discolorations may be extrinsic, intrinsic or internalized stains. Extrinsic stains usually occur due to the accumulation of chromatogenic substances on the external tooth surface. Poor oral hygiene, ingestion of chromatogenic food and drinks or tobacco use are reasons that can lead to extrinsic color changes. These stains are localized mainly in the pellicle and are either generated by the reaction between sugars and amino acids or acquired from the retention of exogenous chromophores in the pellicle. At the early stage of staining, chromogens interact with the pellicle via hydrogen bridges and can be removed by routine prophylactic procedures. With time, these stains will darken and become more persistent, but they are still highly responsive to bleaching **(Viscio et al., 2000)** [(134)]. Intrinsic discoloration occurs when the chromogens are deposited within the bulk of