

How can Bleaching Affect Positively and Negatively on Discolored Teeth

Zahar A Nemer¹ and Ahmed Mohamed Elmarakby^{2,3*}

¹General Dentist, Saudi Arabia

²Assistant Professor at Restorative Dental Science, Alfarabi Colleges for Dentistry and Nursing, Riyadh, Saudi Arabia

³Lecturer of Operative Dentistry, Faculty of Dentistry, Al-Azhar University, Assiut Branch, Egypt

***Corresponding Author:** Ahmed Mohamed Elmarakby, Assistant Professor at Restorative Dental Science, Alfarabi Colleges for Dentistry and Nursing, Riyadh, Saudi Arabia.

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Abstract

Background: The history of dentistry is comprised of many efforts undertaken to achieve an effective tooth-whitening method.

Objectives: This review article will help clinicians improve their understanding of the history of bleaching procedures, bleaching types, components, mechanisms, and their effects on soft tissue, tooth structures, resin composite, and bonding.

Methodology: Collecting data was by collecting the related articles between the years 1998 to 2018 that have been published in PubMed and Scopus indexed journals. The controversial issues about bleaching procedures and their effects are reviewed. Additionally, the consequences of pre- and post-bleaching on the tooth structure are discussed.

Conclusion: Operator should have a thorough understand and awareness about the drawbacks of different techniques used for that purpose. The overall goal of the paper is to help reduce risks for patients.

Keywords: Bleaching; Controversial Effects, Tooth Whitening, Tetracycline Stains

Introduction

Many types of color problems may affect the appearance of teeth, and the causes of these problems vary, as does the speed with which they may be removed. Therefore, the causes of tooth staining must be carefully assessed for better prediction of the rate and the degree to which bleaching will improve tooth color, since some stains are more responsive to the process than others.

Teeth sensitive after bleaching

Discolored teeth may affect self-esteem of individuals depending on the society they live in. The demand of individuals for tooth whitening existed for more than 100 years, and since then significant efforts have been directed toward understanding the nature of tooth discoloration and devising methods to eliminate them [1,2]. Veneers and full coverage crowns are considered most invasive, because sound tooth structure is removed to create room for the restoration. The least invasive procedure to remove discoloration from discolored dentition is bleaching using oxygenating chemicals such as hydrogen peroxide (H₂O₂). This method does not entail removal of sound tooth structure. Vital teeth can be bleached either chair side (in-office) by the dentist or through the application of bleaching agent in a mouth-guard by the patient [3,4]. The in-office vital bleaching is commonly referred as power bleaching, where hydrogen peroxide solutions are used as bleaching agent activated by heat or light source. Previously, the in-office approach typically was conducted over a series of visits, utilizing high concentration peroxides (30 - 35%) under heat sources to increase the kinetics of stain removal [3-5]. Some clinical studies showed that at-home bleaching caused mild degree of tooth sensitivity up to 78% in participants. With in-office bleaching procedures,

the incidence of tooth sensitivity was similar, but the great majority of people, who undergo the whitening procedures, were able to tolerate it well [6-9]. Different studies concluded that bleaching caused tooth sensitivity in 52% of the subjects and 31% of them experienced gingival sensitivity. Several studies showed that bleaching methods using only peroxides without light sources can cause tooth sensitivity, and this can be due to the used peroxide or one of the other ingredients in a high concentration in form of bleaching gel [9-13].

Hydrogen peroxide applied to cracked or microabraded enamel

There are concerns about the biologic safety of the procedure, referring to the indiscriminate use of highly concentrated peroxide products. Studies have shown that the diffusion of hydrogen peroxide through dental tissues may cause pulpal damage [14-16]. Even though the success of a bleaching treatment is directly related to the diffusion capacity of peroxides through enamel and dentin, it is believed that the more intense the penetration, the higher the risk of occurrence of side effects. Thus, bleaching is contraindicated in clinical conditions in which the tooth presents exposed dentin or other enamel tissue changes that presumably increase its permeability. Cracks in the enamel are common but often are ignored or not noticed. These changes appear as fissures within the structure of the enamel and extend preferably along the cervico-incisal axis and may even reach the dentino-pulpal complex, which can also cause fractures in the tooth structure [17-21]. Thus, it seems possible that the presence of these changes may affect the intensity of hydrogen peroxide diffusion toward the pulp chamber. Another common clinical condition refers to chromatic or textural changes on the enamel surface layers. In these cases, clinicians use a micro-abrasive treatment, which is an excellent choice for removing these changes by providing improved esthetics with a minimally invasive treatment [22-26].

Successful bleaching of teeth with dentinogenesis imperfecta discoloration

Dental abnormalities related to dentinogenesis imperfecta (DI) have been extensively described in the literature [27-34]. They include short bulbous crowns, short roots, obliterated pulp chambers, and a dark amber opalescence of all teeth [29-34]. The broad range of treatment options reported in the literature probably suggests that different levels of severity of DI exist among different patients. Therefore, there is a need for classification of DI based on different degrees of severity to recommend treatment guidelines based on the category of the condition. Esthetic outcome is an important barometer by which a patient measures success and satisfaction of dental therapy. Often, a conservative treatment option may satisfy the patient's goal of esthetic therapy. Therefore, it is important for a clinician to first exhaust the conservative treatment options before proceeding to invasive treatment. Bleaching is one such option that has been well documented in the literature. However, there is only one case report that has described the use of bleaching in a DI patient [27]. The authors of this article had used a 10% carbamide peroxide bleaching agent successfully, but the period of follow-up was only 6 months. There are no clinical trials or other reports for bleaching in DI patients. Though the prominence of evidence-based medicine has grown larger, case reports are still considered important as they have a high sensitivity for detecting novelty and form the basis for detecting new concepts, etiological clues, side effects, and new treatments [28-35].

Bleaching of tetracycline-stained teeth

Tetracyclines are broad-spectrum antibiotics used for treatment of a range of common infections [36]. However, they may incorporate into developing tooth tissue and are discolored by light induced oxidization and may deteriorate dental aesthetics significantly [37]. This can be generalized or localized and range in color from mild yellow to grey and dark brown. The clinical presentation is dependent on the type of tetracycline, its dose, length of medication, and period of development of the tooth tissue [38-41]. Clinical management of TST includes the use of bleaching [42], composite resin/porcelain laminate veneers [43] or full coverage metal-ceramic/all ceramic crowns to improve the aesthetic appearance. Bleaching is the most conservative treatment option without sacrifice of sound tooth substances and subjects' satisfaction in addition to that the oral health related quality of life has been improved after bleaching [44,45]. Moreover, bleaching systems based on carbamide peroxide and hydrogen peroxide have been shown to be clinically safe with no irreversible side effects and have minimum biological effect [46-48]. The quinone rings in tetracyclines that are responsible for red discoloration can be altered to less colored molecules [49,50]. Tray based peroxide home bleaching systems have been shown to lighten the appearance of

TST when used for prolonged periods. Using 10% carbamide peroxide gel for a 6-month period in a tray delivery system. Haywood, *et al.* in their study found that the tooth whitening effects were long lasting up to 90 months and that patients gave positive feedback [51,52]. They also observed that severe discoloration in the gingival third of the tooth gave a poor prognosis for total tooth whitening. In a similar design study, Matis, *et al.* compared the effects of different concentrations of carbamide peroxide (10%, 15% and 20%) on tetracycline stained teeth also for a 6-month period [53]. They showed that most rapid whitening occurred in the first month. There was some relapse of the tooth whitening effects after bleaching, mostly 3 months after bleaching. However, improvements in the redness and lightness are still observed at 5 years. They found that the darker the teeth at baseline, the more difficult it was to lighten them. Polyethylene strips have been used for delivery of bleaching peroxide and their direct contact with teeth may reduce overall peroxide dose and treatment time [54]. Hydrogen peroxide bleaching strips used for six months has been shown to significantly whiten teeth with tetracycline staining [55]. Bleaching strips have been compared to 10% carbamide peroxide tray delivery system (equivalent to 3.6% hydrogen peroxide) in non-TST. The strips produced a comparable effect (strips with 5.3% hydrogen peroxide) [56] or even greater (strips with 6.5% hydrogen peroxide) [57] whitening effect when compared to the tray system. For TST, Kugel, *et al.* found that the 6.5% hydrogen peroxide strip system demonstrated significantly greater tooth whitening at 1- and 2-month and experienced a more rapid whitening effect in comparison to 10% carbamide peroxide tray delivery system [58]. Effects of increased tooth whitening with higher concentrations of bleaching agents have been reported on both non-TST [56,59,60].

Effect of bleaching in treatment of dental fluorosis

Dental fluorosis is the main reason for intrinsic tooth discoloration and is caused by high fluoride absorption during tooth development (> 0.05 mg/kg/BW/d) [61-63]. Clinically, dental fluorosis is characterized by white opacities that vary from small spots and lines to extensive areas. More pronounced fluorosis is characterized by brown stains and superficial pitting. These changes are evenly distributed throughout the dentition, although their magnitude varies among the different tooth groups. To characterize the clinical appearance of dental fluorosis, several indices have already been used e.g. The Thylstrup and Fejerskov index (TFI) [64]. Today several invasive and noninvasive treatment strategies for dental fluorosis are available. For severe fluorosis, composite restorations and veneers are optional, whereas tooth bleaching and microabrasion are the basic therapies for mild to moderate fluorosis [65]. Tooth whitening aims at providing optical adjustment between fluorotic and healthy enamel areas. Regardless of the chosen bleaching technique (in-office or at home), inclusions within the fluorotic enamel cannot be eliminated [66].

Conclusion

The increasing demand for tooth bleaching has driven many manufacturers and researchers to develop bleaching products to be used either in the dental office or at home. However, as with any dental procedure, bleaching involves risks. For that reason, this review article is provided to help clinicians improve their information about the bleaching process and their understanding of the controversial issues regarding the effects of bleaching on teeth to help reduce the risks to patients. Finally, Clinicians should inform their patients about the possible changes that may occur on their dental restorations during bleaching procedure as well as the possibility of replacement of the bleached restorations at the end of bleaching treatment.

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