Effect of external tooth bleaching on dental plaque accumulation and tooth discoloration

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Abstract
Objectives: Treatment of dental discolorations with external bleaching is becoming very common in dentistry, however, possible irreversible alterations on enamel surface due to bleaching procedures is a topic of discussion. The aim of this study was to evaluate the clinical effects of bleaching by measuring the dental plaque accumulation on human enamel and tooth discoloration in vivo. Study Design: Forty-four teeth in eleven patients not revealing any restorations or periodontal problems were enrolled in this study. Bleaching agent applied only to labial surfaces of incisors using commercial 35 % hydrogen peroxide gel. Dental plaque and tooth color measured in the same group of participants, at the end of non-brushing periods lasting 3 and 5 days, respectively, before and after bleaching. Results: The results of the comparison of pre- and post-bleaching measurements showed that, after a non-brushing period lasting 3 day, discoloration scores and plaque accumulation scores for bleached surfaces were lower than the non-bleached surface scores. However, at the end of a non-brushing period lasting 5 day, the color measurement score in post-bleaching period was lower than the pre-bleaching counterpart, plaque index measurements showed higher plaque accumulation scores in the bleached group. Conclusions: According to these results, bleaching with 35 % hydrogen peroxide seem to favor plaque accumulation after non-brushing period lasting 5 day and tooth discoloration after bleaching is not in correlation with the amount of plaque accumulation.

Key words: Dental bleaching, 35 % hydrogen peroxide, plaque accumulation.

Introduction
Tooth discoloration can be classified as intrinsic, extrinsic or a combination of both (1). Scaling and polishing of teeth are conventional treatment choices for extrinsic tooth discolorations, however, for stubborn discolorations and intrinsic stains, bleaching techniques may be needed (2). Bleaching of discolored tooth was first described in 1864 (3), and later several bleaching agents such as chloride, sodium hypochlorite, sodium perborate, and hydrogen peroxide were used (4-11). Present tooth bleaching techniques commonly use hydrogen peroxide as the active agent. Hydrogen peroxide may be applied directly, or produced in a chemical reaction from sodium perborate or carbamide peroxide (2). Concentration of the hydrogen peroxide seems to affect the success of the bleaching procedure, together with the duration and the number of times the agent is applied (2). Bleaching has effects on enamel surface roughness.
Plaque accumulation after dental bleaching

Material and Methods

In order to evaluate the differences in plaque accumulation and discoloration on bleached and non-bleached teeth in vivo, plaque accumulation and dental discoloration were analyzed in the same patient group before and after bleaching at the end of periods lasting 3 and 5 days, where participants abstained from oral hygiene. Eleven volunteered healthy dental students (age 20-22 years) were enrolled in this study. Forty-four teeth including 4 upper anterior teeth from each subject formed the study group. The inclusion criteria were: 1) a minimum of 24 teeth in each subject, 2) no clinical signs of gingival inflammation, and 3) no probing pocket depths >3mm. The exclusion criteria were: 1) dental restorations or orthodontic treatment history, 2) having contraindicated conditions for bleaching (extremely large pulps, exposed root surfaces, severe loss of enamel, pregnancy and nursing, peroxide allergy), and 3) systemic diseases or medication usage. The study design was explained and the participants’ written consents were obtained. The local institutional board of ethics approved the study. Study protocol consisted of two periods, pre-bleaching and post-bleaching periods, as shown in Figure 1. Briefly, participants abstained from oral hygiene for 3 and 5 days before (pre-3, pre-5) and after bleaching (post-3, post-5). At the end of pre-3, pre-5, post-3, and post-5 plaque accumulation and tooth color were measured. Also on the day-7 (pre-0) and day-36 (post-0) plaque accumulation and tooth discoloration were measured as baseline values of before bleaching and after bleaching periods. Bleaching agent was applied once and in an only visit.

Pola Office (SDI Limited, Australia), with 35% hydrogen peroxide solution as primary active ingredient, was used as bleaching agent. At the beginning of bleaching protocol teeth were cleaned. A resin barrier was applied to the gum areas, and hydrogen peroxide gel was applied to labial surfaces of each upper incisor. Standard dental light cure applied on teeth for 30 sec. each. The gel was then taken off using suction.

Results

The 11 patients (5 male, 6 female) selected for the study were 20-22 years old. VITA, MNI and TPI mean values for pre-0, -3,-5, and post-0, -3, -5 are depicted in Figure 3. When pre-0 is compared with post-0, discoloration was found to decrease significantly after bleaching. Color shade change was significantly kept low in post-3 and post-5 in comparison with pre-3 and pre-5 scores (p<0.05). Plaque accumulation measurements, both MNI and TPI, gave significantly low scores in post-3 in comparison with pre-3, in correlation with VITA scores (p<0.05). However, on the contrary, post-5 MNI and TPI scores were significantly higher than pre-5 scores (p<0.05).

Discussion

The present study evaluated the effect of bleaching by 35% hydrogen peroxide on dental discoloration and dental plaque accumulation in short term periods. According to the results, after oral hygiene abstaining periods lasting 5 days amount of dental plaque accumulation was higher than non-bleached counterparts.

The role of dental plaque as an etiological agent of both dental caries and periodontal disease is indisputable (20-
In healthy oral cavity, a dynamic equilibrium exists on teeth surfaces between the forces of retention and removal of dental plaque. However, rough surfaces promote dental plaque formation and maturation (17). In the absence of oral hygiene, a detectable dental plaque organizes in around 36 hours on human teeth. Most common areas are the gingival margin and the irregularities on the tooth (20).

Morphological alterations of the enamel caused by tooth bleaching have been addressed earlier (8,9,12,13). Hosoya et al. (16) showed that vital bleaching treatment increases the enamel surface roughness and also suggested that with the repeat of bleaching, the adhesion of Streptococcus mutans to enamel surface increases. However, opposite results that have confirmed the safety of bleaching products have been published (5-7). Yurdakorou et al. (7) analyzed enamel surface morphology using scanning electron microscopy after bleaching with 35% hydrogen peroxide and suggested that there were no significant morphologic differences between bleached and non-bleached enamel. Controversies in enamel surface morphology issue can be explained with the differences in study designs, sample sizes, application times and enamel morphology evaluation techniques (5).

Current study aimed to evaluate the discoloration and accumulation of dental plaque after bleaching; its target was not to evaluate any morphological alterations. Plaque index measurement results after non-brushing periods lasting five days showed that plaque accumulation is significantly higher on bleached tooth surfaces than non-bleached surfaces. And as the dental plaque accumulation on bleached teeth is significantly less than non-bleached surfaces after oral hygiene abstaining period lasting 3 day, it may mean that after the day 3, accumulation of plaque on bleached surfaces accelerates after its initial organization (20).
Tooth color usually changes slightly after polishing, but much promptly after bleaching. Studies by Nakamura et al. (24) and Shethri et al. (25) definitely showed that tooth color change is statistically significant after bleaching. Also Shethri et al. (25) suggested that color relapse begins after bleaching and continues up to fifth week post-operatively. In this study, color change evaluations using Vita Shade Guide showed that color scores significantly reduced after bleaching. However on bleached surfaces, plaque accumulation was higher than non-bleaching counterparts. So we may suggest that, plaque accumulation does not always have to correlate with tooth color.

In order to minimize the subjectivity in evaluations, we used two different plaque indexes while determining the plaque accumulation. Both indexes were in correlation with the others results. We used a commercial color shade guide to evaluate tooth discolorations. Using shade guides for prostheses in measuring vital teeth color has several limitations in comparison with spectrometers or colorimeters; however still it is a quick and cost effective method and human eye is very efficient in detecting even small differences of color between two subjects (26).

With recognition of this short term in vivo study’s limits, it can be said that, bleaching accelerates dental plaque accumulation on non-brushed teeth. However color change after bleaching still get protected after short term non-brushing periods, which may mean that early plaque accumulation does not have to favor with discoloration of teeth.

References