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COMPARISON OF STAIN ABSORPTION BY ENAMEL AFTER BLEACHING WITH TWO DIFFERENT BLEACHING AGENTS

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ABSTRACT

One of the most frequent complaints from individuals looking for cosmetic treatment is tooth discolouration. Both internal and extrinsic variables, such as ingesting chemicals and eating foods that stain teeth, can affect tooth colour variation. Several solutions that purport to whiten teeth and eliminate stains are currently available on the market. Bleaching gels often include a variety of application methods and varied amounts of hydrogen peroxide or carbamide peroxide. In addition, these various uses give rise to various activation mechanisms that enable dental bleaching through oxi-reduction reactions based on partial oxidation of the active ingredient. 8 periodontally compromised teeth extracted in Oral and Maxillofacial department of Saveetha Dental College was collected and cleaned thoroughly. The teeth were segregated in two groups(group 1:bleached with pola office and group 2 : bleached with cavex). The teeth were bleached according to the manufactures' instructions. The two groups of samples were then immersed in almond flavored milk with high saffron content for 24 hrs. Spectrometry values were measured immediately after bleaching and 24 hrs later. The values were then tabulated and graphs comparing the average value were obtained. The study shows that teeth bleached with Cavex bleaching agent showed less stain absorption compared to that of Pola office. Hence it can be concluded that the whiteness of the enamel can be ensured for a longer time in teeth bleached with Cavex than that bleached with Pola Office.

INTRODUCTION

One of the most frequent complaints from individuals looking for cosmetic treatment is tooth discolouration. Both internal and extrinsic variables, such as ingesting chemicals and eating foods that stain teeth, can affect tooth colour variation. Several solutions that purport to whiten teeth and eliminate stains are currently available on the market.[1] Simple professional prophylaxis and the application of bleaching gels to teeth that need to be protected at home or under supervision at a dental office are options. Bleaching gels often include a variety of application methods and varied amounts of hydrogen peroxide or carbamide peroxide.[2–4] In addition, these various uses give rise to various activation mechanisms that enable dental bleaching through oxi-reduction reactions based on partial oxidation of the active ingredient. Through these reactions, the whitening agent modifies the structure of pigment molecules, thereby promoting tooth whitening[5]. Many businesses have created bleaching tooth pastes that promise effects in 2 to 4 weeks and are an alternative to at-home and/or professional whitening methods.

It is not well understood how hydrogen peroxide bleaches. Hydrogen peroxide or its precursor, carbamide peroxide, is the active component of in-office and at-home bleaching gels in concentrations ranging from 3% to 40% of hydrogen peroxide equivalent. The perhydroxyl anion (HO2) is often the mechanism used in hydrogen peroxide bleaching[6, 7]. Other circumstances, such as the homolytic breakage of an O-H bond or an O-O bond in hydrogen peroxide to produce H• + •OOH and 2•OH (hydroxyl radical), respectively, can also result in the creation of free radicals. It has been demonstrated that the generation of hydroxyl radicals from hydrogen peroxide increases in photochemical processes triggered by light or lasers[8]. As hydrogen peroxide diffuses into the tooth, it dissociates to form unstable free radicals that are harmful to the tooth. The unstable free radicals hydroxyl radicals (HO•), perhydroxyl radicals (HOO•), perhydroxyl anions (HOO-), and superoxide anions (OO•-) are produced as hydrogen peroxide, an oxidizing agent, diffuses into the tooth[9, 10]. These radicals target organic pigment particles in the spaces between the inorganic salts in tooth enamel by attacking double bonds of chromophore molecules in tooth tissues. Because of the shift in the chromophore molecules' absorption spectrum and the smaller, less pigmented elements produced by the altered double-bond conjugation, tooth tissues become lighter in color[11].

Some meals and drinks have a reputation for discoloring teeth. These include acidic liquids that can accelerate demineralization and pigment- and ethanol-containing mixtures. The pH level of the staining solution is one of many variables that affect tooth discolouration. Conflicting findings have been found in the several prior research that assessed the negative effects of bleaching agents including peroxide on tooth enamel[12]. After bleaching therapy, some studies found no appreciable negative effects on the surface microstructure of the enamel and dentine. Others, such as altering surface shape, have demonstrated a detrimental impact on the enamel and/or dentine Surface roughness alone cannot explain how staining susceptibility is connected to enamel composition, water absorption rate, due to changes in permeability, and imperfections left on bleached enamel surfaces[13].

MATERIALS AND METHODS

Sample Collection: 8 periodontally compromised human anterior teeth were collected from the oral and maxillofacial surgery department of Saveetha dental college. Soft tissue remnants, calculus and stains from the teeth were removed by scaling and immersing the samples in Sodium hypochlorite for 10 minutes and transferred to a jar of distilled water.

Inclusion criteria:

1. 1.Single rooted, anterior teeth with healthy complete roots.
2. Extracted due poor periodontal prognosis
3. Extracted for orthodontic therapy

Exclusion criteria:

1. Teeth with caries
2. Teeth with root caries
3. Fractured teeth
4. Non vital teeth
5. Restored teeth
6. Cervically abraded teeth

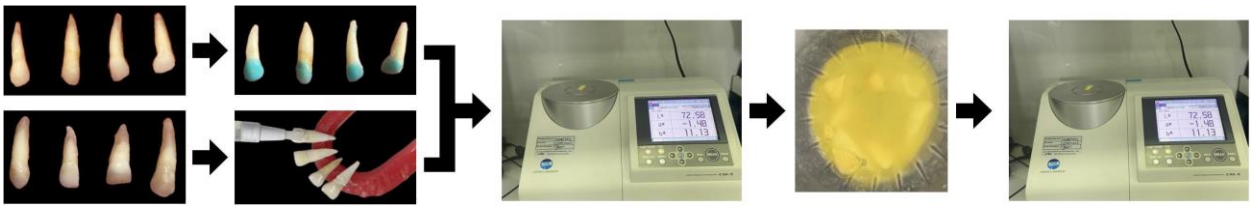


Figure 1: Sequence of steps followed. Collection of sample - Application of bleaching agents - Evaluation with color intensity - Immersing of samples in flavored milk - Evaluation of color intensity.

This in-vitro study was conducted in Saveetha dental college at department of Conservative and Endodontics after obtaining ethical clearance from the research department. 8 natural teeth samples were collected and segregated into two groups.

Group 1: Bleached with Pola Office bleaching agent.
Group 2: Bleached with Cavex bleaching agent.

Preparation of samples: The two in-office bleaching agents were assigned to the two groups of teeth. The teeth were firmly placed on a was sheet to prevent any movement during application of the bleaching agents.

Bleaching protocols: Both the groups with 4 samples were subjected to the bleaching procedure according to the manufactures' instructions.

1. **Group 1 - Bleaching with Pola Office:** The shade of the tooth was determined using Vita* shade guide arrangement according to degree of brightness. The teeth were then cleaned with flour based pumice. The powder pot was opened and one Pola office syringe was taken. The syringe was firmly attached to the pot and the plunger was carefully pulled back to release pressure and extrude the contents of syringe to the pot. It was then immediately mixed using an applicator to form a homogenous gel mixture. A thick layer of the gel was applied on all the four teeth for 8 minutes and wiped off with a wet gauze.
2. **Group 2 - Bleaching with Cavex:** A thin layer of Cavex Bite&White In-Office 25% HPS gel onto the teeth. After 10-15 minutes the gel was whipped using a piece of gauze.

Determination of Colour Intensity: The two groups of teeth were subjected to a spectrophotometer that worked on the principle of CIELAB color space which was developed by the International Commission on Illumination based on the L*a*b* color model in 1976. The three letter L*, a*, b* represent each of the three values the CIELAB color space uses to measure objective color and calculate color differences. L* represents lightness from black to white on a scale of zero to 100, a* and b* represents chromaticity with no specific numerical limits. Using the value of L*a*b* chart the spectrophotometer uses to calculate and quantify the difference between specific colors referred to as Delta. The delta values of the teeth were measured and considered as baseline values.

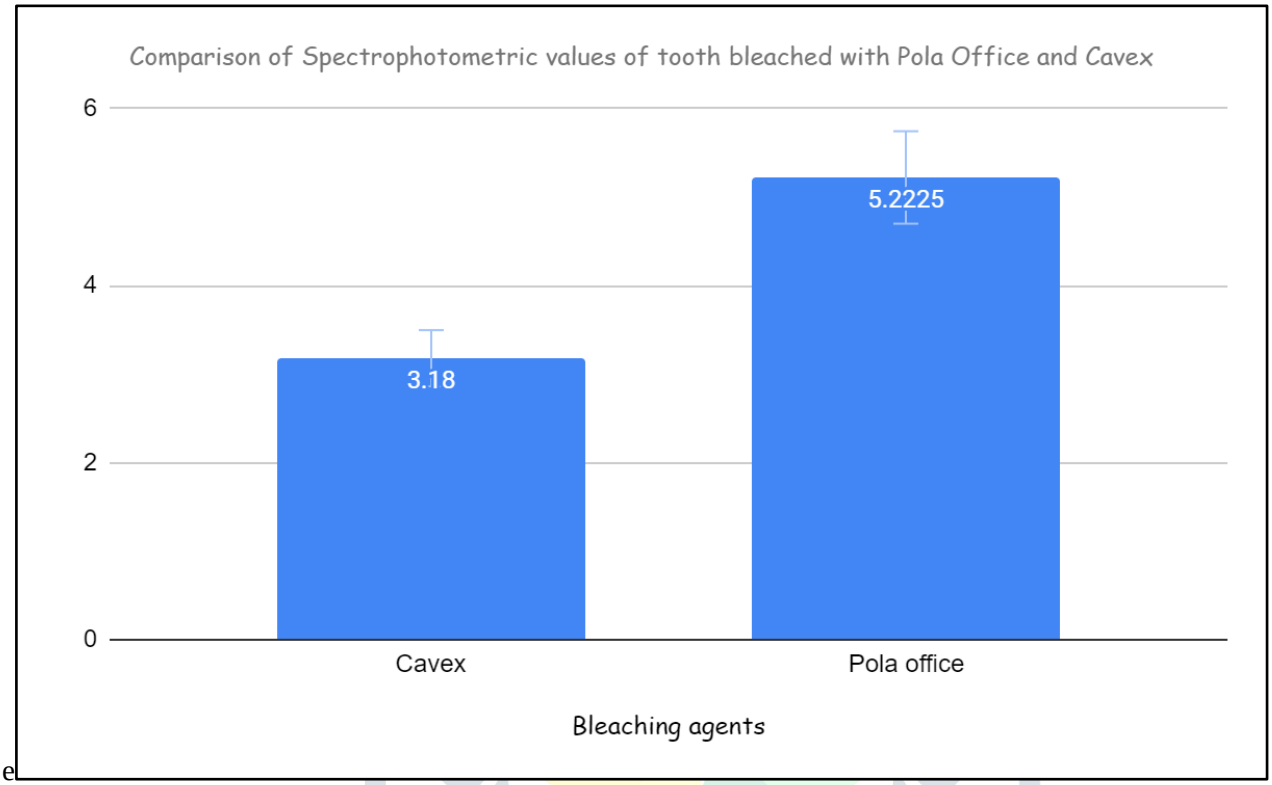
Staining of Teeth: Both of groups of teeth were immersed in flavored milk with high saffron content for 24 hours.

Determination of Color Stability: The samples were again subjected to the spectrophotometer to appreciate any color difference caused by the flavored milk. The delta values were obtained and tabulated.

RESULTS

Table 1: The above table shows the average of spectrophotometric values measured from teeth samples bleached with Pola office and Cavex.

Bleaching Agent	Average Spectrophotometric value
Cavex	3.18
Pola Office	5.2225



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Graph 1: The above graph shows a comparison between the average of spectrometric values measured immediately after bleaching and after 24 hours from bleaching the samples with Pola office and Cavex bleaching agents respectively.

From the above table and graph it is evident that the average of spectrophotometric values of samples bleached with Cavex bleaching agent is less compared to that of samples bleached with Pola Office. Hence it can be concluded that the stain absorption of enamel in the first 24 hours of teeth bleached with Cavex in less than Pola Office. The longevity of tooth whiteness is more in Cavex than by the Pola office.

DISCUSSION

Coffee, tea, juices, wines, and soft drinks made from cola are examples of potential dark or coloured beverages that could stain or discolour the surface of the bleached enamel[14]. While some of them contain ethanol and/or pigments, others are acidic solutions that may accelerate demineralization. In addition, frequent smoking, certain beverages, and artificial food colouring are thought to be the main causes of teeth discolouration, darkening, and staining. It is probable that a bleached enamel surface would be more prone to discoloration, especially by acidic, pigmented, and alcoholic drinks like red wine[15].

The impact of whitening on the tooth's actual structure has come under scrutiny. Several investigations have found surface changes in enamel topography. Using scanning electron microscopy, Shannon et al. (1993) examined the surface topography of enamel tabs subjected to 15% carbamide peroxide for 15 hours each day and found substantial differences from a control group[16]. This is caused by a discernible loss of calcium from the surface enamel and a drop in the depth of the surface hardness of around 25 m. Using teeth bleached in vivo with 35% carbamide peroxide (35 minutes/day for 14 days), Bitter

(1998) [17]showed that the aprismatic layer of the teeth was destroyed, and the damage was not restored after 90 days. However, the amount of exposure and peroxide concentration may have an impact on how much the enamel is altered. Oltu and Gürgan (2000) used infrared spectroscopy to analyse the mineral composition of enamel subjected to 35%, 10%, and 16% carbamide peroxide. They found a change at 35% but no change at 10% or 16%. These findings may have therapeutic implications in that teeth's increased surface roughness after whitening makes them more prone to extrinsic discoloration.[18]

After bleaching treatment, dentists urge patients to cut back on coffee and tea consumption as well as to abstain from smoking and other habits that could stain their teeth. Bleaching agents have been shown in certain studies to change the microstructure and architecture of the enamel surface.[19–21] Surfaces of bleached enamel and dentin may lose biological components like protein loss or denaturation may contribute to changes in the microstructure of teeth, and these modifications may make extrinsic staining more likely to occur again. The effects of staining agents both during and after bleaching treatment should therefore be carefully considered. It is believed that smoking, specific beverages, and artificial food colorings are the main contributors to primary colouring. Rare studies have looked at how eating staining compounds may alter the outcomes of the bleaching procedure after treatment.

CONCLUSION

The study concludes that the teeth bleached with Cavex showed more color stability than that of teeth bleached with Pola office . Futuristic scope of the current study revolves around providing a wider scope of analysis to study in the field of various commercially available bleaching agents for better treatment modalities.

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Conflict of Interest:
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