POST BLEACHING RE-PIGMENTATION SUSCEPTIBILITY OF TEETH – AN IN VITRO STUDY

Dr. Channesh Patel G S1, Dr. Deepu Patil2, Dr. Veeresh Tegginmani3, Dr. Zeenath Ambareen4, Dr. Praveena Sharma5, Dr. Prakash Lokhande6

1Lecturer, Department of Conservative Dentistry and Endodontics, College of Dental Sciences, Davanagere, Karnataka, India
2Professor, Department of Conservative Dentistry and Endodontics, A.M.E’s Dental College and Hospital, Raichur, Karnataka, India
3Professor and Head of Department, Department of Conservative Dentistry and Endodontics, HKDET’S Dental College Hospital and Research Institute, Humnabad, Karnataka, India
4Reader, Department of Pedodontics and Preventive Dentistry, Sharavathi Dental College and Hospital, Shimoga, Karnataka, India
5Reader, Department of Conservative Dentistry and Endodontics, College of Dental Sciences, Davanagere, Karnataka, India
6Professor, Department of Conservative Dentistry and Endodontics, College of Dental Sciences, Davanagere, Karnataka, India

2drdeepupatil@gmail.com

ABSTRACT

AIM: To evaluate the susceptibility of teeth for re-pigmentation using two commonly used teeth bleaching agents, i.e. 35% Hydrogen peroxide (H2O2) and 16% Carbamide peroxide.

Methodology: In this study, 30 extracted teeth were equally divided into three different groups. Group I is bleached with 35% Hydrogen peroxide (H2O2), Group II with 16% Carbamide peroxide, and Group III was used as control. All the teeth were then stained with silver nitrate stain to evaluate their susceptibility to pigmentation after bleaching. The shade of each tooth was recorded before bleaching, after bleaching, and after pigmentation using a ‘Vita classic’ shade guide.

Results and conclusion: Results showed that both bleaching gents were equally effective in bleaching the tooth but after staining with silver nitrate, the teeth in all groups became darker but the amount of change in the shade value of the samples was different for both the groups. The change in shade was greater for Group I as compared to Group II after pigmentation. This change in shade between Groups I and Group II was found to be statistically significant hence it is concluded as susceptibility of enamel for pigmentation can be increased after bleaching, and pigmentation is greater if bleaching is performed with 35% of H2O2.

Key words: Re-pigmentation, Bleaching, Carbamide peroxide, H2O2

I. INTRODUCTION

The public concern about appearance and more attractive smile has been responsible for increased awareness in esthetic dentistry and consequently in various bleaching techniques and materials.

Conditions which may require teeth whitening are age yellowing, mild fluorosis, acquired superficial stains, stains caused due to tobacco smoking, coffee or tea stains and young patients with an inherited grey or yellow hue.1]
Many agents have been used in past, and a number of new agents and methods have continued to be introduced. Presently most commonly used techniques for external vital bleaching are, home bleaching and in office bleaching.

Various studies have found that application of bleaching agents increases surface roughness and decrease enamel microhardness of teeth.\[2\textsuperscript{-7}\]

There are several studies to show the enamel characteristics are altered by repeated bleaching which increases the risk of caries due to adhesion of cariogenic bacteria to the enamel surface.\[8,9\]

So many studies have been carried out to determine the effect of bleaching agents on enamel and dentine microhardness, surface roughness and fracture resistance but few studies have concentrated on susceptibility to re-pigmentation after bleaching.

Hence this study was chosen

II. AIM OF THE STUDY

The aim of this study was to determine which vital bleaching system is more susceptible to pigmentation after bleaching, and also give an insight about the efficacy of the two systems.

III. MATERIALS AND METHODS

Ninety extracted premolars of patients undergoing orthodontic treatment were collected for the study.

All the collected teeth were cleansed with ultrasonic scaler and apical foramina were sealed with glass ionomer cement. (GC Fuji) The root surfaces of all samples were coated with a water resistant transparent nail varnish.

Ninety samples were randomly assigned to three equal groups, each sample was scanned for a matching shade from Vita classical shade guide (VITAPAN) as shown in Figure 1(a) & (b)

![Figure 1(a)](image1a)  ![Figure 1(b)](image1b)

**Figure 1(a)**– Vita classical shade guide (VITAPAN)

**Figure 1(b)** – Shades of samples were registered before bleaching using Vita shade guide

The vita shade guide used for value disposition, assigning an incremental number to each shade as shown in table 1

<table>
<thead>
<tr>
<th>Shade</th>
<th>B1</th>
<th>A1</th>
<th>B2</th>
<th>D2</th>
<th>A2</th>
<th>C1</th>
<th>C2</th>
<th>D4</th>
<th>A3</th>
<th>D3</th>
<th>B3</th>
<th>A3.5</th>
<th>B4</th>
<th>C3</th>
<th>A4</th>
<th>C4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
</tr>
</tbody>
</table>

In Group I, teeth were bleached using 35% $\text{H}_2\text{O}_2$ (Pola - office, SDI) [Figure 2] as per the manufactures instructions.
In Group II, teeth were bleached using 16% carbamide peroxide (Pola - night, SDI) [Figure 3] as per the manufactures instructions

Group III was used as control so no bleaching was done

In Group III, teeth were only immersed in distilled water for 15 days.

All samples in Group I and Group II were stored in distilled water in between the bleaching procedures and after 15 days the samples from Group I and II were compared with the Vita shade guide and their new shades were noted.

![Figure 2: 35% H₂O₂ (Pola - office, SDI)](image1)
![Figure 3: 16% carbamide peroxide (Pola - night, SDI)](image2)

All samples were immersed in silver nitrate solution (50% by weight) for 4 hours they were then fixed for 24 hours using a radiographic fixing solution each specimen was washed under running water for 15 seconds to remove the loosely precipitated silver nitrate

All samples were once again matched with the Vita shade guide in value disposition and their shades were registered as showed in Figure 4

The corresponding value for each matching shade was recorded and used for statistical analysis.

![Figure 4: Shades registered after pigmentation using Vita shade guide](image3)

**IV. RESULTS**

The statistical software IBM SPSS statistics 20.0 (IBM Corporation, Armonk, NY, USA) was used

**Student t test** (two tailed, paired and unpaired) was used to find the significance of the study parameters on continuous scale between two groups

Analysis of variance (ANOVA) was used to find the significance of study parameters between three or more groups followed by post hoc analysis if the ANOVA values were significant

Level of significance was fixed at $P \leq 0.05$
After bleaching, all samples of the two groups became lighter. Although the change in shade values was more in Group I (35% H₂O₂) than in Group II (carbamide peroxide), the difference between them was not statistically significant. (P value = 0.074) as shown in Table 2.

Table 2: Comparison of the bleaching effect of pola office and pola night material using unpaired t test (Taking into consideration the mean difference i.e. Initial shade – shade after bleaching)

<table>
<thead>
<tr>
<th>Group</th>
<th>No of samples</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pola office</td>
<td>30</td>
<td>4.27 (3.0)</td>
</tr>
<tr>
<td>Pola night</td>
<td>30</td>
<td>3 (2.3)</td>
</tr>
<tr>
<td>t value</td>
<td></td>
<td>1.819</td>
</tr>
<tr>
<td>P value</td>
<td></td>
<td>0.074</td>
</tr>
</tbody>
</table>

After staining with silver nitrate, the teeth in all groups became darker but the amount of change in the shade value of the samples was different for the two groups.

The change of shade was greater for Group I as compared to that for Group II after pigmentation.

This change in shade between Groups I and II was found to be statistically significant using unpaired “t” test ‘P’ value was less than 0.001 as shown in Table 3 and Graph 1.

Table 3 & Graph 1: Comparison of the post bleaching pigmentation of pola office and pola night material using unpaired t test (Taking into consideration the mean difference i.e Shade after bleaching – Shade after pigmentation)

<table>
<thead>
<tr>
<th>Group</th>
<th>No of samples</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pola office</td>
<td>30</td>
<td>7.13 (2.1)</td>
</tr>
<tr>
<td>Pola night</td>
<td>30</td>
<td>2.73 (2.1)</td>
</tr>
<tr>
<td>t value</td>
<td></td>
<td>8.090</td>
</tr>
<tr>
<td>P value</td>
<td></td>
<td>&lt;0.001**</td>
</tr>
</tbody>
</table>

V. DISCUSSION

This was an in vitro study aimed at determining whether the pigmentation capability of enamel is altered by the 2 most common bleaching treatments and also giving an idea of efficacy of the two systems used in the study.

In home bleaching technique 10-22% carbamide peroxide is most commonly used whereas in office bleaching where the dentist perform tooth whitening treatment 35%-50% Hydrogen peroxide is most commonly used.[10]

Hence in this study we have chosen 16% carbamide peroxide as Home bleaching agent and 35% hydrogen peroxide as an in office bleaching agent.
Silver nitrate was used for staining because of its high contrast, stability after precipitation and small particle size which allows penetration and clinically undetectable imperfections making them readily visible and it has been used in the pigmentation susceptibility study and also as a disclosing dye in a confocal scanning laser microscope study of carbamide peroxide bleaching.\textsuperscript{[11, 12]}

In this study we found that 16% carbamide peroxide used in home bleaching was as effective as 35% $\text{H}_2\text{O}_2$ used in office which is in accordance with other study done previously.\textsuperscript{[13]}

Therefore, depending on patient’s preference whether they find visiting the dentist or wearing the tray more convenient will be significant in deciding the selection of treatment.

After bleaching, when the silver nitrate dye was introduced, re-pigmentation occurred and all the teeth became darker although a change in the shades of untreated enamel surface (control group) was observed, the difference in their values was not statistically significant.

This can be because of the fact that the dye can penetrate any existing gap between the enamel rods. However, it seems that these gaps are smaller or less frequent in untreated enamel this can be the reason why the difference in shade value of the samples in control group was less.

Re-pigmentation also occurred in the group treated with bleaching agents. Plausible explanation for this may be altered enamel surface after the bleaching.

A study done by Spalding et al. reported that 35% $\text{H}_2\text{O}_2$ had a tendency to promote an increase in density of pits on enamel surface.\textsuperscript{[6]}

Several other studies have also shown that an increase in surface roughness after bleaching with carbamide peroxide.\textsuperscript{[5, 14, 15 & 16]}

Scanning Electron Microscopy (SEM) studies have revealed some changes in enamel morphology and a slight increase in surface porosity after bleaching with H2O2 as well as carbamide peroxide.\textsuperscript{[17, 18]}

In this study we found that the change in the shades was more in Group I ($\text{H}_2\text{O}_2$) as compared to Group II (carbamide peroxide).

Study done using Atomic Force Microscopy on bleached enamel surface revealed that the samples treated with 35% $\text{H}_2\text{O}_2$ showed slightly more number of grooves on their surface than the samples bleached with 16% carbamid peroxide.\textsuperscript{[19]}

These irregularities on enamel surface after bleaching with 35% $\text{H}_2\text{O}_2$ may be responsible for increased susceptibility to re-pigmentation in Group I, thereby adversely affecting the teeth whitening treatment.

In the oral environment though saliva plays a major role in re-mineralization of enamel by reaction of calcium, phosphate and fluoride ions with the cations present in the tooth, However, saliva alone was found to be incapable of reversing the changes caused by the bleaching agents on dental hard tissues.\textsuperscript{[20]}

Turkun et al. in his in vitro study found that it took approximately three months for changes in enamel to disappear which is caused by the bleaching agent.\textsuperscript{[21]}

This recovery time is certainly very long enough to increase the susceptibility of the bleached enamel surface to biofilm formation and discoloration+ by various stains.\textsuperscript{[8, 9]}

VI. CONCLUSION

From this study following conclusion can be drawn

A. Both home bleaching technique using 16% carbamide peroxide and in office technique using 35% hydrogen peroxide are equally effective in bleaching the tooth.
B. Susceptibility to pigmentation increases after bleaching.

C. In vitro pigmentation is greater when H$_2$O$_2$ (35%) is used for bleaching in comparison to carbamide peroxide (16%)

Further studies should be carried out to determine the in vitro changes after bleaching, as the presence of saliva and other factors in oral cavity may influence in re-mineralization of the tooth surface and there by lesser re-pigmentation.

REFERENCES


www.turkjphysiotherrehabil.org