The effect of bleaching agent on the microhardness of composite resins

Saif Alarab A. Alajwadi  B.D.S., M.Sc. (1)

ABSTRACT

Background: The aim of this in vitro study was to evaluate the effect of H₂O₂ bleaching agent on the microhardness of composite resins.

MATERIALS AND METHODS: Twenty samples were made from two types of composite resins then divided into 2 groups. The microhardness value (VHV) was determined for each sample of the two groups before or and after treatment with 35% H₂O₂ bleaching agent using microhardness tester.

RESULTS: The statistical analysis of the results using one way ANOVA and paired t test indicated that there is a significant reduction in microhardness of 3M after bleaching application and there is a non significant reduction in microhardness of Tetric ceram.

CONCLUSION: Within the limit of this in vitro study, it can be said that 35% H₂O₂ has no significant effect on the microhardness of Tetric ceram composite resins while can reduce the microhardness of 3M composite resins.

Key words: Bleaching, hardness.

INTRODUCTION

An important milestone in the history of modern restorative dentistry was the development of light cured composite resins for direct procedures(1). The physical properties are closely related to the degree of conversion and hardness measurements(2). Resins composite have increase strength following to a higher filler contents, modification in the organic matrices and a greater degree of polymerization that improve their mechanical and physical properties(3). One of the main resin that patient seek esthetic dental treatment is a real or perceived. Various methods of vital bleaching have been developed and used over the years until recently; most bleaching methods have used a strong oxidation agent (30% to 35% H₂O₂) in combination with heat or light source. Several studies have establisher the safety and efficiency of the bleaching agents (6). However, although several studies have not reported significant changes, others indicated that the physical and mechanical properties of certain restorative materials may be affected the hardness of composite resins exposed to bleaching agent have been reported increase (9), decrease (10), or be un changed (11). The depth sensing microhardness tester was recently introduced for characterization of dental composite (12) the aim of this study is to investigate the effect of H₂O₂ bleaching agent on the microhardness of composite resins.

MATERIALS AND METHODS

Twenty samples of composite resins were prepared using a prefabricated mold which filled with composite resins using a plastic instrument, over the composite a transparent celluloid strap and a cover slide placed and pushed with 200 g load to extrude excess materials and produce a flat surface (13). A light curing machine was used to achieve polymerization of composite resins, the tip of the light curing machine was put over the tip of the cover slide (0.5mm) curing times was 60 seconds (1) for each composite resins sample which stored in 95% humidity and 37°C. Environment was controlled according to ADA specification NO (27) (16) in an incubator.

The twenty samples were then divided into 2 groups: 10 samples of 3M composite resins and 10 samples of Tetric Ceram (Vivadent)

The microhardness value (reported as Vickers hardness number ) was determined for each sample of groups 1,2 before and after the treatment with 35% H₂O₂ using microhardness tester determination of hardness by indentation of pyramid diamond (Vickers principle). The method consisted of forcing a square based diamond pyramid in to the even smooth surface to be tasted, the hardness value number is defined as the ratio of the load in kilogram (0.5kg) to the surface area of indentation in square millimeter, the later calculated by measuring the length of the diagonals of indentation (14) the hardness number is determined by the formula of Laktin (15) MHN =1.8544P/D²

P. LOAD IN KRAM
D Is the length of diagonal in microns

2 indentations were made for each composite sample then the average of measurement was calculated.

The results were statistically evaluated using one way analysis of variance and paired t test

RESULTS

Statistical analysis of data using analysis of variance ANOVA (table 1) revealed that there is a very high significant differences (p=0.001) between groups of both 3M and Tetric ceram
before and after \( \text{H}_2\text{O}_2 \) application, by using paired \( t \) test (tables 2,3). The results show that there is a significant reduction in microhardness values of 3M after \( \text{H}_2\text{O}_2 \) application while there is no significant reduction in microhardness values of Tetric ceram after \( \text{H}_2\text{O}_2 \) application.

Table 1: ANOVA table

<table>
<thead>
<tr>
<th></th>
<th>F-test</th>
<th>P-value</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M before</td>
<td>77.18</td>
<td>0.000</td>
<td>HS</td>
</tr>
<tr>
<td>3M after</td>
<td>78.85</td>
<td>0.000</td>
<td>HS</td>
</tr>
<tr>
<td>Tetric before</td>
<td>602.21</td>
<td>0.000</td>
<td>HS</td>
</tr>
<tr>
<td>Tetric after</td>
<td>623.76</td>
<td>0.000</td>
<td>HS</td>
</tr>
</tbody>
</table>

\*P<0.0001 High significant

Table 2: \( t \)-test between 3M before & after

<table>
<thead>
<tr>
<th></th>
<th>t-test</th>
<th>P-value</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>1.271</td>
<td>0.235</td>
<td>NS</td>
</tr>
<tr>
<td>D2</td>
<td>4.311</td>
<td>0.002</td>
<td>S</td>
</tr>
<tr>
<td>D1+D2</td>
<td>4.792</td>
<td>0.001</td>
<td>S</td>
</tr>
<tr>
<td>qw</td>
<td>4.550</td>
<td>0.001</td>
<td>S</td>
</tr>
</tbody>
</table>

\*P>0.05 Non significant

Table 3: \( t \)-test between Tetric before & after

<table>
<thead>
<tr>
<th></th>
<th>t-test</th>
<th>P-value</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>0.519</td>
<td>0.616</td>
<td>NS</td>
</tr>
<tr>
<td>D2</td>
<td>0.802</td>
<td>0.443</td>
<td>NS</td>
</tr>
<tr>
<td>D1+D2</td>
<td>0.612</td>
<td>0.555</td>
<td>NS</td>
</tr>
<tr>
<td>Hmm</td>
<td>0.651</td>
<td>0.531</td>
<td>NS</td>
</tr>
</tbody>
</table>

\*P>0.05 Non significant

DISCUSSION

In these last years industry worked in order to improve the physical and mechanical properties of composite (19). A concern exists about the effect of bleaching on the microhardness or restorative materials. This in vitro study was conducted to evaluate the effect of bleaching on the surface microhardness of composite resins for the two types of composite resins which contain across linking agent of low molecular weight monomer (dimethacrylate monomer such as triethylene glycol dimethacrylate) which is chemically and structurally similar to methacrylate, and therefore may be incorporated into growing polymer chains, glycol dimethacrylate possesses two double bonds per molecule of glycol dimethacrylate. As a result an individual molecule of glycol dimethacrylate may serve as a bridge or a cross member that unites two polymer chain (20). The oxygen free radicals that result from the breakdown of \( \text{H}_2\text{O}_2 \) may break the bond between the polymer chain and the molecules of glycol dimethacrylate. If only one bond is broken this will decrease the hardness of the material and soften the composite resin materials. The severity of the effect of bleaching gel depend on it is ability to diffuse or penetrate through the composite resins surfaces, especially through it is organic matrix. \( \text{H}_2\text{O}_2 \), the more it can diffuse the more softening it would cause to the material. As 3M composite resins showed more softening after treatment with 35% \( \text{H}_2\text{O}_2 \) this mean that \( \text{H}_2\text{O}_2 \) has the ability to diffuse through this composite resins very easily.

REFERENCES

1. Flavio HB, aguiar, Aline TB, Braceiro, Glaucia MB Ambrosano Jose Lovadino. Hardness and diametral tensile strength of a hybrid composite resin polymerization with different modes and immersed in ethanol or distilled water media. Dental materials 2005; 21: 1098-103
2. Park SH, Krejci I, Lutz F. Microhardness of resin composites polymerized by plasma arc or conventional visible light curin. Operative Dentistry 2002; 27,30-7
5. Goldstein RE. In office bleaching: where we came from, where we are today. JADA1997; 128(4): 11-8.