Superficial Roughness and Micro Hardness of Nanoparticular Composite Resin Affect by Whitening Dentifrices Contain Optical Agent

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Introduction

Teeth whitening performed by dentists and other dental professionals is more expensive than methods used by patients (1). Plaque accumulation and caries can be reduced by practicing proper dental hygiene (2). Patients and consumers will want white teeth, and many will be unhappy with their current tooth color and want white teeth (3). Because tooth pastes are excellent at removing and reducing stains, a growing variety of whitening tooth pastes with better claims to efficacy have been launched to the market (1). By scraping, dentifrice offers medicinal...
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Dentifrices can have a variety of affects. Scratches may vanish, or new micro wear may form. Toothpaste abrasives and toothbrush bristles can cause superficial grooves on tooth and restorative material surfaces, causing them to degrade. Aesthetic restorative materials are frequently employed in dentistry as anterior restoratives and for less invasive procedures. The three most significant characteristics for any restorative material's lifetime are color, surface roughness, and micro hardness. The surface hardness of the restorative substance is crucial. Its low surface hardness makes it vulnerable to scratches and causes repair failure. Rough surface structure might cause material stains and discoloration, jeopardizing the quality of the restoration. As a result, understanding the impact of a dentifrice abrasion on restorative material loss is critical. Because they are known to have high abrasives, new dentifrices that claim to whiten teeth can have a negative impact on restorative materials. As a result, this research was conducted to determine the impact of whitening and dentifrice on aesthetic restorative materials.

Materials and Methods

Sixty specimens (SPs) of nanoparticulate composite resin, FILTEK Z350XT (3M ESPE®, Dental Products, St. Paul, Minnesota, USA), color A2, universal restorative.

Preparation of the Specimens

To make the mold, a custom-built brass mold with a diameter of 1.2 cm and a height of 2mm was employed. 60 standardized specimens should be prepared. For each of the groups there will be a total of n=20 specimen. The smoothest surfaces were obtained by curing the materials against the mylar strip and then light curing the material for 40 seconds on each side with a light cure device (Bee Cool plus top light LED Curing).

Our SPs were maintained in distilled water at 37°C in a Q316M microbiological oven (Quimis® Ltda., Diadema, So Paulo, Brazil) for 24 hours after preparation. Following this time, the test specimens were subjected to a finishing and polishing procedure. Used medium grain abrasive discs. The specimens were randomly divided into three groups group A (n=20) use distal water (Control Group). Group B Colgate Oral B 3D White Perfection Toothpaste, Group C White Luminous White Brilliant

After the initial reading was taken for each specimen, the three analyzed groups' specimens were brushed for 2 minutes twice a day for 30 days with an electric toothbrush (Oral B® cross action). Using a toothpaste/distilled water mixture in a 1:3 ratio. These test specimens were transferred to a distilled water solution between brushing sessions. A final readings of micro hardness, surface roughness, were checked after four weeks of continuous brushing.

Surface roughness evaluation

Specimens were evaluated using a surface testing machine (Surf meter model no. SJ 201 T, Mitutyo-Japan) with a radius 1.5µm, moved at a constant speed of 0.1 mm/s, with a force of 0.7 mm. The cut off point was set to 0.25mm. Each specimen had three tracings performed at different locations; the average of these three measurements was calculated.

Micro hardness measurement

The hardness of each pellet was measured using a surface micro hardness tester (Shimatzu HMV2000, Germany). The hardness of each test specimen was measured in three separate places with a load of 25 grams for 20 minutes seconds. An average of three readings was used as a criterion.

Analytical statistics

The Shapiro Wilk test (p 0.05) was used to determine whether the data were normal. The Analysis of Variance (ANOVA) was performed to compare the b
beginning and final roughness values between groups, followed by the Tuketests. The T test for dependent samples was used to compare the roughness and hardness of each group before and after brushTable(1) . There were no statistically significant variations between the initial roughness hardness and the ultimate roughness values of the B and C groups under examination, according to the findings. There was a statistically significant difference between the beginning and final roughness hardness values after the simulated brushing technique for A and B C (p = 0.01).

Discussion:
Clinical wear of a resin composite restoration can be caused by a variety of reasons, including centric functional interactions, food friction, and interproximal contacts. (15) Abrasion caused by toothbrushing has been found to be one of the most common types of wear. The most significant issue affecting dental materials, especially resin composites, has been toothbrush abrasion (11). After the brushing challenge, a statistical difference in roughness levels was established, regardless of the toothpaste type. Brushing movements, according to Quirynen et al. (12), can affect composite restoration finishing and polishing generating wear and increasing the composite's surface roughness. A rougher surface, on the other hand, interferes with shine, material aesthetics (13) and bacterial plaque accumulation, promoting the development of secondary caries and gum disorders. Furthermore, Pinto et al. (9) discovered that differing toothpaste formulations had a direct impact on the enamel and resin composite surface roughness, as seen by their findings. New toothpastes have been introduced to the market with the primary goal of improved look. Peroxide compounds, surfactants, polyphosphates, and enzymes interact with abrasive ingredients to produce the major whitening effect (10,14,22). This study looked at the impact of two toothpastes with different abrasives on a nano particle composite resin: hydrated silica (Oral B-3D White), and titanium dioxide (Colgate Luminous White). Some research (16,17) found similar results using a dentifice containing silica and oxide compounds as the most abrasive compounds (18), as demonstrated in our study. As a result, all dentifrices were able to increase surface roughness, suggesting that even a less harmful substance can improve surface roughness.

Ferreira et al. (2013) (19) investigated the profile particles by SEM of toothpastes and discovered that SiO2-based products have higher roughness values. However, the presence of glycerin, cellulose, and fluoride in all investigated toothpastes was able to prevent further mass loss by wearing structure, which could explain, in part, the statistical results (20). The resin matrix composition, matrix/particle interface, particle shape and size, degree of polymerization, and hardness of resin composites could all affect abrasion resistance (21). The larger and more protruded the filler particles were, the more the energy created by the abrasion processes would be passed directly to the surrounding matrix, according to Leinfelder et al. (22), causing microcracks to proliferate and produce particle detachment, hence increasing the roughness and potentiating the repair wear process even more. After brushing hydrated silica containing toothpaste gave the greatest reduction in micro hardness in resin composite. This might be because hydrated silica has greater hardness number than calcium carbonate and trisodium phosphate. Initially the abrasive particles removed protruded fillers from esthetic restorative materials and gave reduction in micro hardness value. With increasing brushing removed extra fillers produced high decreasing in micro hardness (23). The results of our study was in agreement with some investigators who compared the effect of whitening dentifrices on the surface hardness of a nano hybrid composite, they found that maximum reduction in micro hardness was produced by...
whitening paste contains silica as the abrasive agent (24)

**Conclusion**
whitening dentifrices containing Blue covarine have an influential effect on surface characteristics (Superficial roughness and micro hardness) of nanoparticulate composite resin.

Table (1): shows the initial and final roughness values and standard deviation of each group.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Initial roughness (Mean ,SD)</th>
<th>Final roughness (Mean ,SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group(A)</td>
<td>0.56(0.15)Ac</td>
<td>0.65(0.15)Bd</td>
</tr>
<tr>
<td>GroupB Oral B 3D White Perfection tooth paste</td>
<td>0.59(0.17)Ac</td>
<td>0.77(0.17)Bd</td>
</tr>
<tr>
<td>Group C Colgate Luminous White Brilliant value</td>
<td>0.54(0.18)Ac</td>
<td>0.74(0.18)Bd</td>
</tr>
</tbody>
</table>

similar capital letters indicated no significant differences among all groups, similar lower case indicated no significant differences in the same group.

Table (2): shows the initial and final Micro hardness values and standard deviation of each group.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Initial Micro hardness Mean ± SD</th>
<th>final Micro hardness Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control groupA</td>
<td>96.23 ± 0.55 Ac</td>
<td>92.90 ± 1.54 Ac</td>
</tr>
<tr>
<td>GroupB Oral B 3D White Perfection tooth paste</td>
<td>98.23 ± 1.58 Ac</td>
<td>97.90 ± 0.66 Bd</td>
</tr>
<tr>
<td>Group C Colgate Luminous White Brilliant value</td>
<td>97.23 ± 1.39 Ac</td>
<td>96.23 ± 0.61 Bd</td>
</tr>
</tbody>
</table>

Means with different letters states for significant difference, mans with the same letter’s states for non-significant difference.
References