# SURFACE ROUGHNESS EVALUATION OF EXPERIMENTAL DENTAL NANOCOMPOSITE AFTER BLEACHING

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## Introduction

Bleaching or tooth whitening is getting more popular in this world that concerns esthetic [1]. Carbamide peroxide or CP and hydrogen peroxide or HP are oftenly used as home bleaching agent at concentration range from 10% till 35 %. Studies showed many conflicting result on the effect of bleaching on restorative materials [2, 3, 4]. As for hardness concern, the effects of CP are material dependent [2, 3]. In this study, surface roughness was evaluated as this effect on nanocomposite is poorly studied. Surface roughness is an important clinical criterion of restorative materials which leads to bacteria adhesion and thus secondary caries [5]. Also with the emergence of newly in-house synthesized nanocomposite, namely KeLFiL, the bleaching effect on this material need to be evaluated.

The purpose of this study is to compare the effects of Opalescence PF home bleaching agent (Ultradent, USA) at 10% and 20% CP on surface roughness, $R_a$ of experimental nanocomposites, KeLFiL, with Filtek Z350 (3M ESPE, USA) and TPH3 (DENSPLY, Caulk).

## Experimental

*Materials*

Three different dental restorative composites were used for this study which were experimental nanocomposites known as KeLFiL, Filtek Z350 (3M ESPE, USA) and TPH3 (DENSPLY, Caulk). Fillers content in KeLFiL, 35% in weight while Z350 and TPH3 at 78.5 % in weight and 75-77 % in weight respectively.

*Apparatus and Procedures*

The samples were light cured for 20s from each top and bottom surfaces using Elipar Freelight 2 (3M ESPE, USA) according to manufacturer's instructions. 54 samples were prepared using acrylic moulds (4mm diameter x 2mm thick) with 18 samples from each material (n=6 controls and stored in distilled water for 14 days, n=6 were bleached with Opalescence 10% carbamide peroxide, n=6 were bleached with Opalescence 20% carbamide peroxide). All samples were stored in distilled water bath of 37ºC for 24 hours before bleaching. Bleaching procedures were carried out for 8 hours for 10% concentration and 2 hours for 20% concentration carbamide peroxide everyday for 14 days. All samples were then polished with Sof-lex (3M, ESPE, St. Paul, MN, USA). Atomic Force Microscopy (AMBIOS Technology, USA) was used to evaluate the surface morphology of composites after 14 days of bleaching and polished. SPSS version 16 was used to evaluate the data and all statistical analysis were conducted at a significant level of $P < 0.05$ using Anova and *Tukey* post hoc test.

## Results and Discussion

Results found were shown in Table 1. The mean surface roughness, $R_a$, for the control group of the samples stored in the distilled water without using any bleaching agent was 79.96 nm for Filtek Z350, 74.55nm for KeLFiL and 79.20 nm for TPH3. There was no significant difference between all the samples, $p>0.05$. The mean surface roughness, $R_a$, at 10% CP, was 77.98 nm for Filtek Z350, 71.91 nm for KeLFiL and 78.94 nm for TPH3. Again there was no significant difference between all the samples, $p>0.05$. The mean surface roughness, $R_a$, at 20% CP was 65.13 nm for Filtek Z350, 59.92 nm for KeLFiL and 81.83 nm for TPH3. There was also no significant difference between all the samples, $p>0.05$. The result also showed that either at 10 or 20% of CP all the samples did not give any significant difference.

Table 1. Surface roughness of Filtek Z350, KeLFiL and TPH3 after bleached with 10% CP and 20% CP home bleaching agent.

| Test materials | Mean surface roughness, $R_a$, nm (SD) | | |
|---|---|---|---|
| | Without bleaching | 10% CP | 20% CP |
| Filtek Z350 | 79.96 (10.9)$^{Aa}$ | 77.98 (5.5)$^{Aa}$ | 65.13 (17.9)$^{Aa}$ |
| KeLFiL | 74.55 (17.1)$^{Aa}$ | 71.91 (10.5)$^{Aa}$ | 59.92 (16.0)$^{Aa}$ |
| TPH3 | 79.20 (10.3)$^{Aa}$ | 78.94 (2.4)$^{Aa}$ | 81.83 (7.0)$^{Aa}$ |

*Within a column, values with the same upper-case superscript letter are not significantly different ($p > 0.05$, Tukey test). Within a row, values with the same lower-case superscript letter are not significantly different ($p > 0.05$, Tukey test).

Fig.1 to 3 showed AFM images of each sample surface topography after bleached at 20% CP. Similar pattern of the surface topography for all samples were seen.

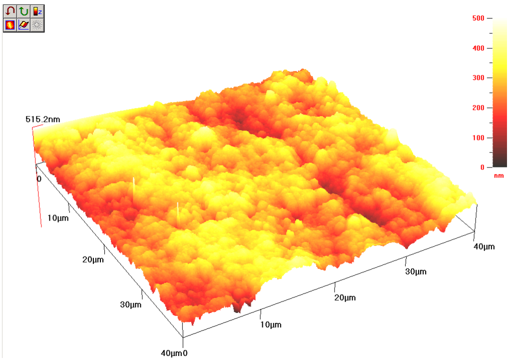


Fig. 1 AFM topography 40x40 μm of Z350 after bleached with 20% CP

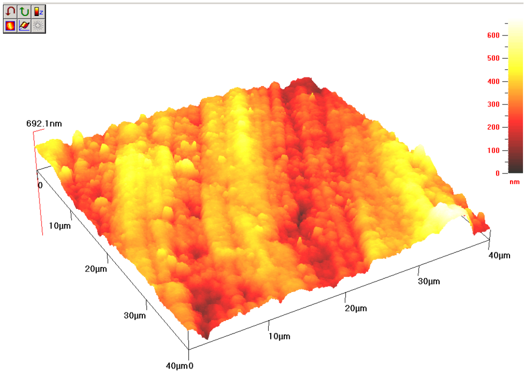


Fig. 2 AFM topography 40x40 μm of KeLFiL after bleached with 20% CP

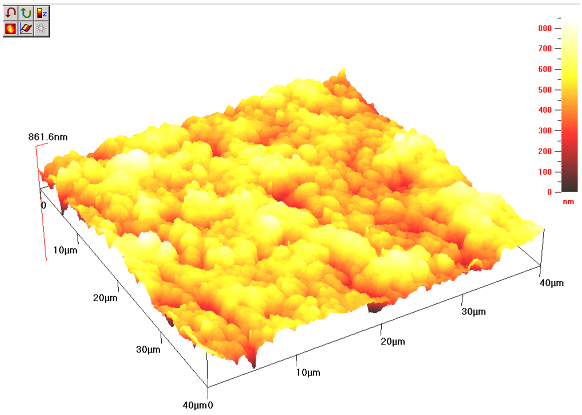


Fig. 3 AFM topography 40x40 μm of TPH3 after bleached with 20% CP

The bleaching used in this study did not have any significant effect on the surface roughness for the material tested which were all nanocomposite regardless of their filler loading. Even though KeLFiL has the lowest filler loading at 35% in weight compared with Z350 and TPH3 at 78.5 % in weight and 75-77 % in weight respectively. This is in agreement with Silva *et al* [6] although the bleaching agent used were different, HP and sodium percarbonate. The $R_a$ values were the same after and before bleaching treatment.
However, Attin *et al* [4] reported that bleaching may exert negative influence on restorative materials.

## Conclusion

The evidence from this study, suggest that 14 days of bleaching with 10% CP or 20% CP bleaching agents did not cause changes in surface roughness of the three tested composites. Also KeLFiL performance after bleaching treatment is as similar as the commercial nanocomposites.

## References

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