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# The Effect of Bleaching on the Basic Colour and Discoloration Susceptibility of Dental Composites

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**Abstract**

**Objectives.** To test the influence of a bleaching procedure using 16% carbamide peroxide (CP) on the colour of composite materials and their consecutive subjection to discolouration in beverages. **Materials and Methods.** Nanocomposite Z550 (3M ESPE) and the microhybrid Z250 (3M ESPE) composite materials were selected for the research. 16% CP was applied to composite plates (15 samples each material) for seven hours a day for 14 days simulating at-home nightguard vital bleaching. The test samples were then divided randomly into three sub-groups and submerged in instant coffee, green tea and Coca Cola for 30 days. The control group (N=5) samples were kept in deionized water. Determination of the L*a*b* dimensions of colour of the polymerized discs was performed by calibrated spectrophotometer 24 hours later, after the bleaching procedure, and on days 7, 15 and 30 after immersion in the beverages. **Results.** After application of 16% CP, there were perceptible changes in the colour of both test materials, which did not exceed the boundaries of acceptability ($\Delta E<3.48$). Coca-Cola did not cause discolouration of the tested composites, but coffee and tea changed their colour above the level of perceptibility already seven days after immersion. A statistically significant difference in the change in colour was established between the materials when they were immersed in coffee ($P<0.05$). **Conclusions.** 16% CP does not affect the basic colour of the composites. Immersion in a beverage led to an unacceptable change in the colour of both test materials in coffee and tea, primarily towards black. The greatest discolouration after bleaching was shown by Z550 when immersed in coffee.

**Key Words:** Composite Resins ▪ Tooth Bleaching Agents ▪ Carbamide Peroxide ▪ Spectrophotometry ▪ Coffee.

## Introduction

Treatments to bleach teeth are one of the most frequently requested dental procedures in contemporary dental therapy (1). The bleaching procedure removes internal and external discolouration of teeth, using peroxide-based preparations. Hydrogen peroxide (HP) can be applied directly or may occur by decomposition of carbamide peroxide (CP) in the mouth (2). The home method or nightguard vital teeth bleaching technique, in a custom tray worn overnight, represents the gold standard of whitening (3).

During treatment to bleach teeth, preparations based on HP inevitably come into contact with restorative materials (4). It is thought that preparations used for bleaching teeth may lead to deterioration of the physical and chemical properties of restorations (5). The interaction of composite fillings with bleaching preparations may be of practical significance if, before bleaching, the colour of the restoration completely matches the colour of the teeth, but after the procedure there is a perceptible change in colour. In that case, it will be necessary to change the colour of the filling. The stability of the colour of aesthetic fillings after application of the bleaching gel, depending on the type of composite, has demonstrated inconsistent results in previous research (6). Some studies showed that preparations based on CP at lower concentrations do not lead to any differences in the colour of the composites before and after bleaching (4, 5, 7), whilst others showed the opposite (8, 9). After completion of bleaching of teeth, the material inevitably comes in contact with coloured liquids. Bleaching of restorative materials may lead to them being more subject to discolouration (7).

The aim of this study was to examine the action of 16% CP bleaching preparations on the colour of two composite materials of different composition, and subjecting them to discolouration in beverages after the bleaching procedure.

## Materials and Methods

In this study, two composite materials with the A2 Vita shade of colour were tested (Table 1), a nanocomposite material (Filtek Z550, 3M ESPE, St. Paul, MN, USA) and a microhybrid composite (Z250, 3M ESPE, St. Paul, MN, USA). The bleaching preparation used was 16% CP gel Vivastyle® (Vivadent, Schaan, Liechtenstein). Four immersion liquids were used (deionized water, instant coffee, green tea and Coca Cola), and the changes in colour were judged at various time intervals. Samples distribution of experimental and control groups presented in Figure 1.

### *Preparation of Samples*

Plates made of the two composite materials, 10×2 mm in size, were prepared in a split mould. The material was placed between two microscopic plates, 1 mm thick, covered in celluloid Mylar strips, whereby a flat surface was obtained, and the surplus material was squeezed out without any bubbles forming. The samples were polymerized

Table 1. Composite Materials Tested in This Research

| Composite | Manufacturer | Type | Matrix composition | Filler particles | Filler amount (wt/vol) | Lot |
|---|---|---|---|---|---|---|
| Filtek Z550 | 3M ESPE, St. Paul, MN, USA | Nanohybrid | BIS-GMA, UDMA, BIS-EMA, PEGDMA, TEGDMA | Combination of surface modified zirconia/silica with 0.1-10 μ particles and surface modified silica particles size of 20 nm. | 82/68% | N502352 |
| Filtek Z250 | 3M ESPE, St. Paul, MN, USA | Microhybrid | Bis-GMA, UDMA, Bis-EMA | Zirconia/silica particles 10 –3500 nm | 75-85/60 | N535897 |

Bis-GMA=Bisphenol A-glycidyl methacrylate; UDMA=Urethane dimethacrylate; BisEMA=Ethoxylatedbisphenol-A-dimethacrylate; TEGDMA=Triethylene glycol dimethacrylate; PEGDMA=Polyethylene glycol dimethacrylate.

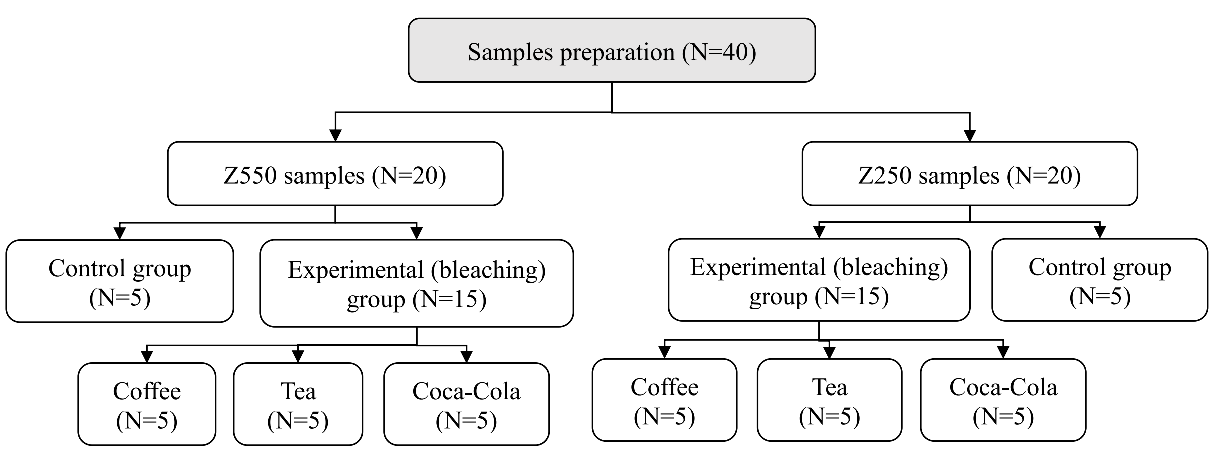


Figure 1. Distribution of samples between experimental and control groups.

through a glass plate using a cordless LED lamp (Elipar™ FreeLight 2 LED Curing Light, 3M ESPE, St. Paul, MN, USA) for 20 s on both sides. Before polymerization, the power of the LED lamp was checked using a radiometer, and it was shown to be more than 1000 mW/cm$^2$. The thickness of all samples was checked with callipers. In order to standardize the surfaces and create clinical-like conditions, all the samples were polished using fine and superfine paper discs (Sof-Lex™ Contouring and Polishing Discs Kit, 3M Company, St. Paul MN, USA) fixed in a contra-angle handpiece at reduced speed for 10 s, with moderate pressure. After the samples had been prepared, they were placed in distilled water for 24 hours at 37°C to complete the polymerization process.

### *The Procedure to Bleach the Composites*

16% CP was applied to the whole surface of the composite plates in the experimental group (15 samples each) for seven hours a day at 37°C, to imitate what is known as nightguard vital teeth bleaching. The gel was then wiped with cellulose fibre, and the samples were rinsed under running water for one minute, followed by distilled water. For the remainder of the time during the day the samples were placed in de-ionized water at 37°C. This procedure was repeated for 14 days (10).

### *The Procedure for Discolouration of the Samples*

After two weeks' bleaching, five samples of each material were randomly chosen and immersed in different liquids for 30 days. The beverages used were: Nescafe 3 in1 instant coffee Classic (Nestle, Hungaria, Kft. Szerenczi Gyara), Lipton green tea Nature (Unilever, Belgium) and Coca Cola (Coca Cola HBC, Sarajevo, BH). In order to prevent contamination by bacteria, fresh test solutions were prepared every day. The content of the packet of instant coffee (17.5 g) was diluted in 150 ml boiled but off the boil water, according to the manufacturer's instructions. The solution was stirred and left to cool for 10 min (11). 200 ml hot boiled water was poured over a bag of green tea (30 g) and left to cool for 10 min. A hermetically factory sealed 0.5 liter bottle of Coca Cola was used at room temperature. During the experiment, the samples were kept in these liquids for four hours and then rinsed with distilled water, and for the rest of the day they were kept in deionized water. Throughout the experiment the test materials were stored in an incubator at 37°C. Five samples from the control group were kept in the incubator at 37°C in deionized water which was changed every day until the end of the experiment.

### *Spectrophotometry*

For spectrophotometric determination of colour, a previously calibrated Vita Easyshade Compact spectrophotometer was used (Vita Zahnfabrik, Bad Säckingen, Germany). For each measurement the samples were dried with cellular fibre and then the L*a*b* colour parameters were measured according to the CIEL*a*b* three-dimensional colour space. Measurements were taken whereby the samples were placed on a white background so there would not be any absorption of colour parameters. To ensure measurements were taken at the same spot each time, the active part of the spectrophotometer was set to focus on the middle of each sample. Determination of the initial values of $L_0{}^*a_0{}^*$ and $b_0{}^*$ colour dimensions in each group was undertaken 24 hours after the preparation and polymerization of the samples. The measurements were repeated three times for each sample, and the mean value and standard deviation calculated. Measurements were repeated after the bleaching cycles, and on days 7, 15 and 30 after immersion in the beverages. The L*a*b* values of the control groups were determined again after 30 days.

The CIELAB colour space defines each colour through three values, placing each colour at a specific spot on a sphere. The achromatic vertical axis L* relates to the lightness of the object, and has a value from 0 for complete black to 100 for perfect white colour. On the a* coordinate the positive value is red and the negative value is green. On the b* coordinate, the positive b* value is yellow and blue is the negative b* value. By categorizing individual

L*a*b* values measured during and at the end of the experiment ($L^*_n$, $a^*_n$, $b^*_n$) in the CIEL*a*b* formula, the changes in all three parameters of colour were obtained (ΔL*, Δa*, Δb*). When ΔL*, Δa*, Δb* are entered into the given formula, the value ΔE is obtained, that is, the difference in position of two points on the CIEL*a*b* three-dimensional colour space, which represents the total change in colour (ΔE) that took place between two measurements. According to Ghinea et al., a minimal difference between two colours that amounts to more than 1.74 exceeds the threshold of perceptibility, and a value of 3.48 the threshold of acceptability (12).

## Statistical Analysis

The statistical analysis was conducted in SPSS v.20 (Statistical Package for Social Sciences), the Windows program package. For description of the data we used arithmetic means, standard deviation and the formula of the International Commission on Illumination (CIE) for measuring chromaticity and determination of small differences in colour:

$$\Delta E_{ab}=[(\Delta L*)^2+(\Delta b*)^2+(\Delta a*)^2]^{½} \quad (13).$$

The statistical analyses used were parametric t-tests for independent samples, multivariate ANOVA to establish the significance of changes in colour, and post-hoc Bonferroni-corrected t-tests for independent samples for appropriate correction of P-values. All analyses were conducted at the level of significance of 5%.

## Results

### *The Effect of 16% Carbamide Peroxide on the Basic Colour of the Tested Composites*

After application of 16% CP for 14 days, there was a perceptible change in the colour of the composite materials. The total change in colour ($\Delta E_w$) for Z250 amounted to 1.94 (±0.67), while for Z550 it amounted to 2.34 (±0.65). No statistically significant difference was found in the values of the colour change after bleaching between the tested materials (all samples combined into one group), $\Delta E_w$: t(28)=-1.665; P=0.0535. The total change established that $\Delta E_w$ primarily took place in the dimension of lightness due to a rise in the L* values (Table 2).

Table 2. Changes in L*a*b* Colour Parametres and ΔL, Δa and Δb after Application of 16% Carbamide Peroxide

| Composite | Chromaticity coordinates | Mean | | Mean Δ±SD |
|---|---|---|---|---|
| | | Baseline | After 14 days | |
| Z250 | L* | 77.57 | 79.86 | 2.29 (±0.12) |
| | a* | -1.25 | -1.31 | -0.06 (±0.19) |
| | b* | 17.99 | 18.24 | 0.25 (±0.05) |
| Z550 | L* | 79.06 | 80.87 | 1.81 (±0.38) |
| | a* | 0.37 | 0.70 | 0.33 (±0.12) |
| | b* | 24.62 | 25.93 | 1.31 (±0.28) |

Δ=colour difference of the coordinate; SD=Standard deviation; L*=Light/dark colour coordinate; a*=Red/green colour coordinate; b*=Yellow/blue colour coordinate.

### *The Susceptibility of the Tested Composites to Discolouration in Beverages*

Immersion of the bleached samples of the composite materials in beverages led to perceptible changes in the colour of both tested materials (ΔE>1.74) in tea and coffee even after seven days, and immersion in both beverages for 30 days resulted in an unacceptable change in colour (Table 3).

By multivariate ANOVA for ΔE, a statistically significant interaction was found between composite materials and beverages [F(2.24)=5.21; P=0.013]. Post-hoc testing was performed in order to determine the differences in ΔE values between the two materials (Z250 vs. Z550) according to individual solutions (tea / coffee / Coca-Cola). T-tests for independent samples with Bonferroni correction of the P value [original P-value (0.05) divided by the number of comparisons (total 3): 0.05 / 3 = 0.016] showed a statistically significant difference in the changes in colour between these two materials in coffee (Table 3), where the nano-material Z550 had a statistically significantly higher ΔE value of t(8)=-3.61; (P=0.007). Table 4 shows the values of the changes in L*a*b* colour dimensions

Table 3. Means and Standard Deviations of the Overall Colour Change (ΔE) of Two Bleached Tested Materials after Immersion in Different Beverages for 30 Days

| Material | Total colour change (ΔE) over time (days) | Tea M (± SD) | Coffee M (± SD) | Coca-Cola M (±SD) |
|---|---|---|---|---|
| Z250 | 1-7 | 2.68 (±0.43) | 4.03 (±0.92)* | 0.73 (±0.54) |
| | 1-14 | 4.28 (±0.43)* | 5.60 (±1.27)* | 1.14 (±0.51) |
| | 1-30 | 7.07 (±0.93)* NS | 7.44 (±0.98)* † | 1.36 (±0.47) NS |
| Z550 | 1-7 | 3.27 (±0.48) | 5.24 (±0.60)* | 0.69 (±0.28) |
| | 1-14 | 4.95 (±0.52)* | 7.30 (±0.73)* | 1.07 (±0.35) |
| | 1-30 | 7.75 (±1.02)* NS | 9.42 (±0.75)* † | 1.05 (±0.43) NS |

*Indicates clinically unacceptable value (ΔE>3.48); †Indicates statistically significant differences in colour changes between Z250 and Z550 on the thirtieth day of immersion according to T-tests for independent samples with Bonferroni correction (P=0.007); NS= Indicates statistically insignificant differences in colour changes between Z250 and Z550 on the thirtieth day of immersion in tea (P=0.308) and Coca-Cola (P=0.304) according to T-tests for independent samples with Bonferroni correction.

Table 4. Descriptive Values of the L* a* b* Dimensions of Colour according to Material, Solution and Point of Measurement after Bleaching

| Chromaticity coordinates (days) | | Material | | | | | |
|---|---|---|---|---|---|---|---|
| | | Z250 | | | Z550 | | |
| | | Beverage | | | Beverage | | |
| | | Tea | Coffee | Coca-Cola | Tea | Coffee | Coca-Cola |
| | | M (±SD) | M (±SD) | M (±SD) | M (±SD) | M (±SD) | M (±SD) |
| L* | First | 80.31 (±0.36) | 80.18 (±0.60) | 79.86 (±0.74) | 81.01 (±0.24) | 80.69 (±0.39) | 80.91 (±0.53) |
| | Seventh | 78.40 (±0.32) | 77.20 (±0.61) | 79.27 (±0.45) | 78.41 (±0.46) | 76.91 (±0.62) | 80.51 (±0.60) |
| | Fourteenth | 76.85 (±0.31) | 75.73 (±0.89) | 78.81 (±0.39) | 77.21 (±0.58) | 75.16 (±0.43) | 80.33 (±0.57) |
| | Thirtieth | 74.48 (±0.51) | 73.83 (±0.86) | 78.62 (±0.38) | 74.69 (±0.98) | 73.14 (±0.34) | 80.46 (±0.60) |
| a* | First | -1.14 (±0.04) | -1.41 (±0.31) | -1.31 (±0.25) | 0.69 (±0.12) | 0.69 (±0.06) | 0.71 (±0.18) |
| | Seventh | -0.73 (±0.18) | -0.54 (±0.33) | -1.18 (±0.25) | 1.60 (±0.17) | 1.87 (±0.18) | 0.85 (±0.26) |
| | Fourteenth | -0.19 (±0.29) | -0.29 (±0.44) | -1.23 (±0.22) | 2.07 (±0.21) | 2.23 (±0.21) | 0.97 (±0.27) |
| | Thirtieth | 0.69 (±0.43) | 0.07 (±0.39) | -1.23 (±0.35) | 2.80 (±0.24) | 2.95 (±0.24) | 0.91 (±0.23) |
| b* | First | 18.10 (±0.30) | 18.50 (±0.34) | 18.24 (±0.40) | 26.26 (±0.12) | 25.85 (±0.45) | 25.67 (±0.29) |
| | Seventh | 19.91 (±0.42) | 20.98 (±0.91) | 18.05 (±0.29) | 27.99 (±0.38) | 29.25 (±0.89) | 26.17 (±0.48) |
| | Fourteenth | 20.43 (±0.44) | 21.63 (±1.17) | 18.56 (±0.28) | 29.07 (±0.59) | 30.30 (±1.14) | 26.51 (±0.56) |
| | Thirtieth | 21.66 (±0.66) | 21.98 (±1.03) | 18.61 (±0.42) | 30.18 (±0.55) | 30.97 (±1.16) | 26.57 (±0.55) |

Decrease in the L* parameter indicating that the material became darker; Increase in a* values indicating redness; Increase in b* values indicate that specimens become more yellowish.

of the tested composite materials in coffee, tea and Coca Cola. It was established that both composite materials were discoloured towards black, red and yellow, and that the degree of discolouration rose over time (1-30 days). After 30 days immersed in deionized water, the control group samples did not change colour above the level of perceptibility. The mean value and standard deviation of ΔE for Z250 were 0.94(±0.17), and for Z550 0.91(± 0.30).

## Discussion

### *Changes in Colour of the Tested Composites under the Influence of Carbamide Peroxide*

On the basis of the results obtained in this research, it may be said that application of 16% CP to composite materials led to a change in colour which surpasses the threshold of perceptibility of ΔE>1.74 in both composites. However, neither form of material tested after bleaching ($\Delta E_w$) changed colour beyond the threshold of acceptability of AT>3.48, and the filling did not need to be changed. The action of 16% CP led to slight discolouration of the microhybrid composite, and more of the nanohybrid, although there was no statistically significant difference in colour between the two tested materials (P=0.0535). Although it is possible that this change in colour is partially related to the process of absorption of water by the composite during the time the sample was kept in deionized water at 37°C, it is more likely that the change in the colour of the composite occurred at the time of the application of 16% CP, because the samples in the control group (continually immersed in deionized water) changed colour below the level of perceptibility.

The mechanism of the action of the peroxide from the bleaching preparation is based on the release of extremely reactive and unstable free radicals (14) that seek to bind with organic molecules and thereby achieve stability. The active substances in CP are aggressive oxidants which lead primarily to the release of non-polymerized monomers, but also other substances, from the composites (15). The minimal change in colour can be explained by the breakdown of the bonds of the weakly polymerized resin matrix (11). The free radicals lead to degradation of the organic and inorganic components of the composites and the disruption of the matrix-filler interface (5). In the inorganic part of the composites, the free radicals cause displacement of the inorganic particles and dissolution of the filler ions as a result of the softening of the resin components in the material (5, 16). In the organic part of the composite, the free radicals cause the breakage of the polymer chains and disruption of the double C=C bonds (9). In addition, peroxide leads to the release of monomers from the three-dimensional polymer network of the composite (17). The final result of the action of the free radicals is the occurrence of micro-cracks and diffusion of water into the composite (10). Therefore, it is always necessary to polymerize composite materials, according to the manufacturers' recommendations, and thereby reduce the quantity of residual monomers.

Our results confirm the results of previous research of imperceptible change in the colour of composite material after bleaching (5-7, 15, 18). Previous research also showed that under the action of bleaching preparations the microhybrid material changed colour least of the materials tested (8). In contrast to these results, some research confirmed clinically unacceptable colour values after bleaching (9, 19), which may be explained by the different compositions of the composite materials, the bleaching protocols, the length of application and the concentration of the gel (5, 6, 9). Preparations that contain higher concentrations of HP lead to higher values of colour change, regardless of the fact that the application is shorter in duration (8). With increases in gel concentration and the duration of immersion, the release of monomers also increases (17). Both materials tested in this research were subjected to the same conditions, that is, the action of CP preparations of equal concentration with the same duration of application, and they were prepared in the same conditions of optimum polymerization, verified by radiometric measurement of the strength of the lamplight. Moreover, both materials have a high percentage of filler, almost the same in weight, which reduces the probability of water sorption. The change in the colour of the composite materials may be primarily ascribed to the organic component, that is, the hydrophilic monomers, UDMA and TEGDMA, in line with previous research in which changes in the colour of composites after bleaching were linked to the presence of the monomer TEGDMA (6). This monomer has low molecular weight and is one of the main monomers that are released from resin based composite materials (17).

### *Change in the Colour of the Composite on the L*a*b* Axes after Bleaching*

The values of changes on the L*a*b* colour axes after bleaching showed that the greatest changes took place in the dimension of lightness, due to the increase in the L* value in both materials (Table 2). Both tested composites became slightly lighter, which may be explained by the dissolution of the matrix due to bleaching, which led to the creation of pores on the surface, filled with saliva or air (20). The change in the value of the L* coordinates may be the result of changes in the roughness of the surface due to elution of the monomers (15). These results are in accord with the results of previous research, (9, 14, 18), which also showed an increase in the L* dimension. On the other hand, after bleaching with highly concentrated 35% HP, de Andrede et al. obtained a lighter colour only in the nanocomposite (7), whilst Pecho et al. did not find any change in the L* values (15).

After bleaching with 16% CP the a* parameter of the tested materials remained almost unchanged, as in previous research (9). Regarding the b* axis, a slight change took place in the direction of an increase in yellow colour for both materials tested. This direction of change in the composites' colour on the yellow-blue axis after bleaching with 16% CP was also found in previous studies (9, 10, 21).

Since the change in colour of the composites due to bleaching did not cross the threshold of acceptability, it may be concluded that 16% CP does not act on the basic colour of the composites. That is to say, whitening does not bleach the material in the same way as it bleaches teeth.

### *Change in Colour after Bleaching and Immersion in Beverages*

Immersion of composites in beverages after bleaching led to a gradual increase in ΔE in both materials tested (Table 3). The threshold of acceptability of the bleached samples of both materials was already exceeded after seven days' immersion in coffee, and the strongest change in colour occurred after 30 days' immersion. When the individual L*, a*, b* dimensions of colour are considered, the composite samples immersed in beverages after bleaching showed the same direction of change in colour in both tested materials. The greatest difference was found in the L* dimension, where, after immersion in the beverages, there was a fall in value towards black, and in the chromatic dimensions there was a slight increase on the a* and b* axes (Table 4), as in previous research (21).

The susceptibility of the composites to discolouration is ascribed to the gradual absorption of water and the hydrophilic characteristics of their components (22). Together with the water, pigment is also absorbed into the organic component of the material. This fluid intake is ascribed to the hydrophilic monomers Bis-GMA and TEGDMA (18), and since TEGDMA is only present in the nanocomposite, this may be one of the reasons for the greater discolouration of that material in coffee. Discolouration by coffee occurs as a result of roasting, whereby it decomposes thermally into a brown caramel substance, which reacts with the chlorogenic acids, creating a browny-black pigment (23). Tea leads to discolouration of the composite thanks to tannin (24). The effect of Coca Cola on the change in colour in this experiment was found to be minimal, that is, there was no perceptible change in colour in either of the tested materials, just like in the deionized water in the control group.

### *Limitations of the Study*

As a limitation of this research we can mention that the protocol conducted is not completely equivalent to *in vivo* conditions, because the oral environment is a dynamic medium in which the secretion of saliva takes place continually, and consummation of beverages is intermittent. The discolouration of composite materials in the conditions of the oral environment may have a different pattern, because aesthetic restorations are exposed to the action of various factors in the oral environment, such as moisture, oral hygiene habits, diet etc. In future research, it is necessary to test how different concentrations of hydrogen peroxide act on the physical properties of dental restorative materials, and the use of artificial saliva as a medium between application sessions. Control clinical studies should also test and establish the cumulative effect of all the factors present in the oral cavity on the colour and surface properties of composite materials. Practice and research have shown that preparations for bleaching teeth effectively change the basic colour of hard dental tissue. However, it is possible that the colour of any composite fillings present in teeth that are bleached by several shades, may not match the new colour of the dental tissue. Therefore, the patient should be informed that it is probable that after the bleaching procedure they will have to change their existing fillings.

## Conclusions

According to the methodology used and on the basis of the results obtained from the research, it may be concluded that bleaching with 16% CP did not change the basic colour of microhybrid and nanohybrid composite materials beyond the threshold of acceptability. Imperceptible changes in colour after bleaching may be ascribed to the dimension of lightness, so that both composites became slightly lighter. Between the universal and the nanomaterial there was no statistically significant difference in the change in colour after bleaching ($P>0.05$). Coffee and tea caused perceptible changes in the colour of previously bleached samples of both composite materials already after seven days of immersion, and the degree of discolouration increased over time. The discolouration of the composites in coffee and tea occurred primarily in the lightness dimension in the direction of black.

**What Is Already Known on This Topic:**

*During teeth bleaching treatment, preparations based on hydrogen peroxide inevitably come in contact with restorative materials, and after whitening the aesthetic effect may be compromised. Knowledge of differences in the action of bleaching on individual types of composites may affect the choice of materials for direct fillings.*

**What This Study Adds:**

*This research is a scientific contribution to increasing knowledge about the action of carbamide peroxide on modern day composite materials used in everyday clinical practice. On the basis of the results obtained of exposure to beverages after bleaching, recommendations can be made to patients regarding consumption after conducting the procedure to bleach their teeth. The research showed how the dietary habits of patients who wish to bleach their teeth may influence the appropriate choice of composite material.*

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